The Sustainable City Becomes Climate-Smart

How Smart City Ideas Reshape Urban Environmental Governance

Darcy Parks

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Contents

List of Articles	i
1. Introduction	1
1.1 Aim and research questions	3
1.2 Thesis outline	3
2. Background	5
2.1 Smart city initiatives around the world	5
2.2 Hyllie, and Malmö's climate-smart ambitions	8
2.3 Conclusion	13
3. Previous Research	15
3.1 Urban environmental governance.....	15
3.2 Smart cities	17
3.3 Smart grids	21
3.4 Smart cities and urban environmental governance	23
3.5 Conclusion	26
4. Theoretical Perspective	29
4.1 STS and cities	30
4.2 Assemblage	33
4.3 Assemblage urbanism	36
4.4 Conclusion	37
5. Methods and Material	39
5.1 Starting out	40
5.2 Interviews	42
5.3 Participant-observation	46
5.4 Documents	50
5.5 Analysis and writing.....	51
5.6 Conclusion	54
6. Summary of Articles	55
6.1 Article I	55
6.2 Article II	57
6.3 Article III	58
6.4 Article IV.....	60
7. Discussion	63
7.1 Introduction of smart city ideas	63
7.2 Reconfiguring urban environmental governance.....	65
7.3 Implications for cities	67
8. Conclusions	69
8.1 Beware the climate-smart city?	69
8.2 Assemblage and smart cities.....	71
8.3 Suggestions for future research.....	72
References	75
Appendix: Interview Guides.....	87
Acknowledgements	89

List of Articles

Article I

Parks, Darcy. “Promises and techno-politics: renewable energy in the Malmö’s climate-smart city.”

Under review (minor revisions) at Science as Culture as part of a special issue on Urban Techno-Politics.

Article II

Parks, Darcy and Harald Rohrer. “From sustainable to smart: Re-branding or re-assembling urban energy infrastructure?”

Submitted to Geoforum.

Article III

Parks, Darcy. 2018. “Energy efficiency left behind? Policy assemblages in Sweden’s most climate-smart city.” *European Planning Studies*.

Part of an upcoming special issue on Urban Experimentation and Sustainability Transitions. Published online.

Article IV

Parks, Darcy. “Not a big happy family: Agonistic experimentation and the limits of higher order learning.”

Submitted to Environmental Innovation and Societal Transitions.

Chapter 1

Introduction

There is no mistaking that it is popular to be smart these days. Smart phones have the company of more and more smart gadgets ranging from smart watches to smart refrigerators. In these examples, the meaning of smart is similar—a device becomes smart when it becomes connected to the internet. When it comes to the ‘smart city’, the meaning of smart is not as obvious. Still, the idea of a smart city has become popular over the past decade and shows no signs of slowing down. For multinational technology companies such as IBM and Cisco, who have popularised the idea of smart cities, it involves using more information and communication technology (ICT) in cities. Some government initiatives draw on similar ICT-centred inspiration (European Commission 2012), while other initiatives let smart cities mean almost anything (Indian Ministry of Urban Development 2015). One might wonder whether smart has any meaning at all in terms of cities. This thesis investigates what changes, and who benefits, from the introduction of smart city ideas.

While smart city ideas might influence many aspects of cities, environmental sustainability is an issue where the influence could be far-reaching. Sustainability and smart are both contested concepts with many interpretations. Sustainability can refer to environmental, social and economic dimensions, and even environmental sustainability has meanings that range from deep ecology (Naess 1973) to ecological modernisation (Hajer 1995). Combining smart and

sustainable can result in the use of ICT as a tool for improving the sustainability of cities (Höjer and Wangel 2015). However, the combination of these concepts might prioritise unsustainable economic growth at the expense of environmental protection (Martin, Evans, and Karvonen 2018). The smart in smart cities can be a means to an end or a goal in itself. Rather than defining smart cities in one way or another, this thesis analyses how the concept is used in practice in urban environmental governance.

As the idea of smart cities has become more popular, social science research has begun to question the implications of smart cities. Researchers have raised questions about the potential for increasing corporate influence over cities (Kitchin 2014; Viitanen and Kingston 2014), the implications of a focus on technological solutions (Söderström, Paasche, and Klauser 2014; Vanolo 2014), increased surveillance (Galdon-Clavell 2013), and changes to urban life that citizens might find undesirable (Gabrys 2014; Vanolo 2014). While this research has addressed a large variety of smart city initiatives, the questions raised are indeed relevant for research on smart cities and environmental sustainability. However, other social scientists have criticised this research for focusing on marketing material and design documents and have called for research on ‘the actually existing smart city’ (Shelton, Zook, and Wiig 2015) and ‘the ordinary smart city’ (Fariás and Widmer 2018). This thesis investigates the relevance of these questions in urban environmental governance in specific cities.

Cities have become important settings of environmental governance, particularly in response to climate change (Bulkeley 2010). Urban governments responded with different modes of governance because of their limited authority in environmental issues (Bulkeley and Kern 2006). While urban governments have taken a central role, their actions have required engagement with multi-level governance (Bulkeley and Betsill 2005) and intermediary organisations (Hodson, Marvin, and Bulkeley 2013). However, there remain questions about what urban responses can achieve due to the role of dominant actors (Bulkeley, Castán Broto, and Maassen 2014) and the complex interrelations between urban settings and larger socio-technical systems (Rohracher and Späth 2014). This multifaceted governance landscape provides many processes in which smart city ideas might influence urban environmental governance.

To study influence of smart city ideas requires an analysis of how urban environmental governance occurs in practice. This thesis studies governance in a smart city district called Hyllie in Malmö, Sweden. There are three reasons why Hyllie in particular suits the study of smart city ideas in urban environmental governance. First, Malmö has established processes for sustainable urban planning that date back to the 1990s, when the city began the redevelopment of a district called the Western Harbour. Environmental sustainability was the focus of a housing exposition that the city held in 2001, and planners worked with sustainability ambitions throughout the development of the district and other parts of the city. Second, Malmö envisions Hyllie as a climate-smart city district and a role model for the rest of the city. This vision combines smart city discourses with the city's environmental governance ambitions. Third, the vision for Hyllie led to a large smart grid demonstration project funded by the Swedish Energy Agency. This project shows how smart city ideas are put into practice in sustainable urban planning. With Hyllie as a starting point, this thesis investigates several aspects of the relations between smart city ideas and urban environmental governance.

1.1 Aim and research questions

The aim of this thesis is to better understand how smart city ideas reshape urban environmental governance. I address the aim by answering three research questions:

1. What types of actors introduce smart city ideas into urban environmental governance, and what conditions enable these actors to do so?
2. Through what processes do these actors use smart city ideas to reconfigure urban environmental governance?
3. What implications does this reconfiguration of urban environmental governance have for cities?

1.2 Thesis outline

Following this introductory chapter, chapter 2 presents the background for this thesis. Chapter 3 reviews previous research about urban environmental governance and smart cities. Chapter 4 presents the theoretical perspective. Chapter 5 describes the methods and

Chapter 1

materials. Chapter 6 summarises the results and contributions of each of the four articles included in this thesis. Chapter 7 discusses the three research questions. Chapter 8 presents more general conclusions in relation to the aim of this thesis.

Chapter 2

Background

The introductory chapter mentioned some examples of smart city initiatives, both in Sweden and around the world. This chapter presents a more extensive review of initiatives and programmes that have been inspired by smart city ideas. The first section reviews the origins of smart city ideas and their spread around the world, including Europe and Sweden. The second section provides background about the initiative in focus in this thesis: the Hyllie district in Malmö, Sweden.

2.1 Smart city initiatives around the world

There are many sources of inspiration where actors in urban environmental governance might get ideas about smart cities. This variety is relevant for the first research question in this thesis. Smart city ideas have influenced urban governance around the world for almost a decade. By ‘smart city ideas’, I mean for example the visions of multinational technology companies, examples of cities and projects from around the world, and the discourses used in government programmes. The definition of a smart city has not stabilised during the past decade, and smart city ideas have taken different forms over time. Multinational technology companies popularised the concept of a smart city. Their initial push led to three high-profile examples that are often referenced in international media and academic literature.

More recently, many national governments have introduced smart city programmes with a varying emphasis on ICT. In the policies of the European Union and the Swedish government, ICT is a part of smart city initiatives but not the only focus.

Multinational technology companies used the smart city concept early on as they marketed ICT solutions to city governments. IBM introduced its “vision for smarter cities” in 2009, claiming that “pervasive information and communication technology means that there is much greater scope for leveraging technology for the benefit of cities” (IBM Global Business Services 2009:10). IBM has spread this vision through its Smarter Cities Challenge, in which “winning cities welcome a team of five to six IBM experts, who work closely with city leaders for a three-week period on their proposed challenge” (IBM 2017:3). Cisco introduced its own Smart+Connected Communities programme. It presented the programme as the company’s “visionary answer” to urbanisation around the world, “using intelligent networking capabilities to weave together people, services, community assets, and information into a single pervasive solution” (Cisco 2010:2). Several other multinational technology companies introduced similar programmes around the same time (Paroutis, Bennett, and Heracleous 2014).

Three well known smart city initiatives have also helped to establish a link between the concept and ICT. Songdo, South Korea, and Masdar City, United Arab Emirates, are two planned cities that have often been held up as examples of smart cities. In Songdo, Cisco found the opportunity to apply its Smart+Connected Communities programme and contribute to making Songdo a so-called ubiquitous city (Cisco 2011). Masdar City was planned to be a carbon neutral city with renewable energy production and a ban on cars in favour of personal rapid transit (Palca 2008). In Rio de Janeiro, Brazil, IBM’s work through its Smarter Cities Challenge resulted in an operations centre that gives the city government a panoptic perspective over the whole city (Singer 2012). However, media coverage has also raised critical questions about these initiatives (Poole 2014; Sennett 2012). And indeed, these examples are not the only inspiration for smart city initiatives that governments have introduced more recently.

Many national governments around the world have adopted smart city programmes in recent years. China initiated a pilot programme in 2012 (CAICT and PDSF 2014); the UK established a Smart Cities

Forum in 2013 (Government of the United Kingdom 2013); the US announced a smart cities initiative in 2015 (United States White House 2015). India's Smart Cities Mission is one of the largest scale examples, with a goal of funding 100 smart city initiatives between 2015 and 2020 (Indian Ministry of Urban Development 2015). These initiatives vary in their ambitions and the role of ICT is not explicit in all initiatives. For example, the Indian Smart City Mission explains that "there is no universally accepted definition of a Smart City" and that "a Smart City would have a different connotation in India than, say, Europe. Even in India, there is no one way of defining a Smart City" (p. 5). In such cases, it is unclear whether the smart city concept contributes anything other than a new, trendy label to existing initiatives.

The European Union's smart city initiatives date back to 2009. While these initiatives include ICT, they originally focused on energy issues. The European Commission first described a Smart Cities Initiative in 2009, at which point the aim was to "to improve the energy efficiency and to deploy renewable energy in large cities beyond the levels envisaged for the EU energy and climate change policy" (European Commission 2009:13). In 2012, this initiative became the European Innovation Partnership on Smart Cities and Communities, which aimed to apply ICT to the energy and transport sectors (European Commission 2012). This initiative provided funding for some initiatives, and has since served as a network for initiatives throughout Europe.

In Sweden, the national government has several smart city initiatives. The Swedish Energy Agency funded two smart grid projects in urban environments, one in Malmö that started in 2011 and one in Stockholm that started in 2012. While the energy agency funded these projects because of their relevance for smart grids, both city districts drew on smart city discourses in their development. More recently, Stockholm and Umeå received European Union funding as part of the Grow Smarter (funded in 2015) and Ruggedised (2016) projects. Two strategic innovation programmes have been launched through a collaboration of the Swedish Energy Agency, the Swedish Innovation Agency and the Swedish Research Council for Sustainable Development. The Smart Built Environment programme, which began in 2016, had the vision of a "sustainable built environment and maximum user benefits through efficient information management and industrial processes" (Smart Built Environment 2016:18). The

Smart Sustainable Cities programme (later renamed Viable Cities) began in 2017 and envisioned that “Sweden will inspire and play a leading role in the energy and climate transition through smart and sustainable cities” (Viable Cities 2017:2). These projects and programmes have different goals concerning the built environment and energy issues, but they all involve ICT solutions to some extent.

The diversity of smart city initiatives has two implications for studying how smart city ideas influence urban environmental governance. First, despite the continued involvement of multinational technology companies, a smart city initiative does not necessarily involve the application of ICT to address existing urban problems. India’s Smart City Mission show just how broadly a government can interpret smart cities. Second, there are many different types of actors who might introduce smart city ideas to a city government. IBM’s Smarter Cities Challenges continues to attract applications from cities, which allows IBM to sell its version of smart cities to city governments. Decision makers might encounter media coverage on high profile cities such as Songdo and Masdar City, which could either increase or decrease their enthusiasm for smart city ideas. Perhaps most importantly, there is a plethora of government funding programmes with smart city framings that encourage cities to adopt smart city ideas. In these situations, cities might adopt smart city ideas because of their reliance on funding from higher levels of government rather than because of the perceived merits of smart city ideas. The diversity of meanings and actors involved requires an empirical study of smart city ideas to be attentive to the many ways in which these ideas might be introduced into urban environmental governance.

2.2 Hyllie, and Malmö’s climate-smart ambitions

Hyllie is well-suited for the empirical study of how smart city ideas reshape urban environmental governance. There are signs of smart city ideas in two large initiatives in the city district: a vision called the Climate Contract and a five-year smart grid demonstration project. Both these initiatives brought together the city government, with its environmental governance ambitions, with Eon, a multinational, publicly traded energy company. Eon is the grid operator for the electricity, district heating and district cooling networks in Malmö. Hyllie also involved Malmö’s established processes for sustainable

urban planning. These processes originated in the City of Malmö's planning of the Western Harbour, and became city-wide processes. They structured the relations between city planners and property developers. They were also situations in which the city administration and Eon could translate their ambitions into actions for property developers.

