

SMART CITY PROJECTS AND ENERGY TRANSITION

A Comparative Case Study of the Smart City Projects in Amsterdam and Cologne



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Smart City Projects and Energy Transition

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Preface

This bachelor thesis has been the last project within my Bachelor Geography, Spatial Planning and Environmental Sciences in Nijmegen. With this research I got the opportunity to combine and different interesting aspects of my bachelor. Smart cities triggered me as they show the importance of the practical implementation of spatial planning as well as environmental sciences in a world which is facing the threat of climate change. It was also very interesting to me to investigate a German as well as a Dutch case within my case study.

I would like to thank my supervisor, Peter van de Laak, for the support in this projects. Furthermore I would like to pay tribute to all the people who have enabled me to get deeper insights in the smart city projects. With special regard to the interviewees who have enabled me to conduct my research and gave me the opportunity to get a unique insight into the smart city projects in Amsterdam and Cologne.

Finally I would like to thank my family and friends for supporting and encouraging throughout my thesis.

I hope you enjoy reading this thesis!

Lea Dulisch

Nijmegen, July, 2016

List of Abbreviations

ASC	Amsterdam Smart City
CO ²	Carbon Dioxide
CTO	Chief Technology Office(r)
CUCP	Coordination Unit for Climate Protection
EU	European Union
ICT	Information and Communication Technology
KVB	Kölner Verkehrsbetriebe
NRW	Nordrhein-Westfalen
SCC	Smart City Cologne

Summary

Context of the Research

The urge of climate change as well as an increase in urbanisation requests cities to develop new concepts addressing those urban challenges (Intergovernmental Panel on Climate Change, 2014; World Bank, 2010). Here, the concept of smart city projects gained importance during the last years (de Jong, et al., 2015). Smart cities are often seen as an attempt to find a solution for those urban challenges. The self-congratulatory term smart city has been criticised and literature study has shown that it lacks research which points out the actual benefits of smart cities (Hollands, 2008; March & Ribera-Fumaz, 2014). Furthermore, the fuzzy term of smart cities was emphasised in many previous studies as well as different smart city projects (Zygiaris, 2012). Therefore, this research connects smart cities and conceptions towards the practical implementations. Within this context it is useful to further investigate the contribution smart cities have on energy transition as it is seen as an indispensable movement to fight climate change. This leads to the objective for this research of *getting a better understanding of the relationship of smart city projects and their contribution to energy transition by applying a comparative case study*. The two cases of the research are “Amsterdam Smart City” and “Smart City Cologne”. In order to fulfil those objectives the following research question is answered in this research: *In how far can different smart city projects contribute to energy transition?*

Theory

For this research the network theory has been chosen. This has been a valuable tool in order to get a deep insight into the two cases and to investigate their underlying structures with respect to energy transition. The theory has been chosen because smart city projects as well as energy transition require the inclusion of different actors. Here, the approach from Driessen, Goverde, & Leroy (2007) has been chosen and the variables “Actors Rules and Resources” were analysed. A conceptual model has been developed where the aspects “Smart City Concept” as well as “Energy Transition” have been included in order to apply the theory to the research question.

Methodology

Throughout the research different sources were used. In order to execute triangulation (Verschuren & Doorewaard, 2007) document research meaning the usage of different documents which came up throughout the research has been applied. Furthermore, the two cases have been investigated through seven semi-structured interviews. Finally there have been observations made. Here, especially in the case of Cologne several energy projects were visited as well as a smart city conference. To get a better insight about the focus on energy within the projects an overview of the different energy projects has been created.

Results

Actors play an important role in energy projects as they are enabled find their role in a changing energy market. Only the collaboration of different actors make certain projects concerning energy transition possible. It is important that there are actors from the energy sector involved in the project and that the focus on energy transition is emphasised through a leading actor. Furthermore, especially citizens play a striking role within energy projects as they advance them.

There are several rules which influence energy transition within smart city projects. Here, it can be stated that especially rules from outside the project influence energy transition in several ways. The research has shown that therefore it is important that smart city projects are embedded in a framework of the municipality which triggers innovative projects through deregulation, but also sets a clear emphasis on energy transition through sustainable regulation. Furthermore, it has been shown that also rules on a national and international level influence energy transition in an urban context. Here, the collaboration within smart cities enables actors to deal with those regulations through collaboration.

The exchange of ideational resources is very important for a smart city project to contribute to energy transition. It is important that the actors exchange their views and interests in order to adjust to new roles in the energy market. Furthermore, also financial resources play an important role to start projects. This financial contribution can come from different actors, however, it has been shown that also the financial contribution of the municipality has been perceived as helpful to start new projects.

Additionally, certain emphasises within the conception of smart cities appeared to be important for the stress on energy transition. It became clear that there should be a certain focus aligned to energy within the project. Furthermore, a clear visions may assist in getting measurable results in energy projects and helps to align focus on those. The research has also shown that scaling has a great impact on certain projects and their contribution to energy transition. Therefore, this aspect should be included in the concept of every smart city project.

Conclusion

In the investigated projects the smart city concept was only part of the integrated climate protection approach. The municipality are executing several measures concerning energy transition which are not included in the smart city project. Therefore, smart city projects are important in order to supplement the administrative process of energy transition. Smart city projects are usually implemented on a voluntary basis and therefore they can reach actors and citizens and help them to find their new roles in the energy market.

Another important finding of this research was that every city has to find its own way of implementing a smart city approach. Different cities face different urban challenges and have different potentials to fight climate change.

This research has managed to give an overall insight of important aspects which trigger energy transition in smart city projects. However, further research could elaborate those different aspects.

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1. Introduction

1.1 Framework of the Project

Within the last decade climate change has become a greatly discussed topic. Several climate conferences have taken place where climate goals for different countries were worked out in order to deal with the threat of climate change. Even though it is striking that there are many different opinions among different countries it is mostly agreed that urgent action has to be taken in order to build a more sustainable world (Intergovernmental Panel on Climate Change, 2014). The climate conference in Paris 2015 finally managed to create an agreement all 195 nations signed (European Commission, n.d.). The agreement points out the importance of balancing greenhouse gases. Even though the agreement does not literally state it but this means a change in energy supply for many developed countries (United Nations Framework Convention on Climate Change, 2015).

Energy Transition

In this context the term “energy transition” or “transition to low carbon energies” becomes increasingly important. Energy transition broadly describes the systematic change in energy supply. Nowadays this usually means that there is a shift from fossil fuels to more environmental friendly and sustainable ways of gaining and using energy (World Energy Council, 2014). Next to the development of renewable energies literature shows that energy efficiency is linked to the term of energy transition (Droege, 2011). On the one hand this makes it easier to shift entirely towards sustainable energy, on the other hand technologies for energy efficiency are easier to implement in the short run (Solomon & Krishna, 2011). In order to develop a more sustainable energy system not only the development of renewable energy is important also the implementation in the contemporary surrounding. Here lock in effects of old energy supply systems challenge the implementation of new ones (Geels, 2014). In the last century especially developed countries have built up their energy supply systems based on fossil fuels. As sustainable energy system differ from traditional energy supply system in forms of storage, land use and technology it makes the implementation of renewable energy sources even more difficult. Research has shown that it can be useful to conceptualize existing energy regimes as the “resistance and resilience of fossil fuel regimes largely negated positive developments such as increasing power generation from renewables” (Geels, 2014, p. 16).

Cities and Energy Transition

Furthermore it is important to acknowledge social paths of our society. Here the literature points out that urbanization plays a great role when it comes to mitigation of climate change and change towards more sustainable forms of energy supply (Creutzig, Baiocchi, Bierkandt, Pichler, & Seto, 2015; The World Bank, 2010; Madlener & Sunak, 2011). Since 2007 officially more than half of the world population is settled in cities. With an energy consumption of about 80% cities can be seen as major contributors to greenhousegas emissions (World Bank, 2010). Most literature does not distinguish between developed and and less developed countries. This is done by the Intergovernmental Panel on Climate Change, (2014) however, which states that there is a striking difference between less developed (non-annex I) countries and developed (annex I) countries. Usually cities in less developed countries have higher energy use compared to the national average. In developed countries cities use less energy than the national average (Intergovernmental Panel on Climate Change, 2014).

Cities also play promising role when it comes to the change in energy supply as they are seen as places where innovation can easily take place. By the World Bank (2010) cities are described as “laboratories of social change with sufficient scale to bring about meaningful actions” (World Bank,

2010, p. 1). Therefore the World Bank (2010) sees sustainable cities as a solution as they ensure a high quality of life whilst reducing greenhouse gas emissions.

Literature broadly points out that cities are diverse and therefore require different plans of mitigation strategies. In his book "Urban Energy Transition" Droege (2011) sees the topic from a broad perspective by stating that challenges in developing countries only differ superficially from those in the developed world, while in other researches a division of cities in developed and developing countries is usually made (Madlener & Sunak, 2011; United Nations, 2013). Research of Creutzig et al. (2015) has given a more detailed analysis on how cities differ in terms of climate change. Through quantitative research they found out that economic activity, population density and gasoline price mainly explain the diversity between cities. By pointing this out they state that there is demand for identifying different mitigation strategies which take the diversity of cities into consideration.

New Sustainable City Concepts

The share of cities to climate change and the chances of cities to contribute to a more sustainable and environment friendly future has triggered new approaches cities aim for. Späth & Rohracher (2010) point out the importance of "guiding images" as they can "bridge language problems across a lay/expert divide or between different professional knowledge cultures" (Späth & Rohracher, 2010, p. 450). Cities are important when it comes to the shift towards new energy systems. Guiding images have coined our cities in the past (e.g. garden city, railway city, etc.) and therefore also play an important role in future city planning (Hall, 2014).

Therefore sustainable cities have become a new framework and can be seen as a broader concept (United Nations, 2013). The United Nations have defined a sustainable city as a city "where achievements in social, economic and physical development are made to last" (United Nations, 2013, p. 61). Research of de Jong, Joss, Schraven, Zhan, and Weijnende (2015) has shown that many different city concepts developed, which are mainly used interchangeably by policy makers. Among the different city concepts the concept of smart city is mentioned. This concept is going to be of greater importance within this research. The research of de Jong et al. (2015) shows that the concept of smart city has gained great scientific importance over the last years. This is due to the fact that even though the term only got popular within the last few years there have already been many publications on the topic. De Jong et al. conclude in their research that the different city categories (sustainable city, green city, digital city, smart city, intelligent city, information city, resilient city, eco city, low carbon city, liveable city) cannot be used interchangeably however, they point out that there is a great conceptual overlap among them. This can be explained by the emergence of new categories out of old ones. Here the special concept of smart city is described as a concept that gained scholar popularity over the last years and it stresses the modernisation of cities (de Jong et al., 2015).

Smart City a fuzzy Concept

Literature shows that the term smart city is very broad. It is often talked about it as a "fuzzy concept" that is difficult to define clearly. Hollands (2008) analyses the term from a rather critical viewpoint by claiming the "self-congratulatory" (Hollands, 2008, p. 304) nature of the term. He states that the term smart city is not well defined among the cities which adopted a smart city project. The name smart city is often justified only through the introduction of new ICT technologies. He implies that a smart city project can easily lead to inequalities in a city. Therefore he defines the most important aspect of the real smart city which he formulates as following. "First and foremost, progressive smart cities must seriously start with people and human capital side of

the equation rather than blindly believing that IT itself can automatically transform and improve cities. “ (Hollands, 2008, p. 315). This argument is also stressed by March & Ribera-Fumaz (2014) who state that it is important that projects keep being clear for citizen as smart city projects otherwise, will only serve capital and political elites.