Hyllie is a new city district under construction in the south of Malmö (see Figure 1). Malmö is Sweden's third-largest city and is located in the south of the country, close to Copenhagen (see Figure 2). Because of Hyllie's location within the ring road that surrounds the city, comprehensive plans had for decades suggested it as the location of a commercial centre. However, it was home to little more than water tower and agricultural land until the mid-2000s. After the Öresund Bridge between southern Sweden and Denmark opened in 2000, the national government decided to build a railway tunnel under the city. The tunnel, which would further shorten travel time between Malmö and Copenhagen, resulted in a new train station in Hyllie. A commercial centre built around the station consists of an arena, a shopping mall, a conference centre, hotels and office buildings. Beyond the commercial centre, Hyllie will also have residential neighbourhoods; fully built, city planners expect 9000 apartments by 2040.

The Climate Contract established the vision of Hyllie as a climate-smart city district. Signed in 2011, it envisioned that Hyllie would become "the Öresund Region's most climate-smart city district and a global role model for sustainable urban development" (City of Malmö, Eon, and VA Syd 2011:2). In addition to the City of Malmö, two other organisations signed the Climate Contract: Eon and VA Syd. Eon owns and operates Malmö's electricity, district heating and district cooling networks. VA Syd is owned by the City of Malmö and several neighbouring municipalities, and it operates the water, wastewater and solid waste systems. The Climate Contract was not a legal document and it did not commit these organisations to providing any specific resources. It did set goals, such as making Hyllie climate neutral by 2020 and making Hyllie's energy infrastructure into a smart grid.

Chapter 2

Figure 1: Hyllie (blue) within the Öresund Region
Map produced using uMap. Map data © OpenStreetMap contributors. Tiles courtesy of Lyrk.

Figure 2: Malmö and Copenhagen within southern Sweden
Map produced using uMap. Map data © OpenStreetMap contributors. Tiles courtesy of jawgmaps.

A smart grid demonstration project translated the Climate Contract into a research and development project with consequences for all of Hyllie: the Smart Grids for Hyllie project (official title: Smart Grids for a Sustainable Energy System in Hyllie). The City of Malmö and Eon received funding from the Swedish Energy Agency for 24% of the project, which has a total budget of SEK 200 million; Eon committed 72%, the City of Malmö 5% (Swedish Energy Agency 2011:22). The project's goals included the demonstration of three types of smart grid technology: a home energy management system for residents, a demand response controller for buildings, and an energy management system for the grid. The project also set goals unrelated to smart grid technology, but related to the Climate Contract: by the end of the project, 50% of Hyllie's energy would come from renewable energy, and buildings in Hyllie would be 20% more energy efficient than new buildings in the rest of Malmö.

The Climate Contract drew on the idea of climate-smart city that the City of Malmö first introduced two years earlier. In 2009, the city government¹ approved a new version of the Malmö Environmental Programme (MEP) that envisioned Malmö becoming "Sweden's most climate-smart city" by 2020 (City of Malmö 2009:7). But despite using the climate-smart concept, this vision did not include smart grids or any other use of ICT. This document applied the climate-smart label to goals for energy efficiency, renewable energy, greenhouse gas emissions, public transit, cycling, and climate adaptation. Its overall goal was ambitious: by 2030, all energy use in Malmö would come from renewable sources. This goal concerned not just energy used by the city government; it included all energy use by residents, companies and industries as well.

It was Eon's involvement that led to two differences between the framings of the MEP and the Climate Contract. Eon has a long relationship with the City of Malmö, having owned the energy

¹ I refer to the city *government* in situations where democratically elected officials—such as city council (kommunfullmäktige), the city executive committee (kommunstyrelsen) or city boards (nämnder)—made formal decisions. In contrast, I refer to the city *administration* concerning the decisions and actions of the employees of city departments. The Climate Contract was, surprisingly, a product of the city administration, and was not approved by any official organs of the city government, though a city councillor did sign the document at a signing ceremony. However, his signature did not bind the city government in any legal sense.

infrastructure in Malmö since 2001. The first difference was the smart grid. The Climate Contract referenced the MEP's concept of a climate-smart city, but in the Climate Contract this concept included a smart energy grid for Hyllie. The second difference was what counted as climate neutral. While the MEP had a goal of 100% renewable energy for Malmö, the Climate Contract had a goal of 100% renewable or recycled energy for Hyllie. Recycled energy refers to incineration of solid waste and production of biogas from organic waste, both of which already existed in Malmö's energy system. By including recycled energy, the signatories of the Climate Contract would need to provide less renewable energy to Hyllie.

The city administration's ambitions for Hyllie follow its earlier work in the Western Harbour. This Western Harbour is a city district built in the early 2000s on the site of an abandoned, centrally located shipyard. The redevelopment of the Western Harbour was part of a larger effort to transform the city from a struggling post-industrial city to a part of the knowledge economy and the home of a university (Dannestam 2009:284–85). It began with an area called Boo1 that was the site of a sustainability-themed housing exposition in 2001. Beginning with the housing exposition, and continuing through the other phases of the district, city planners collaborated with property developers to set goals for environmental sustainability in each phase (e.g. City of Malmö 2003, 2011). The collaboration gave city planners experience in dialogues where they encouraged property developers to set ambitions higher than national regulations.

The planning of the Western Harbour resulted in planning processes that the city administration continued to use in Hyllie. The city government approved a voluntary programme called "Environmentally sustainable construction in Malmö" in 2002 (City of Malmö 2002). It then created the mandatory "Environmental Construction Programme" in 2009. This programme combined dialogue with energy performance requirements that were stricter than the national building code (City of Malmö, City of Lund, and Lund University 2012). It applied to all construction that took place on city-owned land, but the city government ended the programme in 2016 in response to a change in national regulations that prevented city governments from setting their own energy performance requirements. However, the Environmental Construction Programme was still in effect when the first residential property developers

received contracts to build in Hyllie. The city administration's dialogues with property developers gave planners the opportunity to enrol developers in city's sustainability ambitions with Hyllie, and gave Eon the opportunity to enrol developers in the smart grid demonstration project.

The Climate Contract and the smart grid demonstration project led to agreements with property developers and new planning programmes. In Hyllie Avenue, the first residential neighbourhood in Hyllie, property developers signed a Sustainability Agreement in which they committed to installing building automation systems compatible with Eon's smart grid technology (Hyllie Avenue Sustainability Group 2012:4). Several property developers agreed to install smart grid technologies in their buildings. In 2015, the City of Malmö published a voluntary planning programme called the Hyllie Environmental Programme. This programme aimed to show property developers how they could contribute to the ambitions in the Climate Contract. In terms of energy issues, it suggests that developers should build efficient buildings, install smart grid technology, install energy visualisation and control technologies for residents, and include renewable energy production in their buildings.

It is this multitude of initiatives, agreements and processes that makes Hyllie well-suited for the empirical study of how smart city ideas reshape urban governance. Because of Malmö's history with the Western Harbour, it is possible to study the influence of smart city ideas on urban environmental governance. The Climate Contract is one of the processes in which these smart city ideas were introduced by Eon. The Climate Contract, smart grid demonstration project, and the Hyllie Environmental Programme are all initiatives that have reshaped the roles of city government, the grid operator and property developers.

2.3 Conclusion

This chapter shows that smart city ideas can come from a variety of sources. The visions of multinational technology companies have spread around the world, as have some high profile examples of initiatives. The European Union and Swedish government have both introduced smart city ideas into programmes. In Malmö, the Hyllie city district was home to several initiatives inspired by smart city ideas.

Chapter 2

These initiatives, combined with Malmö's history of sustainable urban planning, make Hyllie well-suited for empirical study of smart city ideas and urban environmental governance. The next chapter reviews previous research on these topics.

Chapter 3

Previous Research

There is an increasing amount of social science research about the spread of smart city ideas around the world. This chapter reviews that research to understand how these ideas might reshape urban environmental governance. As shown in the previous chapter, there are several types of smart city initiatives that might influence how smart city ideas are introduced into urban environmental governance. This chapter reviews previous research on the topics of urban environmental governance and smart cities.

The first section of the chapter introduces a concept that is central to this thesis: urban environmental governance. The second section shifts gears to research about smart cities in general. The third section reviews relevant research about smart grids—research that does not have an *urban* focus but is related to environmental governance. The fourth section reviews research on smart cities that is specifically related to urban *environmental* governance. Finally, the fifth section makes conclusions about the state of previous research and its implications for this thesis.

3.1 Urban environmental governance

A basic starting point in defining urban environmental governance is to distinguish between government and governance, the latter of which recognises the role of actors other than the state. Lemon and Agrawal

(2006) define environmental governance as “the set of regulatory processes, mechanisms and organizations through which political actors influence environmental actions and outcomes” (p. 298). They explain that environmental governance consists of “international accords, national policies and legislation, local decision-making structures, transnational institutions, and environmental NGOs” (p. 298). Jordan et al. (2003) add that environmental governance has increasingly relied on ‘new’ policy instruments such as “eco-taxes and other market-based instruments (MBIs), voluntary agreements (VAs) and informational devices such as eco-labels” (p. 2). However, they conclude that “environmental governance is at best supplementing, and most certainly not comprehensively supplanting, environmental government by regulatory means” (p. 214). While environmental governance refers to the inclusion of additional actors, it does not imply a lack of action by governments nor an end to traditional regulation.

Urban environmental governance can take different forms. Some perspectives suggest that environmental problems are best addressed as the local level and that urban or local governments are best suited to develop solutions (Marvin and Guy 1997). In contrast, Bulkeley and Betsill (2005) argue that urban governance of sustainability is not limited to the local scale, but rather interrelated with governance at national and global levels. This thesis conceives of urban environmental governance as the practices that city governments take part in, regardless of whether they are limited to actors within a city or extend to higher levels of government or other networks beyond the city.

Climate change is an environmental issue where city governments have taken a prominent role (Bulkeley 2010). It illustrates the multitude of practices that can emerge in urban environmental governance. For many city governments, efforts to mitigate climate change and reconfigure energy systems are complicated by the “relative inability of public authorities and agencies to control these systems, particularly in an era of liberalisation and privatisation” (Hodson et al. 2013:1404). Bulkeley and Kern (2006) identify four modes of government that involve non-governmental actors to varying degrees: self-governing, governing by authority, governing by provision and governing through enabling. But urban climate change governance is not limited to action within the city; city governments have also

established transnational networks in response to the lack of action by national governments and the slow progress of international negotiations (Gore and Robinson 2009; Rosenzweig et al. 2010).

The diversity of practices that constitute urban environmental governance has implications for this thesis. Smart city ideas could have an impact on any of these practices. With this diversity established, this review of previous research now turns to a closer examination of smart city ideas.

3.2 Smart cities

The rising popularity of smart city ideas has been followed by increasing attention from social science researchers. Some of the research traces the history of these ideas and discusses their potential implications for urban governance. Other more recent research has investigated the impacts of smart city ideas on urban governance in practice. While not specific to urban *environmental* governance, this research nevertheless raises concerns that are of relevance to this thesis.

Hollands (2008) published the first social science article to explicitly address the smart city concept in a critical manner. His criticism focuses on three elements of the discourse: “its definitional impreciseness, numerous unspoken assumptions and a rather self-congratulatory tendency (what city does not want to be smart or intelligent?)” (p. 304). He writes that one key element of the smart city label is “the utilization of networked infrastructures to improve economic and political efficiency and enable social, cultural and urban development” (p. 307), which in other research has also been called intelligent, wired and digital cities. The other important elements that he identifies can, according to Wolfram (2012) be described as four distinct features: (1) business-led urban development, (2) concern for high-tech and creative industries, (3) an emphasis on social learning, education and social capital and (4) social and environmental sustainability. Hollands raises many relevant questions, but he bases his argument on superficial examples from many cities around the world. Fortunately, later research has taken up his questions and examines smart city ideas in more depth.

Questions about the technological focus of smart cities pick up on Hollands’ (2008) observation that previous ideas about intelligent,

wired and digital cities have taken on a new name. In an analysis of smart city politics in Italy, Vanolo (2014) claims that the smart city discourse lacks opposition and “runs the risk of building an a priori non-critical consensus” where “urban visioning is increasingly reduced to a single technology-centric vision of the city of the future” (p. 894). Similarly, Söderström et al. (2014) claim that “becoming a smarter city implies giving priority to investments in technology while technology-poor affordable housing or sewage systems are arguably more urgent in many of the world’s cities” (p. 317). Kitchin (2014) explains that ICT-focused governance “promotes a technocratic mode of urban governance which presumes that all aspects of a city can be measured and monitored and treated as technical problems which can be addressed through technical solutions” (p. 9). He goes on to claim that smart city technologies such as real-time analytics cannot solve structural problems and “only enable the more efficient management of the manifestations of those problems” because they do not address root causes (p. 9). There is a risk that smart city initiatives focus on technological solutions instead of other alternatives to environmental sustainability, preventing more radical change that might be necessary.

Along with a focus on technological solutions, smart cities might also cause a shift in decision making power from citizens and municipal governments to the corporations developing the technology. Some researchers argue that the smart city is a neo-liberal ideology that allows multinational companies to take over governance in times of austerity (Greenfield 2013:62–66; Grossi and Pianezzi 2017; White 2016). Kitchin (2014) warns of “‘one size fits all smart city in a box’ solutions that take little account of the uniqueness of places, peoples and cultures” (p. 10). A corporatisation of decision making in urban environmental governance could further cement the reliance on technological solutions. It could also reduce the ability of citizens to influence local government.