The article of Hollands (2008) turns out to be quite popular within the literature of smart cities and it gives new insights into the topic (Nam & Pardo, 2011; Geels, 2014). However it is striking that his arguments are rather abstract, not based on empirical analysis but instead on general examples and theoretical analysis. Nam & Pardo 's research (2011) tried to close the gap of an conceptual view on smart cities and analyse the term according to the dimensions of technology, people and institutions. Similar to de Jong et al. they also refer to other city concepts which are related to the smart city – they call “Conceptual Relatives of Smart City” (Nam & Pardo, 2011, p. 284). However compared to de Jong et al (2015) they do not go into detail with analysing the different conceptual backgrounds and importance within literature. Nam & Pardo (2011) list those different city concepts under the three dimensions they developed (e.g. Technology: Digital City; People: Creative City). They point out that the technological dimension especially ICT, is part of the term smart city. This is also shown by several definitions of smart cities they have listed in their paper. However they also argue similar to Hollands (2008) that next to the technological dimension of a smart city it is important to remember the human capital side and therefore include people in the concept of a smart city. Finally they add the institutional, governance factors by claiming that there is a move to more collaboration between different parties, more transparency of the city government and more citizen engagement as well as participation (Nam & Pardo, 2011).

Even though the research of Nam & Pardo (2011) managed to get a more conceptualized and clearer view on the term smart city they still claim that it is a fuzzy concept and that there is not “one size fits all” (Nam & Pardo, 2011, p. 283) definition. Nevertheless Caragliu, Del Bo, and Nijkamp (2011) faced this challenge and tried to develop a definition of smart city by evaluating previous literature. They formulate the following definition of a smart city: “We believe a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and highly quality of life, with a wise management of natural resources, through participatory governance.” (Caragliu et al., p. 70) They formulate their dimensions based on research from the Vienna University of Technology which defined six axes of a smart city: “a smart economy; smart mobility; a smart environment; smart people, smart living and finally, smart governance” (Caragliu et al 2011, p. 70; Vienna University of Technology, 2007). With their attempt of formulating a definition of the concept “smart city” they made a great contribution within the literature of smart cities. This is mainly shown by the fact that the definition is often used in further literature (March & Ribera-Fumaz, 2014; Caragliu et al., 2011). Caragliu et al. (2011) also state in their literature research that they see the future challenges of smart cities especially in the fields of social, relational issues. This means that polarization caused by technological means should be prevented, which as it is already explained above poses an urgent challenge for urban areas.

Different Projects

After looking at different conceptualizations of the term smart city it seems to be useful to look at some projects of smart cities or relative city concepts. March & Ribera-Fumaz (2013) argue that it is important for research to go beyond the discursive layer of the term smart city in order to get across the challenges as well as the intended and unintended effects of smart city projects. Considering the diversity between cities all over the world it seems to be sufficient to narrow the literature research down and focus further on smart cities within the European Union (EU). On the

one hand the EU influences the climate goals in the member countries through similar energy targets (European Commission, n.d.). On the other hand however it is striking that there are still different approaches of cities trying to change their energy use and supply and how this is done within the context of a smart city or other forms of sustainable cities concepts. De Jong et al (2015) have argued that even though different concepts are not entirely interchangeable, most of them focus to build on a sustainable future for cities. Therefore the next chapter is going to describe the sustainable city projects of Graz and Freiburg and further on the smart city projects Barcelona, Amsterdam, Berlin.

Graz

Rohracher & Späth (2011) compared the cities Graz, in Austria, and Freiburg, in Germany, and analysed how they approach the green city project. Graz was one of the forerunners as an “ecological city”. The city gained many several awards for its achievements in this field. However it turns out that the project is rather based on action plans which support a great range of projects. Even though the role of different stakeholders is stressed in the project Späth & Rohracher (2011) imply that the project is mainly dependent on entrepreneurial stakeholders. The project has shown that even though Graz is seen as a forerunner for an eco city, the researchers point out that after some years the ecological city project weakened and the city focussed on other projects.

Freiburg

The “green city” Freiburg follows according to Rohracher & Späth (2011) a different approach than Graz. Here the focus lies much more on the citizen who perceive their position within the energy system as active and able to shape new paths. The initiative towards the vision of Freiburg as a “green city” is mainly driven by an active civil society network. Most of the greenhousegas reduction is mainly a result of private investments into renewable energy. Rohracher & Späth (2011) actually speak of a positive feedback loop which can be seen in Freiburg. This feedback loop states that the image of a green city triggers engaged individuals who live and work in Freiburg. Freiburg has similar to Amsterdam has clear energy targets. However, even though the goal of 25% was far from being met in 2010 it was increased by a more ambitious goal of 40% by 2030 (Späth & Rohracher, 2011).

Barcelona

When it comes to analysing implemented projects of smart cities the research of Zygiaris (2012) turns out to be useful. He introduces the framework of 6 layers (layer 0: city; layer 1: green city; layer 2: interconnection; layer 3: Instrumentation; layer 4: Open Integration; layer 5: Application; layer 6: innovation) based on this framework he analysis three popular European examples of smart cities.

On the European scale Barcelona is a popular example for a smart city since 2009. Zygiaris claims that the project mainly consists of projects which aim to improve the interconnectivity layer by extending the ICT network in the city. Furthermore the green layer is stressed through an innovative plan for CO₂ production which includes alternative forms of energy, transport, and green building policies (Zygiaris, 2012). The smart city project is managed by the city council and therefore analysed by Zygiaris (2012) as a rather top down led project. As in the vision of smart city Barcelona all layers are integrated he also talks here of an “integrated layer structure”.

Amsterdam

Another smart city which has been analysed by Zygiaris (2012) is the city of Amsterdam. Zygiaris sees this one as an opposing project to the project in Barcelona it is rather based on a bottom-up approach. Here the different layers are mainly used to develop a targeted “smart city vision” (Zygiaris, 2012, p.227). Amsterdam aims to reduce 40% of greenhouse gases and 25% of its energy

by 2035. The vision is based on movements within the society and therefore it is ensured that the city is rooted and supported within the society. Zygiaris also states that this approach bears challenges when it comes to implementing big projects which are based on successful pilot projects and the challenge to create a master plan for smart city Amsterdam. The project also shows the role of the EU by reducing CO₂ emissions as most of the projects are financed by the European Regional Development Fund.

Berlin

Another example can be seen in the project “Smart City Berlin”. As being German’s capital the city sees itself an important forerunner within Germany. Therefore it set the ambitious goal of being greenhousegas neutral by 2050. However the last years have shown that the goal with an annual reduction of 0.4% is probably not going to be reached. The annual reduction has to be 2% in order to reach the goal (SNPC GmbH, 2014).

Comparison

The examples above show that there are different approaches how different smart city projects are developed and implemented While Barcelona is rather top down planned, Amsterdam seems to be rather built from a bottom-up approach. In the case of Graz the entrepreneurial stakeholders seem to have great power within the project. It is also striking that the projects differ in forms of how targets are formulated. Some cities are rather based on action plans other cities have clear targets, when it comes to the reduction of CO₂. Nevertheless the cases of Freiburg and Berlin show that fixed targets do not always guarantee successful energy transition.

Research Gap

Even though a lot of research has been done investigating the difference of cities and their smart city approaches, it appears as if research on the question in what ways these projects actually contribute to energy transition lacks. This might be due to the fairly new term smart city (de Jong et al., 2015). Furthermore it has been pointed out that research on actual developments in projects on smart cities of smart cities is missing (March & Ribera-Fumaz, 2014). Therefore, the question comes up in what ways smart city projects actually contribute to a transition to low carbon energies Therefore, it is interesting to elaborate the connection between smart cities and their impact on energy transition.

1.2 Research Objectives

This research is practice-oriented and aims at contributing to the knowledge gap of empirical research on smart city projects and their contribution to energy transition. This will be done by analysing the implementation of smart city projects and their role in the process of a transition to low carbon energy emissions. Here the research makes use of a comparative case study with two cases.

The precise objective of this research therefore is:

This research aims at getting a better understanding of the relationship of smart city projects and their contribution to energy transition by applying a comparative case study.

1.3 Research Question

1.3.1 Main Question

In how far can different smart city projects contribute to energy transition?

1.3.2 Sub Questions

- What is the role of energy transition in the different smart city projects?
- In what way can visions/goals help a city to contribute to energy transition?
- What are important factors that influence energy transition in a smart city?
- What kind of smart city projects contribute to energy transition?

1.4 Relevance

1.4.1 Societal relevance

Within the societal context of this research the topic of climate change is of importance as it becomes a more and more threatening issue on a global scale (Intergovernmental Panel on Climate Change, 2014). Here, especially developed countries face great challenges like moving towards new forms of energy (United Nations Framework Convention on Climate Change, 2015). Cities play an important role in this transition as they are seen as “laboratories of change” (World Bank, 2010). Furthermore, a clear increase in urbanization is apparent (World Bank, 2010). The rise of new guiding images of smart city projects is often seen as a possibility to overcome these challenges. Considering the urge of climate change it is of great importance to analyse smart city projects and their contribution to energy transition. Therefore, it is valuable to bring these two terms together in order to analyse the potential of smart cities when it comes to fight climate change.

1.4.2 Scientific relevance

It is striking that the literature on smart cities focuses on the conceptualization of the broad concept smart city (Caragliu, et al., 2011; Vienna University of Technology, 2007; Zygiaris, 2012). The benefit of smart cities is being discussed, but also criticised. Hollands (2008), for example, states that smart cities are a way of positive labelling in the first place, when there is a lack of positive results. Literature research also shows that there is little data on how far smart cities can be seen as a solution to urban challenges (March & Ribera-Fumaz, 2014). In other words, a bridge executing the theoretical concepts and analysing the usefulness of smart cities is needed. By analysing the contribution of smart city projects to urban challenges, it is interesting to look at the way they succeed in the area of energy transition. The literature review on different smart city projects has shown that the shift towards low carbon energy plays a great role in the majority of these concepts (SNPC GmbH, 2014; Späth & Rohracher, 2011; Zygiaris, 2012). Hence, it seems to be of great scientific interest to further investigate the implementation of smart city projects and how they contribute to energy transition.