It could also be that smart city ideas result in cities that are undesirable to citizens. Kitchin (2014) warns of “buggy, brittle and hackable cities” whose dependence on networked, software-enabled systems reduce the reliability of important infrastructure (pp. 10–11). However, the downsides of smart cities are not limited to when things go wrong. Vanolo (2014) notes that “producing ‘smart cities’ inevitably also co-produces what we could call a ‘smart citizen’” (p. 893). In this form of citizenship, “there is little room for the technologically

illiterate, the poor and, in general, those who are marginalised from the smart city discourse; moreover, citizens are considered responsible for their own ability to adapt to these on-going changes” (p. 893). Gabrys (2014) points out how some smart city projects “present ways of life that are orchestrated toward sustainability objectives characterized by productivity and efficiency” which citizens might not find desirable if they do not want to be governed by logics monitoring and economizing (pp. 44–45). Galdon-Clavell (2013) remarks that many smart city ideas are forms of surveillance that lack the safeguards applied to other surveillance technologies. Joss et al. (2017) warn of tension between citizen influence over decision making and conceptualisations of citizens as customers or passive residents (p. 44). These efforts to improve the environmental sustainability of cities might create cities where no one wants to live.

Following this criticism, some researchers have proposed alternative perspectives on smart cities. Hollands (2015) points to citizen-based initiatives that use ICTs but focus on solving urban problems. McFarlane and Söderström (2017) call for a smart urbanism (SU) that “identifi[es] the knowledges and needs of those conventionally on the margins of the techno-fetishism of SU discourses” but that is not averse to technology (p. 14). There are several alternative takes on the smart city idea within research, but whether these ideas will influence governance processes remains to be seen.

This early smart city research raises many issues of relevance concerning how smart city ideas reshape urban environmental governance. However, several researchers point out that this research lacks inquiry into how these concerns play out in practice (Farías and Widmer 2018; Kitchin 2015; Luque-Ayala and Marvin 2015; Shelton et al. 2015). A few studies have nevertheless investigated how smart city ideas influence urban governance in practice.

Crivello (2015) analyses the introduction of smart city ideas in Turin, Italy. This study shows how the smart city discourse was introduced to Turin through the funding programmes of the European Union and the national government. While Turin did adopt the smart city framing, Crivello concludes that “most institutions introduced smartness as a keyword in order to re-label pre-existing initiatives without the need to meaningfully change them” (p. 919). This example

shows how the flexibility of the smart city concept hinders its influence on urban governance.

Taylor Buck and While (2017) study a national government funding programme in the UK and find a mismatch between the programme's ambitions and the project that local governments proposed. They analysed the Technology Strategy Board's Future Cities Demonstrator Competition that encouraged innovation in collaborations between urban governments and businesses. Based on interviews with local authorities and consultants, they found that "the most transformative ideas came from existing public-private vehicles rather than new partnerships capable of rapid innovation, meaning the FCDC was less about innovation and more about maturity of personal public-private relationships" (p. 516). They conclude that the national government's smart city visions had little influence on urban governance because local governments lacked the capacity to develop innovative partnerships.

Wiig (2016) also found little impact on urban governance in his study of a smart city initiative in Philadelphia, USA. In contrast with the role of government funding policies in the previous two studies, it was the city government and IBM who introduced the initiative in Philadelphia. The initiative was a smartphone app that IBM created to "to connect [the city's 500,000] low-literacy residents to workforce education lessons and through that to employment opportunities in the city's twenty-first century economy" (p. 536). However, a pilot project produced few outcomes and the project did not meet its goals. Nor did Philadelphia continue with its smart city branding, leading Wiig to conclude that the branding was rather a matter of "keeping up with the global circulation of smart city policy discourse" (p. 549) without influence on urban governance in practice.

This review of previous research on smart city ideas raises two sets of issues. The first set consists of concerns about the influence of smart city ideas: increasing corporate influence in urban governance, an increased focus on technological solutions, more surveillance, a shift of responsibility to citizens, and decreased reliability of urban infrastructure. The second set of issues rather questions whether smart city ideas will have much influence at all: smart city funding programmes from higher levels of government might have little effect, and smart city collaborations with multinational companies might not result in long-term change. These somewhat contradictory conclusions

suggest not only that there is variability between smart city initiatives, but also that there is a need to study the influence of smart city ideas in practice. A related question is what relevance these issues have in urban *environmental* governance. As a first step to answering that question, this review of previous research now turns to the topic of smart ideas in a different context: smart grids.

3.3 Smart grids

Research on smart grids illustrates what influence smart ideas play in a different context. Even if this research lacks of a specific *urban* focus, there are two ways in which this research can provide insight for the study of smart city ideas. One reason is that smart grid research illustrates how ICT discourses has reshaped *environmental* governance, even if not with an urban focus. Another reason is that smart city initiatives sometimes involve the implementation of smart grids within cities.

Strengers (2013) explains that smart grids have become part of a dominant idea about the future of the energy system. In her view, the smart label in smart grids refers to both the use of ICT and the goal of resource efficiency. She criticises the vision of a smart utopia that depends on “real-time resource management” and an “efficient, technologically enabled and rational consumer” that she calls the Resource Man (p. 2). She concludes that the smart utopia is “a fundamentally flawed vision” that “excludes, ignores or seeks to eradicate the vast majority of human experience and energy’s role within it” (p. 155). The flaws in this vision mean that its implementation is unlikely to achieve the sustainability impacts that governments aimed for when they provided funding for smart grids.

The Resource Man that Strengers (2013) illustrates shows that even an instrumental application of smart discourses can bring with it other assumptions. According to Strengers (2013:36),

In his ultimate imagined state, Resource Man is interested in his own energy data, understands it, and wants to use it to change the way he uses this resource. He is the ideal and idealised individual consumer of energy, and his aim is total control and choice over his use of energy so that it is operating as efficiently as possible, in a way that suits his lifestyle.

The Resource Man ideal includes assumptions about a person's interests, abilities and desires. While smart grids involves the use of ICT in electricity grids, the predicted impacts of smart grids depend on assumptions about the people who consume electricity.

Smart grid technologies provide the basis for various initiatives to govern energy use in everyday life. In practice, the impact of these technologies varies. Some research shows that the combination of smart grids and photovoltaic panels on homes encourages people to adapt their energy use according to their household energy production (Bulkeley, Powells, and Bell 2016:20; Christensen 2017:8). Other research shows that smart grid technology has limited effect on everyday energy practice, even when users fit the Resource Man ideal (Verkade and Höffken 2017:42). However, some people might be more likely to engage with smart grid technology as citizens rather than economic actors (Throndsen and Ryghaug 2015:164). Smart grids might have some potential in environmental governance, but their impact seems limited in current configurations.

The governance processes that brought about smart grids shed some light on why some technologies have had limited impact. The design of smart grid technology has remained a predominantly technical question for developers of electricity infrastructure. These developers "are reluctant to engage publics in the innovation process because they fear that the many divergent opinions can slow down the process" (Schick and Winthereik 2013:97). Experts rely heavily on narratives of economic rationality, even when faced with conflicting evidence from real users of smart grids (Throndsen 2016:12). However, smart grid technologies are "fundamentally flexible in [their] aims and functioning" and can "accommodate a range of intersecting efforts" (Klauser, Paasche, and Söderström 2014:881). Examples from the Norwegian smart meter roll-out show that when there is time to adapt technologies to local circumstances, "there is great generative capacity and potential for innovation" (Skjølsvold and Ryghaug 2015:888). Smart discourses can contribute to environmental governance if they are introduced to existing governance processes in the right way.

This research on smart grids illustrates the influence on environmental governance that can accompany smart ideas and ICT discourses. ICT holds a promise of more efficient energy use, but the implementation of smart grids is limited by technical and economic perspectives on people and a lack of user involvement in technological

development. One lesson for the study of smart cities is that even when smart is defined instrumentally as the application of ICT, the resulting socio-material arrangements might include implicit assumptions about the interests, abilities and desires of people who use the technologies in their everyday lives. If these assumptions are incorrect, smart city visions will have difficulty living up to their promises.

3.4 Smart cities and urban environmental governance

There is some research that focuses specifically on the influence that smart city ideas have on urban *environmental* governance. Some of this research raises similar concerns to more general smart city research. There are also some calls to redefine smart cities in relation to environmental sustainability. A few studies investigate the influence on urban environmental governance in practice.

Viitanen and Kingston (2014) raise concerns that resemble other research on smart city ideas and urban governance. They criticise smart city strategies for a technological focus that is likely to increase demand for energy and materials, as well as the potential for high costs and lock-in with corporate solutions. They conclude that “current smart city strategies outsource environmental and social resilience to the global technology sector,” increasing the power of elites and marginalising alternative strategies (p. 815). But since the empirical basis for this research is primarily policy documents, it contributes little to the topic of how smart city ideas influence urban environmental governance in practice.

Other research takes up the definition of smart cities in relation to urban environmental governance. Höjer and Wangel (2015) propose a definition of Smart Sustainable Cities that defines sustainability as a goal and ICT as a means for achieving the goal. In contrast, Martin, Evans and Karvonen (2018) claim that there are many tensions between smart city ideas and the goals of sustainable urban development. In a similar vein, Hajer (2015) proposes that ICT needs to take less place in smart city discourses if such discourses are to contribute to sustainable cities. This diversity of alternative perspectives within research suggests that actors who are critical of

dominant smart city discourses have a variety of alternative discourses on which they might draw.

Some studies have investigated to what extent smart city framings influence urban environmental governance in specific cities. Trencher and Karvonen (2017) examined smart city initiatives in Kashiwa, Japan. The initiative they studied was led by a private developer, but it collaborated with the local university campus and local government. The Kashiwanoha Smart City district came to focus on health and well-being, through both ICT and non-technological solutions, but also set a long-term goal for reducing carbon dioxide emissions. The authors conclude that the example “demonstrates how smart-ness can serve as a thread binding the three sides of the sustainability triangle (i.e. environment, economy and society)” (p. 16). Smart city initiatives can bring actors together not because they share a specific idea of what a smart city is, but rather because the concept is so flexible.

Haarstad (2017) found similar outcomes of smart city initiatives in Stavanger, Norway. He compares the initiatives in Stavanger with the European Union policy documents from the programmes that funded these initiatives. He explains that the funding programmes focus on the economic competitiveness aspects of smart cities, while ICT is more visible in the descriptions of the initiatives that received funding. The local initiatives in Stavanger were “not necessarily an addition to ongoing sustainability initiatives. But the ‘smart city’ framing allows these different agendas to be articulated under the umbrella of a single conceptual scaffold, and they were arguably strengthened as a result” (p. 12). As in the previous study, flexibility was a positive aspect of smart city ideas, this time in coordinated between local actors and in multi-level governance.

A few studies focus on the role that smart city ideas play in urban energy systems. March and Ribera-Fumaz (2016) analyse initiatives related to Barcelona’s smart city strategy. They “observe that private capital is silently but relentlessly permeating into the different layers that structure the Smart City, from the ubiquitous sensors to the network level and beyond” (p. 824). They compare the public reaction to private involvement in water and district heating networks: while “the regional water supplier’s recent 50-year lease and the reconfiguration of the metropolitan water cycle have been very controversial and sparked widespread debate within civil society,” there was no controversy about private operation of the district heating

network in a new smart city district (p. 824). This studies shows how smart city ideas can lead to a new political economy of sustainability where control shifts to multinational companies.

McLean et al. (2016) also discuss the role of private companies in urban sustainability initiatives. They analyse an urban smart grid experiment in Austin, USA, which proposed new roles for both the existing energy utility and new private actors. On the organisation of these experiments, they conclude that “these kinds of [public-private] partnerships blur distinctions between public and private authority while creating new forms of political space that provide certain interests with an advantageous position in influencing smart developments” (p. 3260). The blurring of authority is particularly contentious in light of how the experiment turned energy consumers into so called prosumers, where the energy utility acts as the provider of an energy marketplace. Here, they conclude that this use of markets “represents a distinctive change in how urban power is provided and will represent a significant restructuring of social and political relationship” (p. 3261). In this case, it is the socio-technical organisation of urban smart grids, rather than simply smart city rhetoric, that creates power shifts between private actors, government and citizens.

Bulkeley et al. (Bulkeley, McGuirk, and Dowling 2016) provide a more moderate perspective on the agency of urban smart city experiments. They studied an urban smart grid project in Sydney and Newcastle, Australia. They point out how the project, despite its funding and political support, struggled to actualise its smart grid vision in an urban environment. Their analysis shows problems such as the location of electricity meters, the strength of radio signals, the size and noise of batteries, and conflicts over the geography of urban wind turbines. They conclude that “the material politics of [the project’s] exceptional experimentalism and, the socio-material orders it sought to produce, were entangled, through its actualisation, in the politics of the everyday and could not achieve more than those everyday politics and would afford” (p. 1724). The challenging material politics of urban smart grids serves as a contrast to analyses that identify socio-political shifts in authority between private actors, governments and citizens. Even the best (or most dystopian) plans for the future face the challenge of implementation in “the messy realities

of particular socio-material conditions” (p. 1723) that make it difficult to actualise visions.

Of this research on smart city ideas and urban environmental governance, the research that studies governance in practice provides particular insight that is of relevance for this thesis. Studies of urban smart city initiatives show that there might be a blurring of authority between governmental and corporate actors, but also that the implementation of urban smart grids is subject to many forms of resistance. Other studies indicate that smart city discourses are flexible in urban environmental governance as well, because their impact is not necessarily to encourage the use of ICT.

3.5 Conclusion

The purpose of this chapter has been to review previous research that might inform how smart city ideas influence urban environmental governance. The first section of the chapter defined environmental governance and describes the diversity of practices of city governments that perform environmental governance. The following three sections reviewed the potential implications of smart city ideas through three topics: smart city ideas and urban governance in general, smart grids and environmental governance, and smart city ideas and urban environmental governance. While the last of those three sections discusses research most similar to this thesis, all three sections provide insight into certain aspects of the influence of smart city ideas on urban environmental governance.

Research on smart city ideas and urban governance in general raises several concerns that could be applicable to urban environmental governance. Smart city ideas might emphasise technological solutions to the detriment of other alternatives. The introduction of smart city ideas by multinational corporations might allow these corporations to take control over aspects of urban governance. Smart city ideas might also contribute to increased surveillance or might shift in responsibility for societal issues to citizens. However, little of the research that identifies these concerns is grounded in the practice of urban governance. Other research on how smart city ideas influence specific cities rather comes to the conclusion that these ideas have little influence beyond re-labelling existing initiatives or creating initiatives that are soon forgotten. While the

latter research does not disprove the concerns, this inconsistency suggests that more research needs to be grounded in how urban governance occurs in practice. Nor are these concerns specific to urban environmental governance, which might involve other actors and practices.