1.5 Research Model

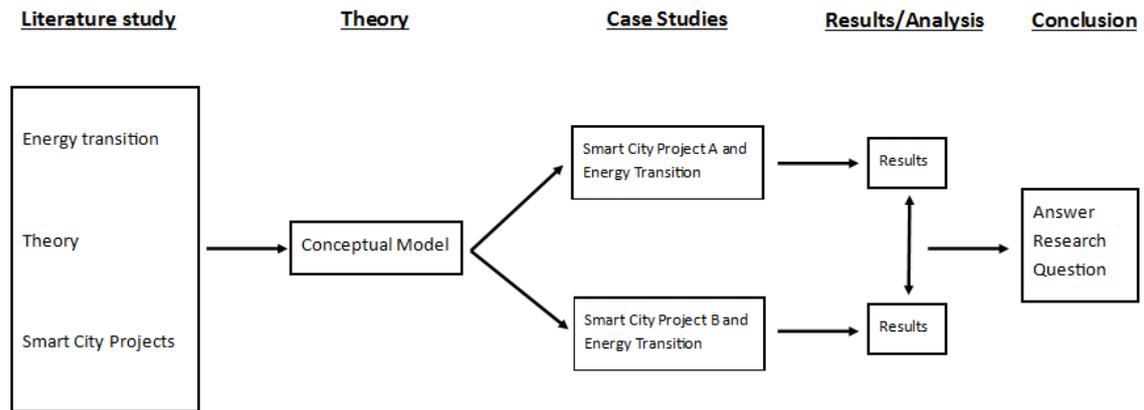


Figure 1.1: Research Model

Outline Research Model

The research model shows the five steps of the research. First the literature research on, smart city projects, energy transition and the theory has shown that there is a research gap between smart city projects and their contribution to energy transition. Based on this research gap a research question is formulated which is going to be answered at the end of this research. In step two based on the knowledge gained from the literature a suitable theory was chosen and a conceptual model was developed which applied the theory on the research question. Afterwards a comparative case study was applied in step three. For this case study two smart city projects were chosen and analysed based on the conceptual model. First the two smart city projects were investigated separately by gaining data from literature, interviews and observation. The collection of different sources of data ensures triangulation which verifies the data (Vennix, 2006). Finally, in the fifth step the outcomes from the two case studies were compared in order to get an answer to the main research question.

2. Theory

After the project framework has been described in the first chapter, which resulted in the research question the next part focusses on the theoretical approach of this research. First the two important terms within the research question, smart city projects and energy transition, are going to be described. A theory is going to be chosen in which the important terms of the two aspects are reflected. Finally, a conceptual model is going to be developed based on the theory and the research question and afterwards the variables will be operationalized.

2.1 Smart City Projects

The literature on smart cities has shown that human networks are a crucial part of smart city projects. Hollands (2008) emphasises that a lot of smart cities focus on information as well as human networks and therefore have a focus on academic knowledge and business innovation. Furthermore, he emphasises the focus of some smart cities on human capital which is created through skills, education competencies and creativity. The concept smart city is also seen as an integrated approach, which connects different sectors like businesses, non-profit organisations, governments and citizens (Nam & Pardo, 2011; Caragliu, Del Bo, & Nijkamp, 2011).

Additionally, the term governance plays an important role for the concept of smart cities (Nam & Pardo, 2011; Vienna University of Technology, 2007; Caragliu, Del Bo, & Nijkamp, 2011). The Vienna University stresses the dimension of smart governance for smart cities which emphasises new forms of communication for citizens. Also the definition of smart cities from Caragliu et al. (2011) stresses that a smart city has to face its challenges through participatory governance. Nam and Pardo (2011) mention that a smart city should focus on governance among stakeholders and emphasise the importance of a transparent governance as well as networking and partnerships.

2.2 Energy Transition

Energy transition broadly focusses on the transition from one energy supply to another (World Energy Council, 2014). Therefore, the contemporary challenge of energy transition is to transform from traditional sources of energy, such as coal and gas towards alternative, renewable forms of energy. In other words the transition which is focussed on in this research is the transition to sustainable energy systems (Späth & Rohrer, 2010).

There are different ways in which energy transition can proceed. There is the implementation of renewable energies which ensures a sustainable energy supply. Another important part of energy transition is to increase energy efficiency. This aspect is of importance because it illustrates a good solution in the short run as energy efficiency technologies can be implemented faster than a change in energy supply (Solomon & Krishna, 2011). Furthermore, the aspect of energy storage is important when it comes to the implementation of alternative forms of energy. Renewable sources of energy such as solar and wind are not always available and therefore it is important to develop strategies for a constant energy supply (Coppez, Chowdhury, & Chodhury, 2010). In addition, the shift to new, low-emission, forms of transportation is important (O'Connor, 2010).

This stresses the importance of key actors which are involved in the challenge of energy transition. Literature stresses that governmental as well as non-governmental actors play an important role (Bridge, Bouzarovski, Bradshaw, & Eyre, 2013; Verbong & Geels, 2007; Solomon & Krishna, 2011). Non-governmental actors are involved in the different sectors, which are effected by energy transition. Those are energy providers and other parts of the economic sector but also the consumers have to perform a behavioural shift concerning the consumption of energy. Also

technological actors play an important role as they develop new technologies, which have to be implemented into the societal context afterwards.

2.3 Network Analysis

The concept of energy transition has shown that the collaboration of different actors is of great importance in order to obtain an optimal result (Verbong & Geels, 2007). Also smart cities include several actors and networks which again play an important role in those projects. The term governance is addressed in many smart city projects showing that not only governmental actors are drivers of change in smart city projects (Zygiaris, 2012; Nam & Pardo, 2011). This requires a theoretical approach which takes into consideration the role and collaboration of different actors in order to find out what the underlying structures of the smart city project are and how they contribute to energy transition. Therefore policy network analysis seems to be suitable in this context. Policy networks are defined by Kenis and Schneider (1991) as “decentralized concepts of social organization and governance.” (Kenis & Schneider, 1991, p. 26). Knoke (2011) defines the analysis of those policy networks as follows:

“Policy network analysis seeks to identify the important actors – governmental and nongovernmental organization, interest groups and persons – involved in policy making institutions, to describe and explain the structure of their interactions during policymaking processes and to explain and predict collective policy decisions and outcomes” (Knoke, 2011, p. 210)

In other words this approach focusses on the different actors, which are involved in the policy process, how these actors are related to each other and how they interact. This approach is used to understand the outcomes of policy decisions. Within the policy network analysis actors are not only individuals but also different organisations which are involved in the policy making process (Knoke, 2011).

Driessen, Goverde, and Leroy (2007) formulated two other variables, next to actors, which are important for the network analysis of environmental issues. These are resources as well as rules which are created throughout the project. Resources such as money, knowledge, information, status or legitimacy have a great impact on how much power an actor has within the network. As many actors are interdependent on resources, they play a great role in their interaction. This is also stressed by the exchange network theory which was founded by Richard Emerson and focuses on the exchange of resources among different actors. In this context it is stated that in modern society single actors lack self-sufficiency, which leads to an increasing interdependence among actors (Inglis & Thorpe, 2012). Additionally, every network has certain rules which determine how the actors interact with each other. These rules can be formal as well as informal and regulate how actors interact, which behaviour belongs to a position but also the costs and benefits of a certain behaviour (Driessen et al., 2007). These variables are also stressed by the rational choice approach which stresses the interdependency of different actors and the game-like character of many policy networks (Rhodes, 2009).

Those aspects seem to be very important to investigate the underlying relations of a smart city project. The integrated approach within smart cities make it interesting to look at different actors and how they interact. Rules within smart cities are important because new forms of governance may come up (Vienna University of Technology, 2007). The focus on human capital, knowledge and information are important resources which are exchanged within smart city projects (Hollands, 2008). Therefore, the rational choice approach of the policy network analysis is suitable for this research and leads in combination with the research question to the following conceptual model.

2.4 Conceptual model

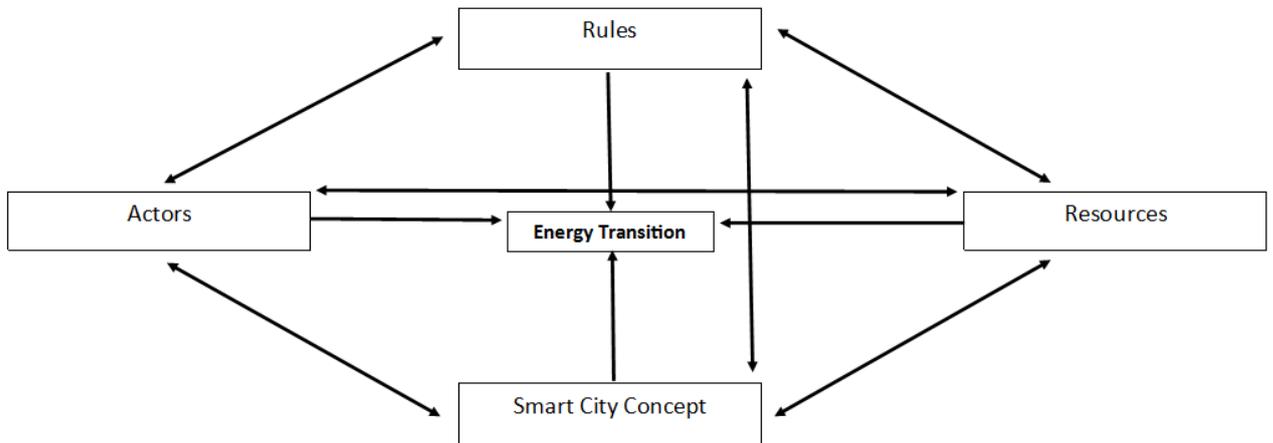


Figure 2.1: Conceptual Model

2.4.1 Operationalization

In order to come to a transparent analysis the variables are operationalized and for each variable some dimensions concerning energy transition have been developed. Those dimensions are explained in table 2.1.

Table 2.1: Operationalization

<i>Variable</i>	<i>Dimensions</i>
Actors	<ul style="list-style-type: none"> • Involvement of the energy sector in the project • Role of citizens in energy projects
Rules	<ul style="list-style-type: none"> • Project rules which influence energy projects • Other rules which influence energy projects
Resources	<ul style="list-style-type: none"> • Funders of Energy projects • Exchange of knowledge and information in energy projects
Smart City Concept	<ul style="list-style-type: none"> • Focus on energy transition in the concept of the project • Focus on energy transition in different smart city projects
Energy transition	<ul style="list-style-type: none"> • Focus on energy supply, saving, storage, infrastructure, efficiency

2.4.2 Outline Conceptual Model

The conceptual model pays attention to the variables “Actors, Rules, Resources” which are part of the theory as well as the variables “Smart City Concept” and “Energy Transition” which are derived from the research questions. Here the term smart city concepts may be surprising. Literature has shown that there are different concepts in different smart city projects therefore this term gives a good addition to the other three variables which combined describe the smart city project. Smart city concept includes visions, targets and focusses of smart city projects. The description of the theory shows that all variables are interconnected. Included actors influence the availability of resources which can be exchanged; the existence of resources also influences the actors and how they interact with each other. Actors within a network also determine the rules, which again determine the positions of different actors and include rules of behaviour. Rules describe how resources can be exchanged among the actors and the availability of resources determines these guidelines for exchange (Driessen, Goverde, & Leroy, 2007). Furthermore those variables also determine the smart city concept. Finally, the influence of the different variables on each other was analysed and furthermore it was elaborated how they influence the contribution of smart city projects to energy transition.

3. Methodology

Previously the context and the objectives of this research have been described. Also important theories and concepts relating to the research question have been explained. The following paragraphs outline how the research is going to be conducted.