Research on smart grids provides a different take on the influence of smart ideas. While not specific to cities, this research is more directly related to environmental governance. This research shows that smart discourses are not limited to the application of ICT, but rather often combine ICT with techno-economic assumptions about human behaviour. These assumptions have steered the work of experts who were tasked with the implementation of national smart grid policies. However, other research shows the flexibility of smart grid technologies to integrate in different contexts. On the one hand, this research suggests that smart city ideas might have limited influence on urban environmental governance if they are intertwined with techno-economic assumptions of human behaviour. On the other hand, the actors who introduce smart city ideas to urban environmental governance might differ from those who implemented smart grid technologies. Different constellations of actors and different contexts might make it possible to adopt smart city ideas without the same assumptions about human behaviour. These alternatives also call for research that is grounded in how urban environmental governance occurs in practice.

There is some research that specifically addresses the question of how smart city ideas influence urban environmental governance, and this research does provide some additional insight. Some of this research is consistent with other research on smart city ideas, coming to critical conclusions about the role of multinational technology companies or suggesting that smart cities should put sustainability goals in focus. Other research is less critical in its conclusions, pointing out how the flexibility of smart city ideas enables new forms of cooperation between public and private actors. Some research that investigates smart city ideas and their influence on energy infrastructure concludes that these ideas do facilitate a shift of power to energy utilities. However, other research points out that efforts to transform energy infrastructure with urban smart grid technologies are difficult to carry out, in particular because of the obduracy of cities and urban infrastructure. Together, this research on urban environmental

governance shows that that influence of smart city ideas depends on factors such as which actors are involved, how they collaborate together, their control over energy infrastructure, and the social and material organisation of the cities.

This review of previous research establishes the need to study urban environmental governance *in practice*. It raises concerns about the potential impacts of smart city ideas: corporatisation, technology-push, surveillance, and a shift of responsibility to individual citizens. However, there is little research to show how these concerns play out in relation to specific cities, nor how they relate to urban *environmental* governance. Similarly, there are only a few studies about how smart grids relate to *urban* environmental governance. The following chapter presents a theoretical perspective that facilitates attention to the concerns raised in previous research but contributes a focus on how these concerns play out in practice.

Chapter 4

Theoretical Perspective

To study urban environmental governance in practice requires a theoretical perspective that takes seriously the concerns of previous research without taking them as given. For example, recognising the potential influence of multinational corporations should not lead to an assumption that all multinational corporations act the same way in urban environmental governance. Along with questions concerning who introduces smart city ideas and what impacts they have, the theoretical perspective should help to understand the influence of the setting in which these ideas are introduced: specific cities with their own history and material form; environmental governance in these cities, with its established practices and institutions; and the multitude of human and non-human actors who are implicated in urban environmental governance. This theoretical perspective builds on ideas from science and technology studies (STS). STS perspectives provide an alternative to technological pessimism by highlighting the ambivalence of technologies and the contingent nature of the appropriation of new technologies (Coutard and Guy 2007). The theoretical perspective builds on many contributions to STS, in particular the concept of assemblage.

This chapter proceeds with four sections. The first section reviews contributions from STS that are relevant for studying cities. The second section highlights the concept of assemblage as developed in STS and by Manuel DeLanda. The third section presents a strand of research

called assemblage urbanism. The fourth and final section summarises the theoretical perspective.

4.1 STS and cities

STS provides many ideas about how to understand the influence of new technologies in cities. Its principles of symmetry and impartiality help to take seriously the concerns of previous smart city research without taken them as given. It has a long history of studying socio-technical change in many contexts. With an increasing attention to mundane objects, it provides concepts for understanding the large variety of elements implicated in urban socio-material change. It also contributes an understanding of multiplicity that is useful for understanding the intersection of multiply realities that exist in cities.

Many theoretical perspectives within STS take inspiration from the field's roots in the sociology of scientific knowledge (SSK). The strong programme of SSK introduced principles of impartiality and symmetry in explanations of how scientific practice produces scientific knowledge (Bloor 1973:173–74). In the study of scientific knowledge, these principles require the same sorts of causes to explain true and false beliefs. These principles are also relevant for the study of urban governance. Previous research suggests that the influence of multinational companies might be increasing. An empirical and symmetrical approach should use the same forms of explanation to explain their influence as it does to explain the influence of other actors.

Another perspective of inspiration within STS is the large technological systems (LTS) perspective. This perspective, which originated in the history of technology, applies a socio-technical perspective to the study of infrastructure networks. Some studies have focused on urban infrastructure networks, such as the electrification of cities (Hughes 1983) or the construction of a district heating network (Summerton 1992). With concepts such as momentum, LTS analyses point out how socio-technical processes shape the development of infrastructure networks, as well as how the socio-technical agency of these networks influences the direction of change. However, LTS studies have traditionally had a focus where “technological systems and networks serve as the basic category of analysis” (Hommels 2005:325). Such a focus is not appropriate for studying the influence of smart city

ideas, which might only affect infrastructure networks within a city's boundaries, or which might include parts of cities other than infrastructure networks.

LTS and the SSK were both inspiration for the Social Construction of Technology (SCOT) approach, which opposed linear, deterministic views of technology development (Pinch and Bijker 1984). According to SCOT, the developers of technology respond to the problems of relevant social groups when they make changes to their technologies. SCOT also investigated processes of stabilisation, which it calls closure. SCOT uses social explanations as an alternative to deterministic perspectives on science and technology. For example, Aibar and Bijker's (1997) study of urban planning in Barcelona applies SCOT to the study of urban governance. They analyse the different social groups that influenced the master plan for the expansion of Barcelona in the middle of the 19th century. This study treats the city as the unit of analysis. It analyses the city's master plan as an artefact and shows how social groups influenced its design and application. The study contributed an alternative to technologically deterministic explanations that were "still a pervasive discourse for those experts and institutions involved in city plan" (p. 23). But as with other SCOT studies, it emphasises the agency of social groups without paying explicit attention to the agency of non-humans. This omission would be unfortunate for studying the influence of smart city ideas, as previous research has shown how material agency complicates urban smart grid initiatives.

Actor-network theory (ANT) took an additional step beyond the social explanations of SCOT and some strands of the sociology of scientific knowledge. Early ANT studies emphasised the agency of non-humans in the stabilisation of scientific facts (Callon 1986; Latour 1993; Law 1987). These studies showed that human agency was not the only factor needed to explain the practice of science and technology. ANT also explains agency as an effect that is generated by networks and distributed in socio-technical configurations (Callon and Law 1995). However, the recognition of non-human agency was not the end of ANT's influence. ANT's development led Latour to call for a reformulation of social theory that rejects the social as an explanatory category (Latour 2005). This later version of ANT serves as the basis for assemblage perspective on urban studies, which helps to study the

variety of potentially influential actors identified in the review of previous research.

Infrastructure is a concept that develops STS ideas on distributed socio-technical agency. While infrastructure refers often to socio-technical networks that support services such as energy and transportation, these types of networks share many characteristics with less physical systems such as the classification of diseases (Bowker and Star 1999) and data-intensive scientific practice (Bowker 2000). When used as a theoretical concept, infrastructure has dimensions that include embeddedness in social arrangements and technologies, transparency, links with conventions of practice, and invisibility until it breaks down (Star and Ruhleder 1996:113). Infrastructures also reproduce standards and conventions in a way that excludes those who are non-standard or unconventional (Star 1991). Infrastructure is a way of understanding how certain socio-technical configurations resist change and standardise, but also the conditions in which they break down and become open to contestation.

Researchers have over time applied STS to more and more empirical domains. What originated in the sociology of scientific knowledge combined with social studies of technology to become science and technology studies, establishing the theoretical resources to study the black-boxing of mundane objects outside of the realm of techno-science (Woolgar and Lezaun 2013:323). Whereas early STS was concerned with socio-*technical* change, for example in scientific laboratories or the design of technologies, later research in the field provides a perspective for studying broader socio-*material* change. Given the multitude of human and non-human actors in cities that are implicated in urban environmental governance, the concept of socio-material change is quite relevant for this thesis.

Later developments in the field have also involved a shift in the STS mantra that ‘it could have been otherwise’. Mol (1999) describes several versions of the idea of multiplicity. One version she calls perspectivalism, which “broke away from a monopolistic version of truth” (p. 76). In contrast, constructivist analyses of science and technology show “that alternative ‘constructions of reality’ might have been possible [...] but vanished before they ever fully blossomed” (p. 76). But her studies of anaemia and atherosclerosis show that there is multiplicity in the present as well (Mol 1999, 2002). Mol’s perspective on practice raises questions about how multiple realities are

coordinated, overlap or interfere with each other, and this perspective has as much relevance for urban studies as it does for Mol's research on health care.

Concepts and lessons from STS have increasingly been applied to cities. Assemblage urbanism is a one strand of STS research in cities that draws particularly on ideas from Latour and Mol. This strand of research is important for this thesis, but before I introduce it I will take a short detour to highlight one concept in particular: the concept of assemblage.

4.2 Assemblage

This thesis builds on ideas of assemblage that come from two sources. The first source is actor-network theory (ANT) as developed by Bruno Latour (2005). The second source is Manuel DeLanda's assemblage theory (DeLanda 2006, 2016). These two sources share as inspiration the relational perspective developed in the philosophical writings of Gilles Deleuze and Félix Guattari. ANT developed in the field of STS and has been influenced by the empirical questions of that field. In contrast, DeLanda's assemblage theory (henceforth referred to simply as assemblage theory) is an attempt to synthesise Deleuze and Guattari's writings on the concept of assemblage. Assemblage theory shares many points of emphasis with ANT, but it develops the concept of assemblage more explicitly. Rather than aiming to synthesise the two, this thesis uses each of them to provide alternative points of emphasis.

In ANT, assemblage is closely related to the concept of an actor-network. However, the concept of network can give misleading ideas about how one sees the world through the lens of ANT. Latour acknowledges that "ANT should really be called 'actant-rhizome ontology'" (Latour 1999:19) to better reflect its philosophical inspirations. It is the concept of a rhizome that ANT draws from the philosophy of Deleuze and Guattari. According to Latour (1996), "ANT claims that modern societies cannot be described without recognizing them as having a fibrous, thread-like, wiry, stringy, ropy, capillary character that is never captured by the notions of levels, layers, territories, spheres, categories, structures, systems" (p. 370). The idea of assemblages as rhizomes provides an alternative ontology of society.

The ontology of rhizomes is central to ANT's commitment to study the construction of seemingly stable phenomena. ANT originated in the social studies of science and its early studies used the theory to analyse the stabilisation of scientific facts. Its origin means that it builds on many other influences beyond the philosophy of Deleuze and Guattari. But more generally, ANT entails a commitment to empirical inquiry that calls into question many of the categories that sociologists have typically used to explain the world. An ANT approach requires the researcher to trace the empirical associations that explain how levels, categories or structures become stable (Latour 2005). Rather than taking such notions for granted, ANT proposes that they are the emergent results of assemblages and that these assemblages have the properties of rhizomes. It is a sensibility that ANT shares with assemblage theory, and which serves as the fundamental relational perspective in this theoretical perspective.

DeLanda (2006, 2016) developed assemblage theory in a context that differs from ANT's origins in the social studies of science. DeLanda's writings are philosophical; they are not driven by sociological questions nor the constraints of empirical material. His ambition is to develop Deleuze's ideas about assemblage into a coherent social theory. DeLanda attributes the theory of assemblages to Deleuze but laments that "the definitions of the concepts used to characterize assemblages are dispersed throughout Deleuze's work" (DeLanda 2006:3). His assemblage theory is very much inspired by Deleuze, but it is his interpretation and his attempt at a synthesis. He describes the overall sensibilities of assemblages in two ways: assemblages are not totalities, and they do not have essences.

For DeLanda, an assemblage is more than the sum of their parts, but the assemblage does not define each part. He distinguishes "the relations between parts and whole" in assemblage theory from what he sees in most schools of sociology. He criticises what he calls relations of interiority, where "the component parts are constituted by the very relations they have to other parts in the whole" (DeLanda 2006:9). In contrast, assemblage theory characterises assemblages by relations of exteriority, which means that "a component part of an assemblage may be detached from it and plugged into a different assemblage in which its interactions are different" (p. 10). This perspective on relations is an extension of the ontology of rhizomes. Since a component can be part of multiple assemblages, these components cannot be cleanly divided

into levels, layers or spheres. But “relations of exteriority also imply that the properties of the component parts can never explain the relations that constitute the whole” (p. 11). Assemblages have emergent properties and it is these emergent properties that the researcher can explain by analysing the construction of assemblages.

Assemblage theory’s rejection of essences involves a philosophical commitment to studying the history of categories. DeLanda (2006) is critical of the “subtler forms of essentialism in which essences are introduced when taxonomists reify the general categories produced by their classifications” (p. 26). This criticism provides another argument against taking for granted levels, layers or spheres and relying on them to resolve sociological inquiry. Extending his argument to include natural sciences, he explains that taxonomic essentialism “starts with finished products (different chemical or biological species), discovers through logical analysis the enduring properties that characterise those products, and then makes these sets of properties into a defining essence (or a set of necessary and sufficient conditions to belong to a natural kind)” (p. 28). His solution to this pitfall resembles ANT’s commitment to empirical inquiry. DeLanda proposes that “to avoid reification we must instead focus on the historical processes that produce those products, with the term ‘historical’ referring to cosmological and evolutionary history in addition to human history” (p. 28). As with ANT, this focus on historical processes makes no distinction between human and non-humans. The emphasis on historical processes also serves as inspiration to investigate how the idea of smart cities becomes adopted in urban environmental governance.

Territorialisation and deterritorialisation are concepts in assemblage theory that complement ANT’s notions about stability. ANT expresses stabilisation in terms of four moments of translation and the concept of an obligatory passage point (Callon 1986). While these concepts are useful in describing stabilising actions at specific points in an assemblage, territorialisation and deterritorialisation refer to processes that occur throughout the assemblage. DeLanda describes these concepts as “variable processes in which these components become involved and that either stabilize the identity of the assemblage, by increasing its degree of internal homogeneity or the degree of sharpness of its boundaries, or destabilize it” (DeLanda 2006:12). Expanding, he writes that “one and the same assemblage can

have components working to stabilize its identity as well as components forcing it to change or even transforming it into a different assemblage” (p. 12). These concepts provide a way of discussing the character of an assemblage as a whole and the general tendencies within the assemblage.

Assemblage ideas from ANT and assemblage theory are complementary and provide an overall relational perspective for this thesis. The philosophical argument against essences and commitment to empirical inquiry are the cornerstones of a theoretical perspective; they help to study concerns about smart city ideas without taking them as given. The next section describes a new strand of urban studies that is based on the concept of assemblage.

4.3 Assemblage urbanism

The theoretical perspective for this thesis builds on a strand of research called assemblage urbanism. Along with a sensibility to socio-material agency, this theoretical perspective draws on discussions about multiplicity in STS. This theoretical perspective differs significantly from critical urban theory and thus requires a different style of analysis.

This thesis adopts a socio-material perspective for studying the influence of smart city ideas. It follows other assemblage urbanism research that “conceives of cities as ensembles of heterogeneous actors, giving analytical priority to the active dynamics of arranging or fitting together socio-material elements” (Blok 2013:8). To apply this perspective is to understand cities as the emergent effects of assemblages. These assemblages are made up of human and non-human elements. For example, a city district cannot be defined simply by its buildings and infrastructure, nor simply by city departments and property developers; it is the relations between all these elements that make a city district.

Inspired by discussions about multiplicity in STS, this theoretical perspective helps to understand what is going on in cities without taking for granted that the city is a coherent object of study. Assemblage urbanism entails a “move away from a notion of the city as a whole to a notion of the city as multiplicity, from the study of ‘the’ urban environment to the study of multiple urban assemblages” (Fariás 2011:369). For example, a city district is not just a place to live

and work, nor just an example of sustainable planning; it is both at once, and the two enactments of the city district influence each other.

This theoretical perspective uses assemblage as an alternative to critical urban theory. While there are applications of assemblage thinking as an empirical or methodological tool that are more compatible with critical urban theory, this thesis adopts assemblage thinking as an ontological perspective where “assemblage analysis displaces the investigation of capitalist urban development and the core concerns of urban political economy” (Brenner, Madden, and Wachsmuth 2011:231). An assemblage urbanism perspective would study capitalism “not as a global abstract logic imposing its forms into local spaces, but as a concrete process assuming multiple forms even within a city” (Fariás 2011:368). The implication for this thesis is to avoid using capitalism as an explanation for phenomena and rather to focus, for example, on the practices of corporations and governments that might be influenced by global economic conditions.

Admittedly, researchers from the tradition of critical urban theory have a point when they criticise assemblage urbanism for “passive-voice politics” (Brenner et al. 2011:236). ANT and assemblage perspectives emphasise the distribution of agency between humans and non-humans (Callon and Law 1995), which inevitably allocates less agency to human actors. However, such a conceptualisation of agency does not require attributing all agency to collectives such as assemblages, nor does it require the researcher to write in the passive voice. The challenge for this thesis is to apply an assemblage perspective, which recognises the distribution of agency between humans and non-humans, without losing sight of who introduces smart city ideas and how.

4.4 Conclusion

This thesis adopts a theoretical perspective based on the concept of assemblage. The theoretical perspective uses STS as its basis for understanding socio-material relations in cities. It uses the concept of assemblage to signify a relational perspective based on the writing of Deleuze and Guattari, as interpreted by Latour and DeLanda. It builds

explicitly on recent research that applies ANT and the concept assemblage to urban studies.

The approach adopted in this thesis involves inquiry instead of critique. As Fariás (2011) writes, in contrast with critical urban theory, an assemblage perspective involves a “more open and explorative form of engagement with the world” (p. 366). Instead of aiming to critique the role of multinational corporations, this thesis examines what influence they have in practice, what conditions allow them to have influence, and what other human and non-human actors have influence on urban environmental governance. Instead of a critique of the introduction of smart city ideas in urban environmental governance, this thesis studies their influence on governance processes. Instead of critiquing the use of smart city technologies in urban environmental governance, this thesis investigates their implications for cities.

An assemblage perspective contributes to this thesis’ ambition to study urban environmental governance in practice. The next chapter describes the methods used to produce in depth empirical material about how smart city ideas reshape urban environmental governance.

Chapter 5

Methods and Material

An assemblage-inspired theoretical perspective provides no specific prescriptions about methods and empirical material. However, the theoretical perspective presented in the previous chapter does have epistemological and methodological implications. Any research based in STS must acknowledge that methods do not simply provide access to reality, but rather that researchers use methods construct the reality that they present in their research. Furthermore, the open and explorative form of engagement encouraged by an assemblage perspective calls for a flexible research design and a combination of methods. This chapter presents the methods used in this thesis and discusses them in the context of the theoretical perspective.

An assemblage perspective—like other relational perspectives—calls for a methodological principle like following the actors (Latour 2005; McCann and Ward 2012). In this sense, assemblage-inspired research shares principles with multi-sited ethnography (Marcus 1995). However though McCann and Ward (2012) do note some differences between multi-sited ethnography and their studies of urban policy mobilities:

The opening up and reassembling of ‘the urban’ point to the continued importance of territories and fixity, but also emphasize the need to both conceive of the relational situatedness of these sites—as places constituted by assemblages of the near and far, the fixed and the mobile—

and also to conceive the situations of policy making as ones that happened in places outside policy actors' own cities, including sites that are fleeting or mobile. (p. 47)

While their research concerns specifically the mobility of policy, their insights are useful for studying the influence of more diffuse smart city ideas. The situations in which smart city ideas influence urban environmental governance concern certain territories (e.g. a city or a city district) and occur in certain places (e.g. meeting rooms in city hall). However, these situations are constituted by assemblages that contain elements from far away: e.g. the corridors of national government funding agencies, or the headquarters of an energy utility, located in another country. While it might be possible hypothetically possible to perform ethnographic research in all these faraway places, there are practical limits to research, not to mention that some activities will always have taken place before empirical work again. As a consequence, other methods are necessary to put together a picture of the assemblages that constitute urban environmental governance.

This chapter begins with a section that discusses the starting point of the empirical work. It then discusses the three types of empirical work and materials: interviews, participant-observation, and documents. After, it discusses the work of analysing and writing.

5.1 Starting out

Decisions about which methods to use depend on where the object of study is situated, not just spatially but also in time. In general terms, the object of study in this thesis is urban environmental governance in practice. More specifically, it is situations where the influence of smart city ideas was visible. I started my empirical work after identifying an artefact that appeared to show the influence of smart city ideas on urban environmental governance: the Climate Contract.

McCann and Ward's (2012) methodological discussion provides some advice about how to apply an assemblage perspective. Concerning their work on policy mobilities, they note:

If, as we argue, policy actors are engaged in a range of contingent and tactical learning and sharing practices as part of their 'local' work, then it is incumbent on researchers to be there—literally when possible, figuratively when not—to gain

a detailed appreciation of the practices through which policy actors draw on circuits of policy knowledge as they cobble together their policies and cities. (p. 49)

In relation to an agreement such as the Climate Contract, their advice would suggest following the practices of negotiation that led to the agreement, as well as the practices of collaboration that emerged from it. At the time of my empirical work, the negotiation of the Climate Contract had already taken place, making it impossible to be there literally. The practices of collaboration, in contrast, were still taking place. To study both required a combination of methods.

The initial focus on the Climate Contract might give the impression that this thesis is a case study of the Climate Contract. Case studies are a useful method for studying situations that are instances of broader phenomena (George and Bennett 2005). A case study of the Climate Contract could be a contribution to understanding the broader phenomena of smart city collaboration between city governments and multinational companies. However, even though some articles in this thesis might come across as case studies after the fact, their coherence is rather a product of the research process rather than a pre-conceived strategy. In contrast with case study methodology, an assemblage perspective “encourages and rewards a methodological openness and flexibility which accommodates the tension between the need to carefully design research projects, on the one hand, and the reality of unexpected connections, mutations, and research sites emerging during the projects, on the other” (McCann and Ward 2012:43). The choice to begin empirical work with the Climate Contract did not determine which methods to use for the rest research process, nor did it limit the empirical material to situations closely related to the Climate Contract.

To explore the practices of negotiations and collaboration related to the Climate Contract, I chose to begin with a combination of methods and empirical sites. I interviewed representatives from property developers to get their perspective on the Climate Contract. I also interviewed the city environmental department’s project manager for the Climate Contract to understand the agreement’s importance and history. Soon after beginning interviews, I received access to regular meetings about the Climate Contract, where I could perform participant-observation. I also began searching for official documents

that would describe the decisions taken to approve the Climate Contract, an effort that ultimately led me to focus on other documents. Already within the first months of empirical work, it proved beneficial to have an open and flexible approach to empirical work.

5.2 Interviews

This thesis builds on interviews with people in their professional roles. Interviewing is a method that can produce knowledge about events in the past and present. Interviews served as my primary method for understanding the influence of smart city ideas in the past. I also used interviews to gain a better understanding of the sites in which smart city ideas were having an influence in the present. The distribution of interviewees reflects the research questions of this thesis, but was also influenced by the relative ease of access to public sector employees.

As interviews are constructed situations, the responses of interviewees cannot be seen as indisputable facts. Interviews are a form of “knowledge production through conversation [which] is intersubjective and social, [where] the interviewer and the interview person construct knowledge together” (Kvale and Brinkmann 2009:34). The design, performance and interpretation of interviews should all be adapted to the interview situation. Interviews with people in their professional roles is a method to begin tracing assemblages around an artefact such as the Climate Contract. However, people in their professional roles might respond to interviews in different ways. My respondents seemed honest with their answers, but they could have been putting a better spin over some problems that they dealt with. Some people who had worked with the Climate Contract were more eager to be self-critical, while others gave versions of events that fit well with the official version of the organisation that they belonged to. The responses of interviewees must be compared to each other and with the material produced through other methods.

When studying events that took place several years in the past, interviewing is a necessary but limited method. For example, interviews were necessary for understanding the practices of negotiation that led to the Climate Contract. There were no official documents aside from the Climate Contract itself, and other documents such as meeting minutes were incomplete. And even if there had been a paper trail, decisions in official meetings often provide

the authority to decisions that were already made (Sahlin 1989). Interviews with the employees who remained in their positions produced valuable information. However, my respondents from city departments and Eon had different explanations for why the Climate Contract came about. One emphasised the city administration's ambitions to build on its work in the Western Harbour; another said that it was part of fulfilling the goals of the Malmö Environmental Programme. A different city employee said that the purpose of the Climate Contract was to convince property developers to raise their ambitions; the property developers that I interviewed did not think that the Climate Contract had anything to do with them. These different versions of the story are not directly contradictory, but they highlight how the Climate Contract was part of multiple practices. The emphasis on these different practices varies in the four articles of this thesis, depending on the aim of the article and the other empirical material used.

I also used interviews to complement other methods. While participant-observation provided a glimpse into how urban environmental governance was taking place at the time of my empirical work, my access was limited to particular meetings. My interviews produced information about other practices that I could not access through participant-observation. Through interviews, I could also better understand the content and context of documents: e.g. the story behind official project reports and why there was no documentation about the Climate Contract in the city archives.

In total I performed 19 interviews, the majority of which were in-person interviews in Malmö. Table 1 lists these interviews and describes the roles of the interviewees. The first five interviews involved people from a mix of organisations; I then turned to people working with the Climate Contract, and then other people at the city administration working with related matters; finally, I interviewed several property developers. I performed semi-structured interviews based on interview guides that I adapted according to the person I was interviewing (see Appendix). I recorded and transcribed the interviews, with the exception of one person from a property development company who did not want to be recorded. Instead, I took notes during the interview and wrote detailed notes afterwards. I strove to transcribe each interview before performing the next one; when that

was not possible, I listened to each interview within a day or two and made preliminary notes.

The interviews were limited to people in their professional roles, and the majority of interviews involved people from the public sector. This distribution reflects the way in which urban environmental governance was performed, as it involved employees from several city departments. Almost all of the city employees I contacted were willing to be interviewed, though some suggested colleagues that they thought would be more appropriate. One person within the city administration ignored several interview requests. I had hoped that this person would help clarify some questions I had about the time prior to the Climate Contract, but I was instead left to complement my interviews with documents. In contrast, it was more difficult to get access to interview people at Eon, where I only interviewed one person. Another employee at Eon, who I contacted first, declined my interview request and suggested that I instead attend an upcoming conference organised as part of the Smart Grids for Hyllie project. Given that earlier smart city research has raised questions about the role of companies, it would certainly seem relevant to study them in as much detail as possible. However, I was able to study the company's involvement in governance processes in other ways: in its participation in meetings, in the documents it helped to produce, and through interviews with city employees and property developers. I was not able, for example, to follow how they developed smart grid technologies for Hyllie. However, these processes of technology development would be more relevant for a study that focuses on the practices of engineers than this thesis' focus on governance processes.

My interviews omitted one group of people who could be of interest for studying smart city initiatives: residents. Understanding the practices of residents is important reducing energy use in homes (Shove 2010), just as an understanding of the needs of users contributes to success in the design of ICT solutions (Axelsson, Melin, and Lindgren 2010). The perspectives of residents could complement the perspectives of city employees and property developers. However, in the planning stages of a new city district such as Hyllie, there are no residents. At the time of my interviews, there were few buildings with residents in Hyllie. However, I interviewed representatives from the companies who owned the buildings, and found that they themselves were critical of the smart technologies offered in Hyllie. Given that the

aim of this thesis concerned governance, I decided that these company representatives provided enough of a critical perspective on behalf of residents.