3.1 Research strategy

In order to get an answer to the research question qualitative research has been used. To get an in-depth understanding on how the processes behind smart city projects work and to gain knowledge about their contribution to energy transition, a case study has been conducted. A case is defined by Creswell as an entity that “can be bounded or described within certain parameters, such as a specific place and time” (Creswell, 2013, p. 98). In this context a case is a city in which a smart city project is implemented.

There are many different strategies for carrying out a case study and analysing it. First of all, a distinction between an intrinsic case study, which analyses the case of a unique phenomenon, and an instrumental case study, which has the aim to get deeper insights about a general topic by using a case which represents the problem has to be established (Stake, 1994). For this research an instrumental case study was chosen as the most suitable because smart cities and energy transition are general phenomena not bounded to a specific case. There were two cases chosen and therefore a comparative case study was conducted, in order to analyse the topic in two different contexts. Even though a multiple case study has the disadvantage that the cases cannot be analysed as deep as in a single case study, the method is suitable here to get a better understanding on how different smart city projects influence energy transition (Creswell, 2013).

As qualitative research makes generalization difficult it is important to make a purposeful selection of cases. The cases have been selected through purposeful sampling, where every case has a special meaning within the research. Here it is appropriate to make use of a maximum variation within the cases, which aims at analysing cases which show a maximum variety within a certain variable (Creswell, 2013). In this context cases are suitable which vary in the way the smart city project is implemented. As this research has been implemented within a time period of only three months it was suitable to only choose two different cases. This has the advantage that the two cases can still be analysed and investigated in detail, while a disadvantage may be the difficult generalization of the research (Creswell, 2013). In the following part the two cases which have been used for this research are described.

Cases

For this case study the cases Cologne and Amsterdam have been chosen. This choice was made with respect to several factors which are described below. On the one hand, the two cities have similarities which allows for a comparison. Both cities have about one million inhabitants, they have a strong and diverse economy as well as several opportunities for higher education (Economist Intelligence Unit, 2009; Economist Intelligence Unit, 2011). This influences the human capital as well as the population within the cities. Amsterdam and Cologne have both signed the “Covenant of Mayors” in which they claim that they will adopt and exceed the energy targets of the EU (Covenant of Mayors, n.d.; Gemeente Amsterdam, 2015). This shows that both cases have a focus on energy transition and therefore makes them suitable for analysing their smart city concepts with regard to energy transition.

On the other hand, there are several differences concerning the smart city projects of the two cities. First of all, the project Amsterdam Smart City (ASC) is often seen as a very established project which

has gained international attention, often occurs in rankings as one of the smartest cities in Europe (Amsterdam Smart City, n.d.; Cohen, 2014). Compared to that Cologne has not gained that much international attention, yet. Another difference is that the project in Amsterdam has a great diversity of founding partners, which have steering roles within the project. Those range from scientific, governmental, economic to cross sectional actors. In Cologne however, the founding partners are only the municipality and the local energy provider. The municipality in Cologne plays an important role within the smart city project (Stadt Köln; RheinEnergie AG, n.d.). Therefore, the project in Cologne is a project which has started from a rather top-down perspective while Amsterdam is a good example of a bottom-up project (Zygiaris, 2012). Furthermore, the webpages of the projects show that in Amsterdam there is a great focus on the collaboration of different actors, while having a very broad thematic focus (Amsterdam Smart City , n.d.). The project Smart City Cologne (SCC) has a clearer thematic focus, while the fact that there are many projects which are only executed by a single actor show that there is less collaboration (Stadt Köln, 2014; Stadt Köln; RheinEnergie AG, 2016).

All in all, it can be said that the two cities share certain similarities, especially concerning their population, economy and their focus on energy transition. The fact that there are, however, also differences among their smart city projects make those two cases suitable for this case study.

3.2 Data collection

As the method of a case study focuses on the in-depth and holistic analysis of a small amount of cases Yin (in: Creswell, 2013) suggests a great variety of data collection methods. Here, he names the following six possible forms of data collections: documents, archival records, interviews, direct observations, participation observation, and physical artefacts. Due to the lack of time and applicability of those forms of data only a few of them have been chosen which seem to be of importance for this research. These are: documents, interviews and observations. Vennix (2006) also suggests different data sources in order to execute triangulation as a verification method for research. This means that in order to prevent biased judgements different sources of data are going to be used. The three forms which have been chosen are: Document or desk research, interviews, and observations. They will be described in detail in the next paragraphs.

3.2.1 Desk Research

While doing desk research existing documents are analysed. Here data and documents from various sources have been taken into consideration (Verschuren & Doorewaard, 2007). By conducting desk research already existing findings are interpreted and bundled. It is important in order to come to valid results and to stress triangulation of data collection. To make sure that the results are valid, it is recommended to use different sources of data, referred to as “source triangulation” (Verschuren & Doorewaard, 2007, p. 184). This has also been applied in this research through the use of different types of documents and data such as websites, studies and reports.

For this research documents and literature have been analysed on several stages. First, a critical literature review has been conducted in order to examine the research gap and the accompanying research question, which is going to be analysed throughout this research. In a second phase, different documents were analysed in order to find suitable cases and to get a general impression of their smart city projects. Here, especially the websites of the projects as well as newspaper articles and already conducted research were important. In the last phase, literature was analysed which has been mentioned in different interviews have been recommended from representatives of the projects.

The literature research differed in the two cases. While there is a lot of literature, and information on the ASC project available, the public information for the SCC project is not as extensive. Beside the websites in the first stages predominantly newspaper articles, as well as publications about certain projects have been analysed. Especially the interview with Thomas Kreitsch from the municipality of Cologne provided information about formal documents which had been published by the municipality. Therefore, it was possible to analyse documents like the integrated climate concept of the municipality of Cologne, or papers which collected achievements of climate change. In Amsterdam there was a lot of literature found beforehand. Here the webpage of ASC was a helpful tool, as well as other studies about smart cities, for instance the report about “mapping smart cities within the EU”. Other documents which were analysed have been mentioned throughout the interview e.g. the “Sustainable Amsterdam” report. Furthermore an evaluation of different smart city projects within ASC was forwarded by the founding partner of the ASC project, the “Hogeschool van Amsterdam”.

3.2.2 Interviews

Interviews also gave interesting insights into the smart city projects and were the second mainstay of data collection. In order to get a deep insight into the project, semi-structured interviews were performed. Semi-structured interviews have the advantage that they are open for additional information the respondent can deliver but the interviews still have a clear structure through the use of an interview guide. This allows to compare different interviews with each other (Cohen & Crabtree, 2006). The interview guides have been adapted based on the type of partner who was interviewed and the findings of previous researches (Yin, 2004). Despite those differences the guide has been based on the variables, which are represented in the conceptual model (Verschuren & Doorewaard, 2007). The structure of the interviews was as follows: First the interviewee introduced himself as well as his or her role in the smart city projects. Afterwards questions concerning the aspects of the smart city concept, the actors, which were involved and how they collaborate, resources which are exchanged, rules of the project and finally some concluding questions about the project were asked. The interview guides of all interviews are listed in appendix A.

The sampling of interviewees is of importance to analyse a specific problem. Here also the method of purposeful sampling has been applied (Creswell, 2013). Therefore, the choice of interviewees should be linked to the theory and literature. Here, the literature on smart cities as well as on energy transition give an idea which actors could be of interest to interview and which play an important role. The literature of the two cases imply that actors of following fields are of great importance: governmental actors, economic actors, energy providers, civil society and scientific actors (Stadt Köln; RheinEnergie AG, 2016; Amsterdam, n.d.).

Hence, purposeful sampling aimed to find interview partners within all these sectors. The sampling of interview partners differed in the two cases. In Cologne it started with one interview with a representative of the municipality which provided a lot of general information as well as further interview partners. Therefore, snowball sampling was used here. In Amsterdam especially the founding partners of the project were contacted from the beginning, as it was possible to find relevant actors from different sectors on the website.

The following people have been interviewed:

Amsterdam

- Bram Sieben: as a representative of the energy grid provider Alliander. Alliander was the founding actor and a lot information about the history and organisation of the programme

could be gained. Next to the general information also specific information about the ASC project were collected.

- Annelies van der Stoep: as a representative from the Amsterdam Economic Board. She could give interesting insights to several projects in Amsterdam, as well as to the collaboration of the Amsterdam Economic Board within the ASC. The Amsterdam Economic Board has been especially interesting because it connects actors from a governmental, economic and scientific level.
- Thijs Cloosterman: as a representative of a newer founding partner, Arcadis. That interview was interesting as the actor has due to the new connection with ASC a more critical view about some aspects. Furthermore, it was interesting as Cloosterman is also in other smart city networks so that he can compare the Amsterdam Project to other projects.

It was also tried to get interviews with the municipality of Amsterdam as well as with the Hogeschool Amsterdam. Unfortunately, they did not reply to interview requests. However, information about the municipality in this project as well as its task could be provided through the other interviews. The missing information of the Hogeschool van Amsterdam can be provided through results from certain researches, which have been conducted by other scholars.

Table 3.1: Overview Interviews Amsterdam

Name	Organization	Date, Place	Type of Interview
Bram Sieben	Alliander	3 rd June, 2016, Alliander Arnhem	Face-to-Face
Annelies van der Stoep	Amsterdam Economic Board	25 th May, 2016	Skype
Thijs Cloosterman	Arcadis	2 nd June, 2016	Telephone

Cologne:

- Thomas Kreitsch: as a representative of the municipality. He is working in the project office of the SCC program. He could give a lot of insights concerning the work with the municipality and was able to explain certain processes within the administration of Cologne. As the municipality is one of the founding partners and has a lot of influence in certain projects this interview was of great importance and also resulted in further contacts with important actors of the project.
- Holger Kahl: as a representative of RheinEnergie, the energy provider of Cologne and the second founder of the project SCC. This interview was important because it allowed data collection from an economic oriented actor, and provided a lot of information about the collaboration of several actors, and the difference between the two project managing parties.
- Gerrit J. den Heijer: as a representative of an external project partner he is also rather an economic actor. This interview provided a lot of useful information on how project partners experience the project as well as the collaboration with other actors within the project.
- Stefan Groennerud: as a representative of the University of Cologne (Universität zu Köln). However, he is also involved in the administration and gives scientific advice. He sees things from an interesting viewpoint as he had a lot of knowledge about the interface between the municipality and scientific actors.

Table 3.2: Overview Interviews Cologne

<i>Name</i>	<i>Organization</i>	<i>Date, Place</i>	<i>Type of Interview</i>
Thomas Kreitsch	Municipality Cologne	19 th April, 2016, Stadthaus Köln	Face-to Face
Holger Kahl	RheinEnergie	11 th May, 2016, RheinEnergie Köln	Face-to-Face
Gerrit den Heijer	Immo-Projektmanagement	12 th May, 2016, Sürther Bootshaus, Köln	Face-to-Face
Stefan Groennerud	Universität zu Köln	2 nd June, 2016	Telephone

In total seven different interviews were conducted. All of them were recorded and transcribed afterwards in order to be able to perform an analysis, which is as precise as possible.

3.2.3 Observation

Finally, as the third aspect of triangulation, observation seems to be a suitable tool to get a deeper insight into the smart city projects. In this research it was used in several ways.