Interviewing has been a way to produce knowledge about events that occurred in the past, and provided a complement to other methods for studying practices in the present. However, the knowledge produced during interviews is always an account from a person's professional perspective. The next section discusses a complementary method for studying practices in the present: participant-observation.

Table 1: List of interviews

	Date	Position	Organisation	Type
1	June 2014	Employee with experience from several city districts	Environmental Department	In person
2	April 2015	Project manager	MKB Fastighets AB (owned by city of Malmö)	In person
3	May 2015	Unit leader, and member of the Climate Contract's project group	VA Syd	In person
4	May 2015	Current project manager for Climate Contract, and member of the Climate Contract's project group	Environmental Department	In person
5	May 2015	Energy strategist	MKB Fastighets AB	In person
6	September 2015	Current project manager for the Smart Grids for Hyllie project	Environmental Department	In person
7	September 2015	a) Strategist with experience from several city districts, and member of the Climate Contract's project group	City Planning Office	In person
		b) Planner who was project manager for the Hyllie Environmental Programme, who later became a member of the	City Planning Office	

	Date	Position	Organisation	Type
		Climate Contract's project group		
8	September 2015	Project leader for property development in Hyllie, and member of the Climate Contract's project group	Property Department	In person
9	September 2015	Project leader for the company's work in Hyllie	Eon	In person
10	October 2015	Previous project leader for the Climate Contract	Environmental Department	In person
11	January 2016	Owner and CEO	Nevstens Fastighets AB	Telephone
12	February 2016	Owner and CEO	Roth Fastigheter	In person
13	February 2016	Technical manager	Skanska Öresund	In person
14	February 2016	Project manager for marketing work in Hyllie	Property Department	In person
15	March 2016	Same as 7a		Telephone
16	March 2016	Project leader who had worked with several companies in Hyllie	Ikano Bostad	Telephone
17	April 2016	Two employees who worked with the Environmental Construction Programme	City Planning Office	In person
18	April 2016	Owner and CEO	Lustgården AB	Telephone
19	April 2016	Project officer	Swedish Energy Agency	In person

5.3 Participant-observation

Participant-observation is a method that produces data about everyday contexts, which differs from the second-hand accounts produced through interviews (Hammersley and Atkinson 2007). My participant-observation consisted primarily of inter-organisational meetings concerning the Climate Contract. This empirical work provided a valuable understanding of how inter-organisational collaboration took place in practice. Observing meetings only provides a partial

perspective of urban environmental governance, but it provides a level of detail that is difficult, if not possible, to produce after the fact through interviewing and studying documents.

After my interview with the Climate Contract's project manager, I was invited to participate regular inter-organisational meetings that brought together city departments, Eon and VA Syd. The collaboration took place through groups on three levels of the organisational hierarchies. My empirical work focused on the project group, made up of employees from four city departments, Eon and VA Syd. In the project group's meetings, its members shared information about different activities related to the Climate Contract, and evaluated the progress toward the Climate Contract's goals. Above the project group was the steering group, which was made up of the superiors to the members of the project group; it met three or four times per year and provided direction to the project group. There was also a commissioning group made up of higher-level decision makers such as department heads, which made final decisions about the interpretation of the Climate Contract. Table 2 lists the meetings that took place during my empirical work, from September 2015 to November 2016. In addition to regular meetings, I also attended a meeting of an organisation called Consensus Hyllie ('Samsyn Hyllie') where members of the project group made a presentation to property developers.

The regular meetings that I attended lasted one to three hours. Aside from the first meeting where I presented my research interests, I had little input during the meetings. I made notes during the meetings and re-wrote my notes directly after each meeting.

This type of participant-observation differs from more extensive ethnographic research. There is no denying the difference between attending monthly meetings, as I did, and ethnographic research of planners that involves following them all day (Macmillen and Pinch 2017), let alone for months (Tait 2011). Still, in-person meetings arguably have an important role to play in organisations, given that they have not been replaced by virtual meetings or other forms of digital communication (Sandler and Thedvall 2017). Inter-organisational meetings involving different city departments and utility companies require not only getting people into the same room at the same time, but also travelling across the city to get into the same building. The meetings of the Climate Contract project and steering groups served multiple purposes: information sharing, getting

feedback on reports, discussing how to solve problems, and in the case of commissioning group, making decisions. While it is possible that people avoided certain topics because I attended meetings, I did observe disagreements and the discussion of ideas that the project group later gave up on. These meetings do not tell the whole picture of inter-organisational collaboration, but participant-observation produced more information than would have been possible through interviews.

In the context of urban environmental governance, such meetings are only one site among others. While the theoretical perspective of this thesis shares principles with multi-sited ethnography, it is rather of the character of a strategically situated single-site study (Marcus 1995:110). Urban environmental governance occurs through so many actors in so many sites—such the city employee at their desk, the planner in a meeting with a property developer, the grid operator designing district heating network—that it would be impossible for a single researcher to perform participant-observation of all these sites at once. Even inter-organisational collaboration takes place in settings beyond the regular meetings, such as telephone calls between two people or small group meetings to prepare an issue for an upcoming meeting of the entire project group. To stick with participant-observation as the only method would necessarily require a much more limited object of study.

Instead, this thesis uses participant-observation as one method among others. Participant-observation produces a level of detail that cannot be produced in interviews, but is limited to practices that take place during the period of empirical work. A third type of empirical material, which provides an additional level of detail about events in the past, is documents.

Table 2: List of meetings during participant-observation period

Date	Group/ Meeting	Atten- ded?	Documentation
September 2015	Project group	Yes	Field notes, agenda, minutes
	Note: I presented my research interests to the group.		
September 2015	Steering group	No	Agenda, minutes, presentation

Date	Group/ Meeting	Atten- ded?	Documentation
October 2015	Project group	Yes	Field notes, agenda, minutes
November 2015	Project group	Yes	Field notes, agenda, minutes
November 2015	Steering group	No	Agenda, meeting minutes, presentation
November 2015	Commissioning group	No	Agenda, meeting minutes, presentation
December 2015	Project group	Yes	Field notes, agenda, minutes
January 2016	Project group	Yes	Field notes, agenda, minutes
February 2016	Steering group	Yes	Field notes, agenda, minutes
February 2016	Project group	Yes	Field notes, agenda, minutes
March 2016	Samsyn Hyllie	Yes	Field notes
	Note: a meeting of property developers in Hyllie, where the project group presented information about the Climate Contract and the Smart Grids for Hyllie project.		
March 2016	Project group	Yes	Field notes, agenda, minutes
April 2016	Project group	Yes	Field notes, agenda, minutes
May 2016	Project group	Yes	Field notes, agenda, minutes
May 2016	Steering group	Yes	Field notes, agenda, minutes
June 2016	Project group	No	Agenda
June 2016	Project group	No	Minutes
August 2016	Project group	No	Agenda
August 2016	Steering group	Yes	Field notes, agenda, minutes
September 2016	Project group	No	None
October 2016	Project group	No	Meeting minutes
November 2016	Steering group	Yes	Field notes, agenda, minutes, presentation

5.4 Documents

Documents have been an important part of my empirical work in several ways. I have used some sets of publicly available documents as the basis for systematic document analysis (Bowen 2009). Many other documents have been part of desk research that helped me prepare for empirical work such as interviews. Documents have also been part of the participant-observation that I performed. Even searches that turned up no documents produced information about practices of collaboration.

My initial searches for documents at the city archives were informative because they turned up nothing. I looked into the city archives as an extension of my desk research, while waiting out the delay before my first interview with someone in the Climate Contract project group. To my surprise, I found no mentions of the Climate Contract in the archives of the city council, the city executive committee, or the city board responsible for infrastructure. The lack of official decisions provided me with an understanding of the context for the project group, the steering group and the commissioning group; they had to relate to the Climate Contract, but they did not have to follow the standard decision making rules of the city government.

Desk research served several purposes in my empirical work. Planning processes and property development both produce a wealth of documents. Any city plans, reports or decisions that have been approved by politicians are available to the public, often through the city government's website, but otherwise through the city archives. The city website was also the source of many other documents that had been produced by city staff but which were not official enough to be included in the archives. Similarly, the websites of property developers provided some information about their buildings, but there were differences between developers and the information often appeared only as buildings were about to go for sale or rent. Even though much of the information on websites was incomplete or poorly contextualised, it provided information that could be used tentatively until confirmed by more reliable sources such as interviews.

Documents are a complement to participant-observation of meetings. As Table 2 shows, I received documents related to many of the meetings that I was not able to attend: the agenda, often meeting minutes, and sometimes presentations that the project manager had

prepared to the steering group and commissioning group. The documents were informative even for meetings that I did attend. The agenda showed which items were left out when a meeting ran out of time, and which pressing issues were given time at meetings without being on the agenda. The meeting minutes complemented my field notes, and also helped me fill in the blanks concerning topics that I did not understand or whose details I had missed in my notes. I also received access to agendas, minutes and presentations from meetings that took place before began my participant-observation. Some minutes were missing, while others were scribbled by hand and full of unexplained acronyms. It would be impossible to guess what issues were excluded from the minutes. However, the information in these minutes did help to corroborate what my interview respondents told me about events that took place several years prior to the interviews.

Official project reports were the documents that I analysed most systematically. As part of the Smart Grids for Hyllie project, the city administration and Eon filed progress reports twice a year for five years. I also received the original project application and the applications to extend the project. These documents were more formal than the Climate Contract meeting minutes, but they did have some limitations of their own. They were written within the context of a large project, by the receivers of funding to the funding agency. It would not be surprising to learn that the project participants put a good spin on their efforts. With that in mind, these regular progress reports do allow for a look back in time from the optimistic perspective of the project participants. I included these documents with my field notes and interview transcripts during my analysis and coding.

No documents, regardless of their source or quality, can be accepted as true representations of reality. They played various roles in my empirical work. Together with interview transcripts and field notes, they constituted the empirical material that I analysed and used to write the four articles.

5.5 Analysis and writing

Doing research involves many forms of work: reading, developing research questions, empirical work, analysis and writing. While there is a logical order to this work, it is not necessarily linear, nor do the different forms of work correspond to distinct phases. The conditions

also varied between the four articles, since I did not write all four at once. This section discusses how I analysed my material in relation to empirical work, previous research, and the writing process.

To characterise the research process as non-linear is consistent with this thesis' theoretical perspective. The concept of assemblage is also appropriate for understanding the research process from study design to published article. As McCann and Ward (2012) write, an assemblage perspective highlights the importance of writing:

Yet, as Richardson (2000), among many others, has noted, writing is not, nor should it be, simply 'writing up.' While the latter implies a post hoc, mechanistic, and transparent reporting of 'findings', the former encourages analysis and expression in and through the process of representation. As such, it also indicates another process of assemblage. Through our practice as researchers, the already-assembled policy world is (re)assembled twice more, first in reference to research design decisions, then through writing. (p. 50)

A sincere account of the research process should account for the non-linearity of the research process and the relations between the various forms of work. These relations include beginning analysis while performing empirical work and formulating links to theory and previous research while doing analysis and writing.

My explorative approach to empirical work required that I begin with preliminary analysis of my material before I had finished my interviews and participant-observation. For example, analysis of my field notes from participant-observation informed my decisions about who to interview and what questions to ask. During this preliminary analysis, I coded my empirical material as I produced it, working in Atlas.ti, and using primarily inductive themes. This style of coding, which does not result in abstract themes, is consistent with a theoretical perspective based on actor-network theory (Wright 2016). Indeed, I continued to use such a close-to-data approach to coding even after I finished my empirical work.

While my empirical work did proceed inductively, my analysis process was only partially inductive. In the process of writing each article, I set out to combine interesting empirical material with relevant theoretical perspectives and ongoing discussions in previous research. This approach prioritises neither the empirical material, theoretical

perspective nor previous research; it uses empirical material to challenge previous research and uses theoretical perspectives to suggest avenues for empirical analysis (Alvesson and Kärreman 2007). In practice, it meant a combination of coding strategies such as versus coding (to explore tensions in empirical material) and theoretical coding (Saldaña 2013) as a strategy to identify tensions while reading through my empirical material. Of the four articles in this thesis, I relied on theoretical coding most in article I, where I used concepts from the sociology of expectations to inspire the analysis.

There are some similarities in the process of assembling the four articles. Each article is the result of many revisions with feedback from several sources: particularly from my supervisors, but also from colleagues from my seminar group, as well as the audiences at several conferences and courses. Each article also began with more general arguments in relation to previous research, and I developed more specific arguments as a result of writing drafts, engaging more closely with research, and re-analysing the empirical material. I supported this iterative process by writing analytical memos and relational mapping (Clarke 2005).

The differences in the assembling of each article depend on timing and the main source of inspiration. In terms of timing, I began writing article I while doing empirical work. This article owes its focus to my participant-observation; my analysis began with the tensions about wind energy that I observed during meetings, and I looked for theoretical perspectives that could help me understand these tensions. I wrote the other three articles after I had finished my empirical work, aside from collecting some additional documents. Still, I did not use the same process for all three. Article III was similar to article I in the sense that it began with a focus on an aspect of my empirical material—the Hyllie Environmental Programme. In contrast, articles II and IV were inspired by more analytical arguments. Article II had from the beginning a focus on the shift from sustainable cities to smart cities, and I re-coded my material with this general interest in mind. My inspiration for article IV came from reading previous research on urban experimentation, as well as attending a conference session on the same topic. I wanted to explore the topics of urban experimentation and political economy, and I re-coded my empirical material again with this interest.

5.6 Conclusion

This thesis uses a combination of methods and material: interviews, participant-observation and documents. This combination is necessary to study urban environmental governance in practice. I have used interviews and documents to study urban environmental governance in the past, and in sites that were not accessible to participant-observation. I used participant-observation of regularly scheduled meetings to follow urban environmental governance at the time of my empirical work. This thesis' theoretical perspective has epistemological and methodological consequences that apply not just to understanding the production of empirical material, but also to the assembling of articles. I produced the four articles through different processes, and relied on a different mix of empirical material for each article. In the next chapter, I discuss the findings and contributions of each article.

Chapter 6

Summary of Articles

6.1 Article I

Promises and techno-politics: Renewable energy in the Malmö's climate-smart city

The aim of this article is to better understand how smart city visions emerge, how they affect urban change, and how their effects change over time. Early research on smart city visions raises concerns about the influence that multinational corporations have in such visions (Söderström et al. 2014; Viitanen and Kingston 2014), but this research has focused on the content of visions rather than the influence that they have in practice (Kitchin 2015)—or in other words, their techno-politics. This article analyses the emergence of the Climate Contract for Hyllie, its influence on renewable energy production, and later changes to the vision.

The main result of the article is that actors negotiate ideas about the future repeatedly as they go about creating visions and acting on them. The Climate Contract established a vision for Hyllie, but signing the contract did not mean that the vision was fixed for good. Rather, the Climate Contract established a collaboration between the three signatories: the City of Malmö, Eon, and a municipally owned infrastructure company called VA Syd. Primarily, the contract

combined Malmö's vision of a climate-smart city and 100% renewable energy with Eon's ambitions to demonstrate urban smart grid technology. The contract guided their initial efforts to provide Hyllie with renewable energy. But soon after, Eon added to the vision for Hyllie by promising that it would provide renewable district heating and build wind turbines. That promise further coordinated the collaboration between the three signatories. Four years later, when they realised that Eon would not be able fulfil its promise of building wind turbines, the signatories decided to re-interpret the Climate Contract according to prevailing state of energy consumption and renewable energy production in Hyllie. They continued to reference the Climate Contract and Eon's renewable energy promise, but the re-interpretation of the Climate Contract became the guiding vision for these actors.

The main empirical contribution is in showing how challenging it is to realise a vision for a city district, even when dominant actors such as the city administration and the grid operator support the vision. Previous research on smart city visions raises concerns that multinational companies will push these visions on city governments, with negative consequences such as unnecessary investments in technology and increased surveillance. This article shows that these visions are unlikely to be realised in full, due to the challenge of coordinating socio-material change in cities. However, this article also shows that some parts of a vision become realised while other parts don't. In collaborations between city governments and multinational companies, there is an uneven distribution of resources. There is a risk that the companies will place more resources into the parts of a vision that they proposed, while leaving the government's parts of a vision to fail when problems arise.

The main theoretical contribution is a better understanding of the techno-politics of urban visions. Previous research conceptualised a vision as a reference point for coalition building (Hodson et al. 2013:1407), without considering what happens with a vision over time. This article conceptualises a vision as a series of discrete promises, each of which needs to maintain the support of a unique coalition of actors. Furthermore, this article uses the concept of assemblage to highlight the combinations of socio-material elements that contribute to maintaining credibility of a promise.

6.2 Article II

From sustainable to smart: Re-branding or re-assembling urban energy infrastructure?

Co-author: Harald Rohrer

The aim of this article is to better understand how smart city ideas become integrated in cities with well-known traditions of sustainable urban development. Previous research suggests that the inspiration for smart city ideas might come from the pressure of multinational technology companies (Söderström et al. 2014; Viitanen and Kingston 2014) or from the examples of other cities around the world (McCann 2011). This article analyses the shift from sustainable to smart in Malmö, Sweden, and Graz, Austria.

The main result of the article is that smart city ideas come from multiple actors in each city, and that the integration of smart city ideas is a gradual process of discursive, institutional and socio-material change. In Malmö, the city made the discursive shift from ‘sustainable’ to ‘climate-smart’ on its own; the interest in smart energy grids came from Eon; the Swedish Energy Agency provided funding that enabled the demonstration of smart grids, within the limits of the agency’s mandate. In Graz, actors involved in eco-city ambitions introduced smart city discourses to receive funding from the national government, but without adopting ICT significantly; later, other actors within the city government pushed for more ICT in urban development projects, in collaboration with companies such as IBM and Cisco.

The main empirical contribution is the identification of two logics that explain how the shift to smart occurs. This contribution builds on the analysis of two assemblages in each city: an existing sustainable city assemblage and a new smart city assemblage. In both cities, we first identify a logic of appropriation, where actors within the existing sustainable city assemblage draw on smart city discourses. The appropriation gradually leads to the institutionalisation and materialisation of a smart city assemblage. Later, we identify a logic of colonisation, where the smart city assemblage takes control over resources that previously were under the control of the sustainable city assemblage. The logics of appropriation and colonisation provide an alternative to understandings of an integrated concept of smart-sustainable cities (Bibri and Krogstie 2017; Höjer and Wangel 2015).

The main theoretical contribution is a better understanding of how discursive and socio-material change occurs in cities with well-established discourse coalitions. While Hajer's theory of argumentative discourse analysis helps to explain the relations between discourses, coalitions of actors and processes of institutionalisation (Hajer 1995), it lacks concepts to explain how change occurs when one discourse is institutionalised and materialised, while another discourse has at first no institutional or material form in the city. We extend Hajer's ideas about discourse coalitions and institutions by drawing on DeLanda's assemblage theory (DeLanda 2006, 2016) and recent research in urban studies that uses the concept of assemblage (Blok 2013; Farías 2010). By conceptualising discourses and discourse coalitions as elements of assemblages that also include institutions and socio-material practice, we study how changes to these elements affect each other. In DeLanda's terms, we study how an assemblage territorialises, meaning that it becomes a more homogenous whole, or deterritorialises, meaning that it loses homogeneity. We analyse how the territorialisation of a smart city assemblage leads to the deterritorialisation of a sustainable city assemblage.

6.3 Article III

Energy efficiency left behind? Policy assemblages in Sweden's most climate-smart city

The aim of this article is to provide a better understanding of how smart city experiments reshape the urban governance of building energy use. The governance of building energy use has been a challenge for many years, and building energy codes have been a central tool to address the split incentives between construction companies, building owners and tenants (Laustsen 2008; Smedby 2016). Experiments with urban smart grids have shown the potential to overcome these challenges, as well as introduce more renewable energy into electricity grids, by reconfiguring the dynamics of energy supply and demand (Klauser et al. 2014; McLean et al. 2016). However, it is difficult to translate urban experiments into long-term change due to the obduracy of urban infrastructure and the inertia of socio-technical systems that extend beyond a single city (Bulkeley, McGuirk, et al. 2016; Hodson, Geels, and McMeekin 2017). This article analyses how two smart city

experiments—the Climate Contract and the Smart Grids for Hyllie project—influenced the governance of building energy use.

The main result of the article is that energy efficiency risks being left behind as smart city experiments introduced a smart grid policy assemblage in Malmö. The smart grid policy assemblage allows Eon to take a central role in the governance of building energy use, and the city administration provides legitimacy to this role. In contrast, the energy efficiency policy assemblage leaves the city administration with a rather passive role, as energy efficiency has become the responsibility of the property developer alone. The experiments also led to a smart home policy assemblage, which also leaves most responsibility to the developer, but Eon's prominent position in Malmö gives it the opportunity to continue pushing smart home technology such as energy visualisation and controls. Finally, the experiments also produced a renewable energy policy assemblage in which the city administration has its most active role; it can shape spatial plans to facilitate renewable energy in buildings.

The main empirical contribution is in showing the tension that comes from institutional change in which grid operators take a more central position. Previous research has criticised increased corporate involvement in urban environmental governance (March and Ribera-Fumaz 2016; Viitanen and Kingston 2014) without considering the potential for governance innovations (Haarstad 2017). Urban smart grids do provide grid operators with a larger role in the governance of building energy use, and this role is outside the bounds of oversight provided by regulation of energy distribution networks. However, urban smart grids also provide the opportunity for governance innovation, for example by involving the grid operator in the early stages of building design. This involvement might encourage developers to address energy issues in new ways, particularly in integrating demand response technologies that can improve the overall efficiency of the energy system.

The main theoretical contribution is a better understanding of how urban experiments influence governance arrangements. The concept of a policy assemblage conceptualises a governance arrangement as socio-material relations between not only policy documents, but also organisations, visions and infrastructure. In terms of urban experiments, the policy assemblage concept helps to analyse the process in which an experimental result—such as a new technology, a

new policy goal or a new organisational relationship—becomes codified in a policy and enacted in socio-material relations. Similarly, the policy assemblage concept helps to understand the socio-material relations that enact existing policies, and how these relations are influenced by urban experiments.

6.4 Article IV

Not a big happy family: Agonistic experimentation and the limits of higher order learning

The aim of this article is to better understand how participants in socio-technical experiments navigate these open-ended processes. Research on urban socio-technical experiments has identified many actors whose interests might come into conflict, such as local residents (Heiskanen et al. 2015), energy utilities (Bulkeley et al. 2014) and intermediary organisations (Matschoss and Heiskanen 2017). However, theoretical conceptions of socio-technical experiments tend to emphasise the importance of inclusion and social learning (Sengers, Wieczorek, and Raven 2016) rather than the potential for conflict. This article analyses the politics of the Smart Grids for Hyllie project.

The main result of the article is that the Smart Grids for Hyllie dealt with unanticipated turns without social learning. The Smart Grids for Hyllie project was organised by a rather small coalition: Eon and the City of Malmö, with funding from the Swedish Energy Agency. However, its demonstration of smart grid technologies in apartments and buildings required the participation of property developers. One unanticipated turn was weak interest from property developers; another was a lack of support from other departments of the city administration. The experiment resulted in new smart grid technologies despite these unanticipated turns. But the success did not come from a social learning—the coalition behind the experiment did not create an inclusive vision together with property developers and other parts of the city administration. Rather, it made the most of weak support from those actors, and responded by shifting the experiment to other parts of Malmö.

The main empirical contribution is in showing that socio-technical experiments can produce results despite a lack of inclusive politics. Matschoss and Heiskanen (2017) make a similar point when they write

that the work of intermediary organisations in experiments “requires choices in who to engage and what to promote” (p. 92). But these choices are not limited to intermediary organisations; there are important questions of who to include and what to prioritise in the decisions of funding agencies and city governments.

The main theoretical contribution is the concept of agonistic experimentation. This concept provides a model of experimental politics that is an alternative to consensus and social learning. It borrows the concept of agonistic politics from Mouffe’s (2000) conceptualisation of democratic politics. While socio-technical experimentation is a completely different setting than democratic politics, it is still useful to consider agonism as a middle ground of experimental politics between consensus and antagonism. Agonistic experimentation does not preclude consensus, but it recognises that consensus is not always possible. Socio-technical experiments should be prepared to deal with unanticipated turns in ways other than social learning.

Chapter 7

Discussion

This chapter considers the combined results of the four articles and discusses how they together answer the three research questions posed at the beginning of this thesis.

7.1 Introduction of smart city ideas

1. What types of actors introduce smart city ideas into urban environmental governance, and what conditions enable these actors to do so?

The cast of the climate-smart city differs from the usual players described in much early smart city research. Grid operators have a particular position to introduce smart city ideas into urban environmental governance. City governments need the help of grid operators, a condition that enables some smart city ideas while excluding alternative discourses.

The climate-smart city is an opportunity for both city governments and grid operators. For grid operators, the application of ICT to urban energy systems promises to alleviate capacity problems in distribution networks and facilitate increasing amounts of intermittent renewable energy production. Smart cities are also an area of potential business growth for these companies. Given their appeal to grid operators, climate-smart ideas are useful for city governments that need to build

coalitions in their efforts to transform urban infrastructure networks (cf. Hodson et al. 2013). The needs of city governments creates conditions that enable grid operators, but not necessarily the multinational technology companies on which early smart city research has tended to focus. The advantage of grid operators is their ownership of urban energy systems.

The potential climate-smart ideas does not come exclusively from the promise of ICT in urban environmental governance. The idea of a smart city also provides a political opportunity for city governments (Haarstad 2017). The discursive flexibility of smart city ideas allows city governments to combine their goals in urban environmental governance, the business interests of grid operators, and the priorities of higher levels of government. Part of what makes the climate-smart city appealing to coalitions of city governments and grid operators is the funding available from national governments and the European Union.

However, the combination of building coalitions and finding funding makes it difficult to adapt a coherent discourse. Coalition building requires negotiation to create common visions. Finding funding for new initiatives additionally requires actors to balance what they want to achieve with what they believe the funding agency will accept. These negotiations and balancing acts hinder the adoption of coherent notions of climate-smart or Smart Sustainable Cities (cf. Höjer and Wangel 2015). City governments and grid operators lack the conditions in which either one could dictate visions, while neither the European Union nor national funding agencies are dogmatic in pushing a strict definition of smart cities when it comes to urban environmental governance.

These conditions also exclude alternative smart city discourses from urban environmental governance. Increasingly, research on smart cities calls for alternative, citizen-centred discourses, often with references to some exemplary initiatives (Hajer 2015; Hollands 2015; McFarlane and Söderström 2017). These alternative smart city discourses often focus more on societal problems, with or without solutions based on ICT. However, these alternatives lack the basis for creating coalitions between city governments and grid operators; they are smart city ideas that lack a political opportunity for urban environmental governance.

7.2 Reconfiguring urban environmental governance

2. Through what processes do these actors use smart city ideas to reconfigure urban environmental governance?

Visioning and experimenting are two processes in the climate-smart city. Both are processes that involve city governments, grid operators and funding agencies from higher levels of government. However, they also involve numerous other human and non-human actors that push back. In contrast with the conclusions of other smart city research, urban benchmarks and canonical examples of smart cities are not evident as processes that reconfigure urban environmental governance.

Visioning should not be seen as a process that ends once actors form a coalition and agree on shared goals. Part of the process is indeed the building of a coalition and creation of a shared vision (Hodson et al. 2013). However, a climate-smart vision between the city government and the grid operator will need, to have any chance of success, the involvement of other actors such as developers and residents. Visioning continues in two ways. First, as an initial vision is often ambitious but vague on details, its proponents must follow up with additional, more concrete promises about the future. Working with visions also involves the creation of new promises that help to fulfil the overall vision, and ensuring that these promises enrol the necessary publics. Second, the process of realising more concrete promises can identify tensions in the overall vision, which might require refinement or changes to the original coalition. In the sense that a vision is a reference point for a group of actors, visioning is a process of establishing and adapting multiple reference points. In terms of the climate-smart city, visioning is a process of adapting city climate goals initially with the practices of grid operators, followed by the discourses of funding agencies, and the more local and concrete ideas of developers.