The case of Cologne has shown two big projects which came up in different interviews and which were linked to energy transition. Those projects were the EU project “GrowSmarter” which has given the SCC a lot of international attention. Secondly, the Climate Street has been monitored. This project has been mentioned especially in the interview with Holger Kahl as an interesting project which aims at visualising the ongoing changes and shows the contribution to energy transition. Thirdly, it was possible to attend the smart city conference in Cologne which has given good insights into the project, especially in relation to the interviews which have been held before. For those observations an observation protocol has been used of which Creswell (2013) suggests to get good results of the observations. This can be found in appendix B.

Table 3.3: Overview Observations SCC

<i>Date</i>	<i>Place</i>	<i>Project/Occasion</i>
14 th June, 2016	Stegerwald Siedlung, Cologne	GrowSmarter
14 th June, 2016	Neusser Straße, Cologne	Klimastraße Nippes
20 th June, 2016	Historical City Hall Cologne	Smart City Cologne Conference

Even though the interviews with actors of the project in Amsterdam have given implications about several important energy projects, those were rather “invisible” for the observer and therefore a site visit did not seem very appropriate. For instance, one of the projects is “zoncoalitie” which stresses the inclusion of different actors.

Furthermore, the link of the smart city projects to energy transition was investigated through an observation of all projects with a direct link to energy. Here, the focus of the project within energy transition was made clear. The different categories are: supply, storage, intelligent use, thermal insulation, and mobility. In addition, the actors which are included in the projects have been listed. The listed projects can be found in the appendix C.

3.3 Data analysis

Yin (2004) states that within the case study approach data analysis and data collection cannot be seen as two individual research stages but are rather connected to each other. Therefore, he suggests that during the collection of data the researcher already has to analyse the data in order to modify the research collection as for example when conflicting information is found. Throughout the interviews this has been taken into account. Most of the times it was possible to sum up the important points of an interview and to consider those by adopting the interview guide.

After collecting the data an embedded analysis of the cases was performed (Creswell, 2013). In this context both cases were analysed according to the four variables and their dimensions mentioned in the theory chapter. Furthermore, Creswell (2013) suggests that while doing multiple case studies, each case should at first be analysed on its own according to a specific problem and only afterwards should the outcomes of the two cases be compared with each other. Thus, in the next chapters first the case of Amsterdam and the Cologne case were analysed separately, before in the concluding chapter the findings are compared and an overall conclusion is drawn.

4. Results and Analysis Amsterdam

4.1. Amsterdam

Amsterdam, the capital of the Netherlands has a population of about 800,000 people (January 2012) (Centraalbureau voor de Statistiek, 2014). It is located in the West of the Netherlands and is part of the province "Noord-Holland" (figure 4.1)



Figure 4.1: Map Amsterdam
Reprinted from: Travellersspot, 2016

History

The history of Amsterdam starts in the 13th century. In that time a village developed around a dam in the river Amstel. This is also where the name "Amsterdam" comes from (Vincent, n.d.; I Amsterdam, n.d.). Until the 15th century Amsterdam remained a small village where people earned their living through fishing. In the 15th century Amsterdam experienced an economic boom through the use of its harbour for international trading (Amsterdam.org, n.d.). The influence of the Golden age (17th century) can be seen in the canals which show the cultural, political and economic importance of Amsterdam during this time. They also symbolise useful, modern city planning. Another milestone in Amsterdam's history was the development of the North Sea Canal in 1876 which connected the harbour to the sea. Through that and the development of steamships Amsterdam developed new international trading routes (I Amsterdam, n.d.).

Economy

Nowadays Amsterdam's economy is no longer dependent on trading anymore but reflects a rather great diversity. Trading still plays an important role concerning the workforce however, while the business sectors also gained importance. Here the diversity of businesses should be emphasised. The city hosts businesses ranging from information to technology, telecommunication and finances (Vincent, n.d.; Economist Intelligence Unit, 2009). Furthermore, cultural health and social services play a great role in the Amsterdam economy (Vincent, n.d.). Another important sector of Amsterdam's economy is the tourist sector which attracts millions of visitors (Gemeente Amsterdam, n.d.). Within the borders of Amsterdam only few manufacturing industries are settled, however the majority of the m can be found beyond the city borders (Economist Intelligence Unit, 2009).

Society

Trading fostered the value of networking and connecting with other cultures. This still coins the society in which a lot of diversity in terms of culture and different lifestyles is encouraged. About 37% of the population belong to an ethnic minority and have their origins in 178 countries (I Amsterdam, n.d.). The Amsterdam lifestyle encourages "everyone to be who they area and say what they think" (I Amsterdam, n.d.). Amsterdam is politically liberal and left-wing. Furthermore, the green party "Groenlinks" is with

10.7 % the fourth biggest party in the city council (Gemeente Amsterdam, Bureau Onderzoek en Statistiek, 2014).

Energy

In the Netherlands there are four major energy companies. Those are Electrabel (GDF Suez), E-on Benelux, Essent (RWE), and Nuon Vattenfall (Vattenfall, n.d.). Nuon Vattenfall can be seen as the traditional energy company in Amsterdam (City-zen, n.d.). Those companies are responsible for the supply of energy and some are also involved in the selling of energy. The Amsterdam grid is provided by Liander (part of Alliander). Alliander emphasises its open and sustainable focus in the energy market (Alliander, n.d.).

The percentage of renewable energy in the Netherlands is quite low with a share of about 5% (Centraalbureau voor de Statistiek, 2015) (in 2014). Here, they mainly get their energy supply from fossil fuels and research has shown that there are still investments made in those sectors. However, the government is aiming for a share of 14% in 2020 (International Energy Agency, 2014).

The table below shows several interesting numbers concerning Amsterdam's economy, and CO₂ emissions. The data is mainly from 2007, and therefore not very up-to-date. However, the numbers give a good overview of the situation before the project ASC has been implemented. The comparison to other countries has shown that the yearly per person emission in Amsterdam is with 6.7 tons higher than the average of the 30 cities which were investigated by the green city report. Reasons for that are the transport and industry in the city (Economist Intelligence Unit, 2009).

Table 4.1: Energy Table Amsterdam

Adapted from: Economist Intelligence Unit, 2009; Centraalbureau voor de Statistiek, 2014

Category	Amsterdam
Inhabitants	2014: 810, 937 (Centraalbureau voor de Statistiek, 2014)
GDP	2009: 41.443 €
CO ₂ Emission per unit GDP	2006: 150 t
CO ₂ Emission per person	2006: 6.7 t
Percentage of renewable energy per head	2009: 5.8 %



Figure 4.2: Logo ASC

Reprinted from: Amsterdam Smart City (n.d.)

4.2 Amsterdam Smart City

The ASC Programme was implemented in 2009 by the Dutch energy grid provider together with the "Amsterdam Innovation Motor". The Amsterdam Innovation Motor merged with two other businesses and became the "Amsterdam Economic Board" in 2011 (Interview Sieben 2016, p.1). The reason for implementing the project was to address urban challenges through finding new ways of collaboration among the different actors (Interview Sieben 2016, pp. 1-2). Afterwards the Municipality as well as Amsterdam ArenA, Hogeschool van Amsterdam, KPN, post nl and Arcadis joined the project and formed the founding partners of the project (Amsterdam Smart City, n.d.). Here, it is striking that the founding actors come from public, private as well as knowledge sectors.

The structure of the project is described in figure 4.3 below. All founding partners have one representative on a director level which forms the steering committee. Furthermore, they set up a working team, with at least one fulltime-employee from each party for ASC. They also have to pay a financial contribution to the ASC. This budget is used within the project predominantly for communication as well as salaries, but is not invested in specific projects.

Within the project the steering committee has a rather advisory task, which means that they point out urban challenges in the city and therefore have a rather strategic view (Interview Sieben 2016, p. 5; Amsterdam Smart City, 2016). Within the core team consultants, innovators as well as strategists are involved. They help to set up different projects which address challenges and try to develop new collaborations. Those projects are mostly self-steering and do not require legitimisation from the steering committee (Interview Sieben 2016, p. 6). The role of the municipality is that of representing a public actor within the group of founding actors, and sends some representatives who work in the core team. The ASC project works closely together with the Chief Technology Office (CTO) which Amsterdam set up 2014. This is a department within the municipality who works on innovations (Gemeente Amsterdam, n.d.).

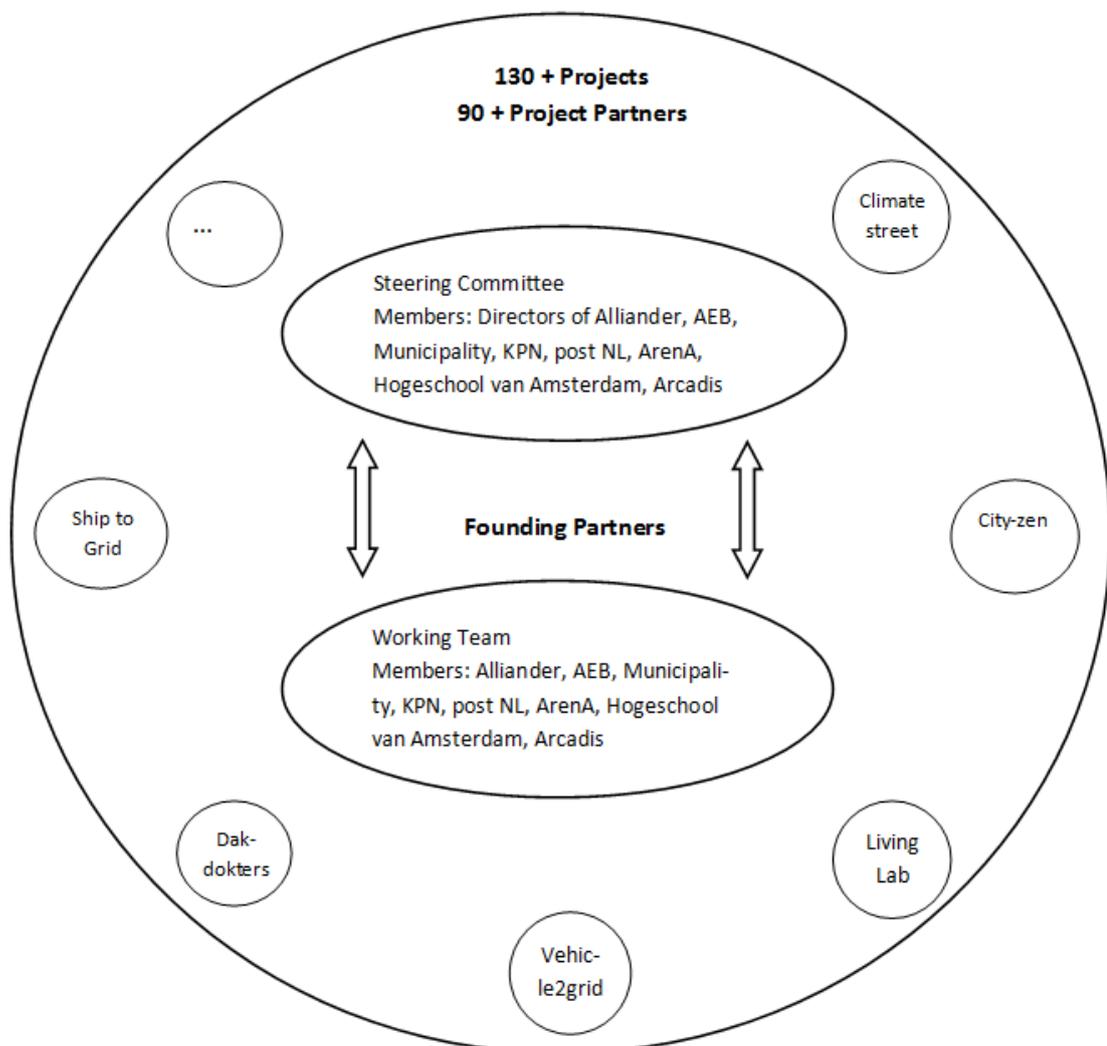


Figure 4.3: Structure ASC

Amsterdam defines the smart city as a:

“city in which social and technological infrastructure and solutions facilitate and accelerate sustainable economic growth with the ultimate aim to improve the quality of life in the city for everyone. To reach this intensive collaboration is needed to create open and fair social infrastructure between all stakeholders within the city.” (Amsterdam Smart City, 2016)

This gives a good impression of the key points within ASC. Here it is focussed on the collaboration between different sectors of the city in order to address urban challenges improving the quality of life (Interview Sieben 2016, p. 1). Furthermore, the project aims to accelerate the process of sustainable growth. This definition and working methods is visualised in figure 4.4.



Figure 4.4: Working Method ASC
Reprinted from: Amsterdam Smart City (2016)

4.2.1 Actors

Different Actors

The Project ASC is aiming to bring different actors together in order to face urban challenges. The partners in the project come from different backgrounds and cover the public, private and the knowledge sector. This range can be also observed within the founding partners of ASC (figure 4.5). The municipality is an actor who covers the public sector, the Hogeschool van Amsterdam is covering the knowledge sector, and Alliander, KPN, Post nl, and Arena are actors from the private sector (Amsterdam Smart City, 2016). The eighth founding actor is the Amsterdam Economic Board. The Amsterdam Economic Board is a private partnership, which aims to improve the standard of living in the Amsterdam region in a sustainable way (Amsterdam Economic Board, n.d.). To achieve this goal they are connecting partners from the public sector, businesses as well as knowledge institutions. Even though the thought of collaboration between different actors is reflected here too, Annelies van der Stoep – a representative of the Amsterdam Economic Board - states that the Amsterdam Economic Board is broader oriented (Interview van der Stoep 2016, p.2). However, they are involved in the ASC project by connecting ASC to their broad network and facilitating within the ASC platform for example by hosting the website (Interview van der Stoep 2016, p. 1). It also shows that besides ASC there are several other network organisations available – next to the Amsterdam Economic Board also the CTO and de Waag Society (van Winden, et al., 2016). In addition to that citizens play a major role between those different sectors (Amsterdam Smart City, 2016). Furthermore there are several organizational partners listed on the ASC website (Amsterdam Smart City , n.d.)



Figure 4.5: Founding Actors of different Sectors
Reprinted from: Amsterdam Smart City (2016)

Different Levels of Partners

Cloosterman, who works as a consultant of Arcadis, describes the role as a founding partner as more intense than the role of a project or network partner. As a founding partner all the dynamics within the project are directly experienced. The partner gets a deep insight into the project and gets the opportunity to build up as much knowledge as possible. However, he also sees it as a quite challenging role, as workforce and time have to be provided, which makes it difficult for Arcadis to use all the knowledge which is provided. Nevertheless, he stresses that they are glad to participate in the programme (Interview Cloosterman 2016, p.4).

Next to the eight founding partners there are more than 90 project partners who are involved in certain projects (Amsterdam Smart City, n.d.). Those are partners who are only involved in certain projects. They are usually dedicated to a certain topic. Therefore, it is less time and cost-intensive for those partners to participate (Interview Cloosterman 2016, p. 4).

Apart from the previous two groups of partners there are different network partner who are interested in the process however not involved yet (Interview van der Stoep 2016, p. 5). Cloosterman (Interview 2016, p. 4) states that this might be the first step to become a project partner within ASC.

Motives

Alliander, was one of the founders of the project and started the ASC project in order to get more experience in collaborative working. Sieben stresses that Alliander is a typical network company which works with customers on different levels. Furthermore, the project feeds their innovation process and stresses sustainability which is one of the values of the company (Alliander, n.d.; Interview Sieben 2016, p.4). This alignment emphasises that the company had an interest in triggering energy transition through starting the project (Alliander, n.d.). Next to this, the aspect of collaboration has been an important motivation to join the project (Interview Sieben 2016, p. 4).

There are different reasons why partners join the project. Public actors like the municipality see the ASC project as a marketing strategy. Diverse private partners are attracted by the connection with the municipality, see the opportunity to innovate from different levels and see possibilities to promote their products (Interview Sieben 2016, p. 5). Scientific actors such as the University of Applied Sciences see the collaboration as an opportunity to get into contact with different companies to gain insights which knowledge is needed within that sector. Furthermore, this sector supports the project through evaluations the project can then learn from (Interview van der Stoep 2016, p. 5). Examples for that are

the Smart Stories Report or the Evaluation by the University of Applied Science, which evaluated twelve ASC projects (Amsterdam Smart City, 2011; van Winden, et al., 2016).

End-user / Citizens

Another important factor for the development of certain projects is the end user. They differ in the projects and can range from professionals over organisations to citizens (van Winden, et al., 2016). The evaluation of ASC projects has shown that in many projects the end user has not been involved sufficiently and certain projects are based on assumptions about needs and desires of the citizens (van Winden, et al., 2016). This has been also reflected in the interviews where the citizen has never been mentioned as a major actor for the implementation of projects. The difficulties about including citizens as end-users have been pointed out by Cloosterman who stated that it is about “involvement at the right moment” (Interview Cloosterman 2016, p. 3). Van der Stoep (Interview 2016, p. 5) also mentions that one of the lessons learnt is that a living lab is not a “goal in itself” but is an enabler (Interview van der Stoep 2016, p. 5). Therefore, projects have to be supported by the end users. Furthermore, Sieben (Interview 2016, p. 3) points out that the level on which citizens are included is dependent on the kind of project.

Involvement of Partners and Projects

Throughout the interviews it became clear that most of the partners within ASC get involved in the project via networking (Interview Cloosterman 2016, p. 5; Interview Sieben 2016, pp. 2-3). This can be seen for example in the project partner Arcadis. Cloosterman (Interview 2016, p. 1) assumes the personal alliance of the European director of Arcadis and the CTO in Amsterdam were the starting point of this collaboration. However, project partners are usually gained through discussions or on events. He stresses that everyone can join if it adds value to the project (Interview Cloosterman 2016, p. 5). According to him it is highly dependent on the party and how willing they are to gain new partners (Interview Cloosterman 2016, p. 5). Sieben stresses that new collaborations are established through examining an urban problem and scaling it down further more. Additionally, it is being tried to involve the stakeholders and problem holders in a project. For him those collaborations among an urban challenge are new eco-systems which are created (Interview Sieben 2016, p.1).

Sieben states that ASC is only involved in projects where three or more stakeholders are involved. Here, the emphasis on collaboration within ASC can be seen again. He states that as soon as there are more than two actors involved it becomes difficult for them to collaborate. In those situation ASC is needed. In order to develop a programme, those actors come together and discuss how to examine a certain topic (Interview Sieben 2016, pp. 1-2). Sieben claims that the most important resource, partners have to provide for a project is some sort of commitment. Every project is independent and has different structures. In some projects there is a working team and a mandate team. The working team is working on solution, while the mandate team has to decide about it (Interview Sieben 2016, p. 9). Those collaborations and discussions are usually held on a round table (Interview van der Stoep 2016, p. 3; Interview Sieben 2016, p. 13).

Role of the Municipality

Sieben (Interview 2016, p. 7) as well as van der Stoep (Interview 2016, p. 6) state that the municipality is only one of the eight founding partners which is experienced as rather positive. Sieben points out that they are collaborating with the CTO. For him it is a very important strategy that the municipality sets up a Chief Technology Office, which created a connection between the public and private goals (Interview Sieben 2016, p. 7).

Even though it is often stressed that the municipality is only one of the founding actors, Sieben (Interview 2016, p.7) mentions that the municipality might be one of the most involved actors within ASC project. This has also been shown by research from Nikayin and de Reuver (2012) which analysed the network of actors within ASC. They found that the municipality was involved in most

of the projects followed by AIM and Alliander. According to them this shows a certain role of leadership which has developed throughout the project. However, it is stated that even though the municipality might be involved in most of the projects its role does not differ from that of other project partners (Interview Sieben 2016, p. 7).

Actors in Energy Projects

The observation of energy projects in Amsterdam has shown that there is a great range of actors which are committed to energy projects. Most of the projects have several different partners and therefore stress the focus on collaboration. Next to economic partners also organisational and scientific respectively knowledge partners are present in different projects. Next to those partners also several financial institutions are mentioned which are involved in the financing of the projects (appendix C1).

It has been obvious that especially the grid provider, and founder of the project Alliander is very present in several energy projects (appendix C1). Next to the grid provider also the energy company Nuon, Vattenfall is involved in five projects (Amsterdam Smart City, n.d.). However, there are also smaller energy companies which are incorporated in energy projects such as Qurrent, which claims to be the greenest energy provider in the Netherlands, and Eneco (Qurrent, n.d.; Amsterdam Smart City, n.d.) There are several energy cooperatives which are active in the project like Zuiderlicht, Onze Energie and Amsterdam Energie (appendix C1). This shows that next to the traditional energy companies also alternative energy providers play a role in the projects. Therefore, the project also takes into consideration the change in roles of the energy sector. This development is supported and taken up by different energy projects (Interview van der Stoep 2016, p.7).

Sieben (Interview 2016, pp. 10-11) mentions the importance of collaboration in the project “zoncoalitie”. Here he stresses the point that it is important for different partners to understand each other’s viewpoints. In this project citizens are seen as a target group and are also included and supervised concerning their involvement within the project and are constantly addressed throughout the project (Zoncoalitie, n.d.). This project shows the emphasis on collaboration in different ASC energy projects, as well as the focus and involvement of the citizens. Sieben (Interview 2016, p. 11) claims that the social and innovative approach ASC has is a good way to contribute to energy transition. Similar to that project there are several other projects where the citizen is seen as a clear target and is motivated to join the project as for instance in the project Zonstation, or Oosterlicht, city-zen power plant (Amsterdam Smart City, n.d.). Furthermore, the EU project City-zen, which covers different energy sub-projects (appendix C1) has a clear approach which involves citizens (City-zen, n.d.; Amsterdam Smart City, n.d.) The Climate Street, compared to this does not directly involve citizen, because it is an initiative which came from the shop owners who wanted to change something (Amsterdam Smart City, n.d.). Those projects emphasise a certain bottom-up structure in energy projects. Projects which include many stakeholders from different groups have the strengths that an exchange of different viewpoints takes place. This is especially of importance considering the large changes in the energy sector. However, the evaluation report of ASC says that the involvement of different people also bears the challenge that energy projects lose focus and therefore do not lead to results (van Winden, et al., 2016).