Experimentation is a process that is interdependent with visioning in the climate-smart city. Research on the urban governance of climate change has for many years identified experimentation as a critical means through which city governments address climate change (Bulkeley and Castán Broto 2013). Rather than being open-ended,

urban experiments are shaped by the strategic interests of dominant actors in the city, for whom the flexibility of smart city ideas becomes an additional resource. Smart city ideas can be adapted to urban climate change goals, as in the case of the climate-smart city, and the combination of policy goals with smart city ideas helps to access funding from higher levels of government. By packaging new initiatives as experiments, delimited in place and in time, city governments gain access to additional resources for the governance of climate change. In turn, however, city governments must play their part: they must dedicate places to these experiments; they must adopt discourses and ideas of smart cities; and they must use their resources to persuade other actors in the city to participate.

Both visioning and experimentation are challenging processes, even when they are carried out by dominant actors. Even in abstract, they are both processes for dealing with uncertainty; creating a vision is response to uncertain futures, while experimentation aims to test new ideas and technologies without knowing the end result. In practical terms, visioning and experimentation in cities require the participation of many other actors beyond the proponents of the vision or the experiment. The processes must contend with local politics and the mundane materialities of cities (Bulkeley, McGuirk, et al. 2016), as well as infrastructures that extend beyond the confines of the experiment and the city (Hodson et al. 2017). The challenges of carrying out these processes has implications for the ways in which climate-smart ideas transform cities.

The processes of visioning and experimentation differ from some of the processes raised in earlier smart city research. Smart city benchmarks serve to discipline cities into acting in a way that can be measured according to specific indicators (Vanolo 2014). Rather than being punished by a benchmarking stick, the carrot of funding from higher levels of government plays a larger role in the development of the climate-smart city. Media and research on smart cities is also full of canonical examples such as Songdo, South Korea, and Masdar City, United Arab Emirates. These examples do not figure in the visions of city governments or grid operators when it comes to the climate-smart city, nor does their influence show in the actions of funding agencies within European governments and the European Union.

7.3 Implications for cities

3. What implications does this reconfiguration of urban environmental governance have for cities?

Visioning and experimentation with smart city ideas introduce new technologies and new discourses into urban environmental governance. They reconfigure urban environmental governance through new governance arrangements, some of which redefine sustainability. While these processes originate in collaboration between city governments and grid operators, there is still the risk that the goals of city governments lose out.

The climate-smart city introduces shifts in which actors perform urban environmental governance as well as new governance arrangements. New roles and new applications of ICT in urban energy systems reconfigure the dynamics of supply and demand in urban energy systems (McLean et al. 2016). Urban environmental governance can itself be reconfigured to encourage these new dynamics. Smart grid technologies such as demand response require interaction between grid operators and developers, preferably early in the process of designing a building, which provides a reason for grid operators to be involved in the governance of building energy use. Energy infrastructure that accommodates renewable energy gives city governments the role of encouraging more renewable energy production, for example by adapting spatial plans according to the solar energy potential. These governance arrangements have potentially positive implications for climate change mitigation. However, they also introduce a larger role for grid operators in urban environmental governance, and might deprioritise other policy goals that would otherwise influence the spatial organisation of cities.

In urban environmental governance, the climate-smart city begins to redefine urban sustainability. Smart energy grids enact sustainability in a different way than longstanding energy efficiency measures; while energy efficiency is often measured in terms of annual energy use, smart energy grids consider the instantaneous mix of production units in operation. The use of smart grid technology does not necessarily conflict with energy efficiency measures, but there is the potential for institutional drift (Streeck and Thelen 2005),

particularly when governance consists of voluntary measures that allow developers to choose.

Differences in materiality and institutions between types of energy systems also have implications for climate-smart cities. The liberalisation of electricity markets, in Europe as around the world, places limits on the roles of grid operators. The boundary between the electricity utility and the electricity producer, even when they are both within the same conglomerate, places limits on the extent to which smart grid technologies can reconfigure the dynamics of supply and demand. In contrast, in district heating and cooling systems, the grid operator often controls the production of energy as well. The district heating utility, for example, is able to apply demand response technology according to its operation of production units. This integration facilitates the organisation of demand response systems. However, it lacks oversight from city governments or market regulators, which makes it difficult to ascertain whether demand response is controlled according to a logic of climate change mitigation or profitability.

There is a risk that the climate-smart city prioritises the ambitions of grid operators over the climate governance goals of city governments. Smart city visions and experiments are entangled with local politics and the materialities of urban infrastructure. While the entanglement does allay some concerns about the potency of corporate smart city visions, it calls for attention to where some aspects of smart city visions are translated into socio-material change more than others. When problems do arise in the implementation of a vision, city governments have few resources to contribute in response; after all, their turn to visions is often a reaction to a lack of resources in urban environmental governance. The implementation of an ambitious smart city vision easily leaves the city government beholden to the grid operator and the resources it decides to contribute along the way.

Chapter 8

Conclusions

The aim of this thesis has been to better understand how smart city ideas reshape urban environmental governance. The previous chapter discussed how this thesis contributed to this aim in relation to three research questions. This chapter relates the aim of this thesis to some more general topics in the field. First, it presents conclusions about smart city ideas and urban environmental governance. Second, it concludes about the use of assemblage perspectives to study smart cities. Finally, it suggests topics for future research.

8.1 Beware the climate-smart city?

The shift from sustainable to climate-smart city has several affinities to the concerns that previous research raises about smart cities. This thesis investigates the relevance of these concerns in practice, in the context of urban environmental governance. This section discusses concerns about branding, corporatisation and an increasing amount of technology in climate-smart cities.

In the context of urban environmental governance, smart city ideas can be part of more than discursive change. New brands or buzzwords can be the first step toward other changes. In some cases, it might be that the smart city label is vague enough to allow re-labelling existing initiatives without otherwise changing them (Crivello 2015). But while re-labelling sustainability initiatives as climate-smart might begin as a

discursive change, it provides a new label that can also be applied to initiatives that focus on ICT. This thesis shows the role of the grid operator in introducing new socio-material practices based on smart grids. These practices differ from one-off initiatives that arise from a city government collaborating for a short period of time with a high profile consulting company such as IBM (Wiig 2016). There is a material side to infrastructural change, which means that a grid operator cannot easily retract itself from a city if its climate-smart vision does not end up as planned. While the climate-smart city does function as a new brand for sustainability initiatives, it also changes socio-material practices in a way that cannot easily be reversed.

The socio-material change that accompanies the climate-smart city label does raise questions about the corporatisation of urban environmental governance. Smart city ideas are an area of growth for many multinational technology companies, where each aims to establish itself as an obligatory passage point in urban governance (Söderström et al. 2014). This thesis investigates reconfigurations of urban environmental governance that involve a specific type of multinational company—the grid operator. A grid operator differs from other companies in that it already is an obligatory passage point, having a monopoly over energy distribution infrastructure. Its monopoly makes it an obvious collaboration partner for the city government. When the grid operator is not owned by the city government itself, there is the possibility that the climate-smart city outsources urban environmental governance to grid operators (Viitanen and Kingston 2014). For example, urban smart grids redefine carbon governance in terms of instantaneous greenhouse gas emissions of the energy system, but calculations of instantaneous emissions depend, for example, on whether system boundaries are limited to a city district or extend to include all of Europe. Without oversight from the city government in deciding these system boundaries, it is left to the grid operator to decide how urban carbon governance is performed.

The focus on technological solutions that accompanies smart city ideas is another concern that previous research discusses in several ways. In this thesis, the most prominent example of a technological solution is a demand response system that allows the grid operator to control energy use in multi-family apartment buildings, offices and facilities. Similar to other smart city technologies, such a system risks

being buggy, brittle and hackable (Kitchin 2014:10). A critical error in the demand response system, where from accidental or malicious causes, could leave residents without heat in cold weather. In terms of the individual, previous research is critical of two trends: technological solutions that frame societal problems in terms of citizen responsibility (Gabrys 2014; Vanolo 2014), and the surveillance and measurement of individuals that could lead to a panoptic city (Cakici 2013; Kitchin 2014:11). While some smart grid technologies do follow these trends, demand response at the level of the building works differently. It places responsibility on the building operator and relies on measurement of energy use that is aggregated at the building level. Smart city technologies that act at the level of aggregated groups of individuals, such as the building, avoid some of the potential problems associated with excessive citizen responsibility and surveillance.

8.2 Assemblage and smart cities

The theoretical perspective of this thesis, based on the concept of assemblage, benefits the study of smart cities. It helps to show that the distribution of agency extends beyond multinational corporations, and to uncover new dynamics of urban change. This thesis also makes contributions about the use of assemblage in urban studies.

An assemblage perspective helps to maintain an open and explorative perspective concerning the distribution of agency in smart city initiatives. Rather than focusing on the force of multinational corporations and their visions, this thesis identifies other actors with the agency to shape visions and resist the push of dominant actors. The resources of funding agencies encourage city governments and grid operators to adapt their visions to the priorities of higher levels of government. Developers can resist visions of the climate-smart city; the geography of cities and the materiality of wind turbines pushes back against renewable energy goals; the obduracy of infrastructure and the organisation of energy markets complicates urban experimentation.

Assemblage perspectives also contribute to identifying new dynamics related to smart city ideas. As a relational perspective, assemblage helps to show how networks of actors lead to emergent effects; it also helps to describe how previously stable entities become undone. Visions are an example of both; this thesis shows how visions

are constructed through processes of coalition building, but also how they lose their function in relation to more specific promises and the challenge of orchestrating change. The concepts of territorialisation and deterritorialisation illustrate how the appropriation of new discourses can gradually lead new assemblages that colonise existing practices. Whereas the notion of policy mobilities has shown how new discourses travel between cities (McCann 2011), the notions of appropriation and colonisation help to understand messier dynamics of urban change.

This thesis also contributes to the growing body of assemblage urbanism research. Much of this research has explored the multiplicity of assemblages through conflicts (cf. Baron and Petersen 2015; Blok 2013; Ureta 2014). In exploring the interaction of assemblages through visions, this thesis shows that it is possible to coordinate assemblages such that they work together. The notions of appropriation and colonisation show how the type of coordination between assemblages can change over time. In studying how experiments influence urban governance, this thesis shows how several policy assemblages can together support a broader visions, even while one policy assemblage destabilises another.

These questions about the agency of actors, the dynamics of change, and the multiplicity of assemblages all provide interesting conclusions concerning smart cities in urban environmental governance. They also provide the basis for further research about urban change and smart cities.

8.3 Suggestions for future research

The continued popularity of smart city ideas calls for further research about their influence on urban environmental governance. One concern is the impact that smart grids and other new technologies have on other governance arrangements. Will energy efficiency be left behind as urban smart grids become more prevalent? A similar concern is warranted for behaviour change, which lacks the novelty of new technology. A second consideration for future research is how the organisation of smart city initiatives affects the level of aggregation of data collection and action. Are there ways to organise these technologies so that responsibility falls to collectives rather than individuals, and to avoid increasing surveillance of individuals?

Finally, the role of funding agencies in smart city initiatives deserves additional attention. Will they begin to push more specific interpretations of smart cities, and with what impacts on urban environmental governance?

There are also many avenues to further explore the dynamics of urban change and the processes that reconfigure urban governance. First, in relation to visions, it would be worthwhile to study how the proponents of a broad vision successfully form publics around specific promises. What are the practices and arguments that enrol actors such as developers and residents, even when they do not necessarily have an interest in broader visions of urban change? Second, in relation to urban experiments, more attention should be paid to the practices of translation that allow actors to enact past experiments as successful. Finally, the dynamics of appropriation and colonisation could be further studied to better understand the tipping points between territorialisation and deterritorialisation of assemblages. What are the conditions that allow city governments to maintain control over urban planning assemblages, and what factors contribute to increasing corporate control over public sector decision making?

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Appendix: Interview Guides

These interview guides were the result of my preparations for interviews. While I started each interview with the points listed in the interview guides, answers to some of the questions came up without me asking them. I also asked follow-up questions as necessary and in response to interesting comments.

Questions for employees within the city government, Eon, VA Syd and the Swedish Energy Agency

Climate Contract

- Where did the initiative for the Climate Contract come from? Which organisations were involved in the discussions leading up to it? What role did developers play in these discussions?
- What issues have been taken into consideration in calculating Hyllie's energy balance?
- What have been the challenges in building wind turbines for Hyllie?
- What influence has the Climate Contract had on the work that your department/organisation has done in Hyllie?

Smart Grids for Hyllie project

- Where did the initiative for the project come from? How did the application process take place?
- Which city departments have been involved in the project?
- Which property developers have been involved in the project?
- What influence has the project had for your department/organisation?
- What have been the biggest challenges in the project?

Other initiatives

- How was sustainability taken into consideration in Hyllie Avenue? (the first residential neighbourhood in Hyllie)
- What has been the relationship between the Climate Contract and Consensus Hyllie?

Questions for employees of property developers

Planning processes

- In what ways do the city government's sustainability ambitions influence planning processes?
- How does planning in Hyllie compare to your previous experience in Malmö?
- What role did the Climate Contact play in planning processes?
- Have you had any experience with the Hyllie Environmental Programme?

Buildings in Hyllie

- How have you worked with energy issues in your building?
- Have you been involved in the Smart Grids for Hyllie project?
- Have you done anything else different in Hyllie compared to previous projects?
- What was the importance of the Hyllie Avenue Sustainability Agreement for your building?
- Do you plan to build more buildings in Hyllie?

Collaboration

- What role has the city's marketing efforts for Hyllie, such as Consensus Hyllie, played in your business?
- Do you collaborate with other businesses outside of Consensus Hyllie?

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Papers

The papers associated with this thesis have been removed for copyright reasons. For more details about these see:

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