Another important point is that from the governmental sector not only the municipality Amsterdam is present among the actors but also other municipalities (e.g. Haarlem, Zaanstad). Those projects are not limited to the area of Amsterdam but support a smart region among Amsterdam (e.g. Watt voor watt). Furthermore, there are some international projects which are often subsidized through the EU (City-zen; Transform). Here, also international cooperation are founded (appendix C1).

4.2.2 Rules

Decision Structure /Power Relation

Cloosterman (Interview 2016, p. 5) describes the decision-making structure as rather “laissez fair”. Van der Stoep points out that there is “collaboration on an equal basis” (Interview van der Stoep

2016, p. 4) and that the structure is very “flexible” as all the partners can decide every year whether they want to continue the collaboration with ASC. Even though there is no manager according to van der Stoep (Interview 2016, pp. 1, 4), Sieben (Interview 2016, pp. 6-7) mentions that there might be leading visionaries on the director’s level. People tend to agree faster to their decisions and therefore a rather informal power structure exists. In his opinion the director of Alliander is one of those leading visionaries and can steer the project for a certain direction; also the CTO has an experienced and informal steering role in the project (Interview Sieben 2016, pp. 6-7). Especially Alliander is considered to be an actor which focusses predominantly on energy projects (Interview Cloosterman 2016, pp. 5-6). The power partner can therefore favour different energy projects.

Cloosterman also mentions that it is difficult to see a decision structure, because there were not many hard decisions made in the past years. According to him this has changed through the development of different focus projects, which they developed and discussed as a team. He mentions that an open power structure has the risk that the development of projects can take a lot of time as there is nobody who is responsible (Interview Cloosterman 2016, p. 5).

Formal/Informal Rules

Van der Stoep (Interview 2016, p. 4) points out that there are several rather informal rules within the project. Here she mentions that data should be openly available however also care about privacy of data. There are contracts made among different partners, however they concern several projects and not so much the overall smart city project (Interview Sieben 2016, p. 10). This again emphasises the independence of certain projects within ASC. Because of the loose structure there are no restrictions if a collaboration does not go well. Here, it has been pointed out that ASC should benefit and learn from those cases as the statement “we have to learn from best practices but also from failure” shows (Interview van der Stoep 2016, p. 4). Sieben (Interview 2016, p. 10) also mentions the rule that as soon as a project can run itself, ASC is not needed anymore and that it is important to then focus on the next challenge, as well as the guideline that a project should involve more than three actors in order to become a smart city project. Through this rule some projects which could benefit energy transition in the city are excluded from the project.

Preconditions for Projects

On the website of ASC everyone is invited to send in an own project. There are three preconditions a project has to fulfil in order to become a smart city project. Those three conditions are:

- “It should provide a solution for an urban challenge
- The project is executed in cooperation with more than two different stakeholders. [...]
- The project can be replicated in other cities in- and outside the Netherlands “ (Amsterdam Smart City, n.d.)

Those internal rules influence energy transition in several ways. First of all the emphasis on urban challenges is mentioned. Cloosterman points out that reduction in CO₂ is seen as a great societal goal for the ASC project (Interview Cloosterman 2016, p. 2). Therefore, this first rule favours new projects which contribute to energy transition. The second rule stresses the innovative focus of the project. This rule has also been mentioned by Sieben (Interview 2016, pp. 1-2). It has been explained that there is no need for ASC to intervene in projects where only two parties are involved. On the one hand, this regulation excludes certain bilateral projects and innovative ideas, which are not promoted or listed on the ASC platform. An example for that are certain projects which have been initiated by the municipality (Municipality of Amsterdam, 2015). On the other hand, this guideline makes sure that the project keeps the innovative character which has been emphasised in several interviews. Therefore, it guarantees that only projects are listed which were enabled through the

ASC and could not have been done without it (Interview Sieben 2016, p. 1-2). The third aspect makes sure that projects have the ability to be scaled up. The Smart Stories report which evaluates certain projects has shown that through scaling up there is a great potential in CO₂ savings. The ambition of different energy projects and international collaborations show that this aspect plays an important role within energy projects (Amsterdam Smart City, 2011).

Laws and Restrictions

Van der Stoep (Interview 2016, p. 6) emphasises that the urban challenges ASC is addressing are not on a technological level but rather on a political or societal level. Within those levels the “municipality has possibilities that other partners might not have” (Interview van der Stoep 2016, p. 7). According to her, the biggest change in energy transition is that the roles of actors are changing. For instance that energy consumers are not only consumers anymore but can also become producers. Here, there are still restrictions from outside the project levels which hinder a wisely use of resources (Interview van der Stoep 2016, p. 4).

In the Amsterdam Sustainability Agenda the municipality states different approaches on how to deal with regulations smartly. Here, the agenda points out that the municipality tries to deregulate as much as possible, but gives clear implementations about goals and directions, especially when it comes to the long term development. The municipality states for instance that it intends to abolish rules concerning solar panels such as that solar panels can be installed without planning permission. This could be seen as a valuable change for energy transition, and could enable as well as improve the contribution to energy transition (Municipality of Amsterdam, 2015).

Furthermore, the Sustainability Agenda shows that there are certain measurements implemented by the municipality which may not be connected to the smart city project, but nonetheless contribute to energy transition. Those measures are for instance the support of zero energy housing, especially in public buildings like school, but also making sustainable energy supply within the city more attractive such as in underground heating (Municipality of Amsterdam, 2015). In addition, there are regulations which favour owners of E-vehicles. They get for example special parking spaces within the city (Klimaatbureau Amsterdam, 2010; Munsch, 2015). This shows that the municipality has a unified sustainable alignment of which the ASC project is only a part of. Therefore, the municipality creates a framework which enables energy projects within Amsterdam.

4.2.3 Resources

Commitment

Sieben (Interview 2016, p. 9) mentions commitment as an important resource for the ASC project. Commitment can be shown in several ways as for example through resources like data, manpower as well as financial support. He stresses that it is clever to first talk about the commitment of the different partners and not about the finances (Interview Sieben 2016, p. 9). The evaluation also shows that different forms of committing resources ensure the value of the project (van Winden, et al., 2016). All the project partners also have to bring in man power or other types of commitment by joining the project. Sieben (Interview 2016, p. 6) emphasises that also on a steering level, within the core team there are different levels of commitment. For instance there are some who want to sell consultancy hours, others are trying to market the programme. Even though it is mentioned that it is important keep the smart city thought, those different levels of commitment are positive, as long as a constructive discussion takes place (Interview Sieben 2016, p. 6).

Financial Resources

From 2009 to 2011 there has been a budget of 3.4 million Euros. Those financial resources come from the European fund for regional development. 40% of the project are paid by this funding, 40%

by private funding and 20 % are funded through the government (Manville, et al., 2014). The importance of the European development fund within the project has also been stressed in the research of Zygiaris (2012).

As already mentioned, the founding partners of ASC support the programme through a communication budget and bring in at least one of the team members for ASC. Through the financial support from founding partners it is ensured that they are involved and committed to the project (Interview Sieben 2016, p. 12). The financial contribution of the different founders of the project may differ. However, Cloosterman supports it that those contributions are not public. He thinks that it does not play a role for the project. This is an implication that the main goal of the partners is to change something and that financial contributions play a rather secondary role (Interview Cloosterman 2016, p. 7).

All the different projects have to be financed on their own. Van der Stoep points out that it is intentionally that projects do not get any starting funds. She states that if there is no financial support then there is not “enough energy to do this project” (Interview van der Stoep 2016, p. 4). Sieben agrees with that and states that this strategy helps to start projects which actually add value to the main project. He stresses that there is enough money in the market to support innovation. However, a suitable business model has to be found. The financing usually happens in an iterative way meaning that projects are financed step by step. Usually all the partners of a project pay about the same financial contribution which prevents power inequalities (Interview Sieben 2016, pp. 8-9).

Financial Contribution Municipality

Sieben (Interview 2016, p. 7) emphasises that ASC may be different because the municipality of Amsterdam is only one of the eight founding partners to fund the program and does not have a bigger role than that. However, he stresses that the municipality of Amsterdam is quite rich and therefore has the opportunity to pay a financial contribution to the project unlike other smart cities (Interview Sieben 2016, p. 13). Nevertheless, he underlines that it is also possible to find other ways of financing the project. Here, he names examples in America where smart city projects are only financed by the private sector and with the time the measures become a matter of the public sector.

The evaluation of ASC has shown that there are some projects which would not be possible without financial contributions or subsidy from the governmental level. It also points out that other projects have been executed without any funding (van Winden, et al., 2016). In order to continue the investment into certain projects the municipality sets up an energy fund. Furthermore, the municipality states that it especially wants to invest in transition “where the market is not willing or able to” (Municipality of Amsterdam, 2015, p. 48). This energy fund enables the municipality to get involved into energy projects within ASC, but it can also start energy projects.

Ideational Resources

The brand ASC as well as the kind of people who are involved in the team are seen as an important resource according to Sieben (Interview 2016, p.7). He emphasises that it is a good team which is well connected, and can provide a lot of expertise. Furthermore, he stresses that the team predominantly consists of pragmatic people who are sharing a common public goal. The team is also coined by a high level of trust and that the members are willing to help each other for example with expertise (Interview Sieben 2016, p. 7). Moreover, he mentions that all the different founding partners together have 140, 000 employees which is a great pool of available expertise. Here the connecting thought and the emphasis on ideational resources is stressed again (Interview Sieben 2016, p. 7).

The way different actors work together within the project give implementations that the exchange of ideational resources is valued highly within those projects. Within the collaboration actors exchange opinions, or add value to the project in other ways (Interview van der Stoep 2016, pp. 2-3). She also points out that the roles in the energy market are changing (Interview van der Stoep, 2016, p. 7). This point emphasises the importance of an active exchange of different parties in order to implement energy projects. Also Sieben (Interview 2016, p. 11) stresses that through the innovative and social approach of a smart city energy transition is triggered.

4.2.4 Concept

Amsterdam Pathway

In the introduction of the ASC concept a pathway for the project has been created (figure 4.6). This pathway is based on four phases which were addressed throughout the project. Those phases range from visioning, over road mapping to implementing projects until finally full scale roll out takes place (Amsterdam Smart City, n.d.). How those phases developed is described below.



Figure 4.6: Pathway ASC
Reprinted from: Amsterdam Smart City (n.d.)

Vision

ASC “is a liveable city, where it is nice to work and live and we do so by bringing companies, urban authorities and knowledge institutions together to create collaboration” (Interview van der Stoep 2016, p. 1). This vision explains the content-oriented goal of ASC and also reflects its working strategy. The aim for a more liveable city has been addressed several times throughout the interview and can also be found in the definition of ASC (Amsterdam Smart City, 2016). Cloosterman (Interview 2016, p. 2) for instance states that the vision is to improve the “quality of life for Amsterdam” in several ways. He stresses that even though technology can be a tool for this improvement, the “ambition should be built on societal values and not on technology” (Interview, Cloosterman 2016, p. 2). By that he means that it is crucial to address urban challenges within the ASC projects. This point has also been stressed by van Winden, et al (2016) who state that technology is never the problem within ASC projects. In the end the citizens have to benefit from the process in a direct or indirect way (Interview Cloosterman 2016, p. 3).

Definition

The working definition of ASC leads to the other crucial point of the smart city concept in Amsterdam which has also been mentioned in the vision above: the collaboration of different partners. Sieben states that collaborative innovation is the main concept of the project and was also one of the reasons why Alliander started the project. Therefore, he formulates the concept of ASC as bringing “different stakeholders [...] together, collaboratively realizing their project [goals]” (Interview Sieben 2016, p. 2).

Another important aspect of the concept is that they want to see how these connections can accelerate the processes within the city. Sieben (Interview 2016, p. 2) and van der Stoep stress that ASC is “about practical projects within the city” (Interview van der Stoep 2016, p. 2). Sieben

(Interview 2016, p.11) sees the ASC approach with a focus on social innovation as a successful concept to accelerate the process of energy transition.

Sieben (Interview 2016, p. 1) mentions that ASC is creating eco-systems. It is important to narrow down the urban challenges to public spaces and to find the stakeholders and “problem owners” of those places. Furthermore, those stakeholders are trying to get involved in creating a solution through collaboration. Also it has been emphasised that ASC is actually about applying technologies and concrete measures (Interview van der Stoep 2016, p. 1). It is striking that the ASC project is functioning on different levels. As the steering committees task is to address certain challenges and therefore work on a rather conceptual level, the different projects are about preventing and solving those challenges on a practical level.

Even though ASC has a working definition, Cloosterman (Interview 2016, pp. 5-6) highlights the challenge to define a smart city. He stresses that there may be different definitions and focusses on different partners. For instance KPN is rather focussed on ICT while Alliander has an energy focus. Alliander is an important founding partner what stresses the thematic focus on energy in ASC (appendix C1; Interview Sieben 2016, pp. 6-7).

Although Arcadis is a quite new founding partner of the project, they are still working on their vision of a smart city. However, next to the different definitions or interpretations which are based on the expertise of certain partners he mentions differences between the different sectors such as that some partners clearly focus on showcasing their equipment (Interview Cloosterman 2016, pp. 5-6).

Awareness

Even though Cloosterman states that it is important to always have the Amsterdam inhabitant in mind he also states that inhabitants should not be included during all phases of a project as “it is about involvement. But involvement at the right moment” (Interview Cloosterman 2016, p. 3). This view is also supported by Sieben (Interview 2016, p. 3) who stresses that some projects are rather in the background and some projects do not involve the citizen in a direct way. He also stresses that even though inhabitants might be familiar with a certain project, the ASC initiative is rather in the background. To improve awareness and support the platform thought the new website was launched in the beginning of June (2016) (Interview Sieben 2016, p. 3). Furthermore, the observation of energy projects has shown that there are several projects where citizens are involved into an ASC project like house-owners (appendix C1). Also the new website with a clear platform structure gives every citizen the opportunity to bring in own ideas in ASC.

Focus

The project ASC has been grown from bottom up and therefore covers a lot of different areas (van Winden, et al., 2016). On their website they divide their projects into the topic areas of: Infrastructure and Technology, Energy Water and Waste, Mobility, Circular City, Governance and Education and Citizens and Living (Amsterdam Smart City, n.d.). This shows the great thematic range of projects which is available within ASC. The evaluation report of the University of Applied Science in Amsterdam states that it is important that there is sufficient attention paid to the scope of the projects and all project partners are aware of the focus of ASC (van Winden, et al., 2016). Sieben (in: van Winden, et al., 2016) mentions that especially in energy it is difficult to find a clear focus and that this makes the implementation of the project rather difficult.

Cloosterman says that the open structure of the ASC project could bear the challenge that there is “no focus aligned [...] to make a difference” (Interview Cloosterman 2016, p. 2). He states that, as there are so many new projects it becomes difficult to define a focus. Therefore, he criticises that this might have led to a loss of focus during the last months. This challenge has been addressed

through six main ambitions which have recently been developed and can be seen as focus projects within ASC. Sieben (Interview 2016, p. 11) similarly sees it as important to select wisely and to set priorities because it is not possible to take up all challenges at once. Within those focus projects two of the projects deal with energy transition (Interview Cloosterman 2016, p. 3) which stresses the priority of this urban challenge for ASC. Even though the lack of leadership and alignment within ASC has been criticised by several sources (Interview Cloosterman 2016, pp. 2, 5;; van Winden, et al., 2016), Siegele suggests that the real smart cities of the future will be created from the bottom up (Siegele, 2013).

Scaling

ASC has the clear ambition to develop projects on a larger scale. This has become obvious in different interviews (Interview Sieben 2016, pp. 1-2; Interview van der Stoep 2016, pp. 1, 5) and is seen as a precondition for new smart city projects (Amsterdam Smart City, n.d.). In addition it is an important aspect in several reports which evaluate ASC. The ASC Report (2016) has evaluated different smart city projects with respect to their ability to be implemented on a larger scale (van Winden, et al., 2016). Here it has been paid attention to three different sorts of scaling which have been worked out by van Willem and are shown in figure... below. The importance of scaling for energy transition has been shown in the Smart Stories Report (2011) of ASC. A realistic scaling up of the already implemented projects could lead to an increase in CO₂ reduction from 0.5 to 7% (Amsterdam Smart City, 2011, p. 142).

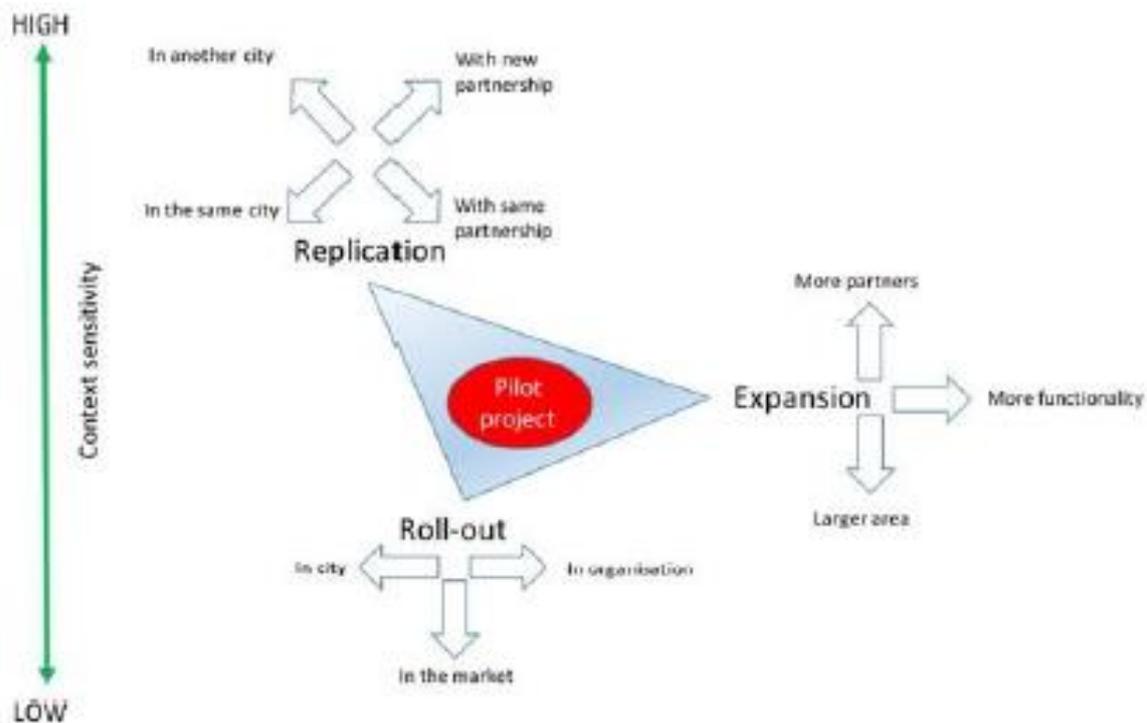


Figure 4.7: Types Scaling
Reprinted from: van Winden (2016)

The aspect of scaling also appears in several energy projects. Most of the projects are implemented on a large scale and have high ambitions. For instance, the project “zoncoalitie” sets the target to implement one million solar panels in the region of Amsterdam. Several other projects go beyond the borders of Amsterdam (Amsterdam Smart City, n.d.). Furthermore, international partnerships among energy projects facilitate the replication of certain projects in an international context.

Energy transition

Within these urban challenges energy transition plays an important role. Cloosterman (Interview 2016, p. 3) sees energy as a great societal goal which therefore improves the quality of life within Amsterdam. Here he says that whether a smart city project is triggering energy transition is mainly dependent on the smart city concept. For instance some SC concepts are only focussed on ICT technologies. However, the above mentioned stress on urban challenges within ASC, make energy transition one of the topic ASC addresses (Interview Cloosterman 2016, p. 3).

Cloosterman is involved in the program “urban clients” in Arcadis. This program has the vision that cities can learn from each other. Therefore, he states that if a new project is developed one always has in mind that it can be scaled up elsewhere. Even though cities and people are different, “the learning effect should always be taken into account” (Interview Cloosterman 2016, p. 3). Therefore, he points out that their approach concerning energy transition can be clearly seen as global. Cloosterman also mentions that energy transition is a very broad topic which is indirectly influenced and connected to other urban challenges such as pollution (Interview Cloosterman 2016, p. 3).

Sieben (Interview 2016, pp. 3-4) stresses that ASC itself does not have independent targets for energy transition. He states that there are energy targets from the municipality of Amsterdam and sees ASC rather as a tool of the municipality to implement those targets. The Amsterdam municipality signed the covenant of mayor and therefore agrees to succeed international climate goals through an integrative approach (Covenant of Mayors, n.d.). Amsterdam’s targets are to increase renewable energies by 20% as well as using 20% less energy than in 2013 (Municipality of Amsterdam, 2015). Sieben (Interview 2016, p. 8) also emphasises that for him ASC is not about reaching targets but rather about supporting change among certain important actors within the city. Despite the fact that the ASC project does not see its role in developing clear energy targets, several energy projects have clear goals they want to reach. For instance the project “zoncoalitie” has the ambition to implement one million solar panels in Amsterdam (Zoncoalitie, n.d.). Other projects, like the Energy Atlas clearly aims to make energy use more transparent (van Winden, et al., 2016; Amsterdam Smart City, n.d.).

This can also be seen in the broad focus of ASC, as well as in the topic areas mentioned above. In appendix C1 the projects with a direct connection to energy transition have been listed. About one third of the projects have a direct link to energy transition. However, other projects which have focal points on education for instance might influence energy transition in an indirect way (Amsterdam Smart City, n.d.). Within the energy projects it can be seen that there is a clear focus on energy efficiency (intelligent use; thermal insulation), and energy supply (appendix C1). Furthermore, it is striking that there are several projects which also include the region of Amsterdam, as well as international cooperations. The project City-zen is developing Zero Energy Cities in ordinary areas, like they can be found in many other cities, of Amsterdam and Grenoble. This shows the inclusion of very broad energy projects, with a lot of focal points (Amsterdam Smart City n.d.).

Amsterdam way

Sieben (Interview 2016, p. 12) and van der Stoep (Interview 2016, p. 6) imply that the Amsterdam way of a smart city has its origins in the Dutch history. They take the typical Dutch polder model as an example. When the Dutch pledged land there was already communication between different sectors and different layers needed. Therefore, the Netherlands is quite known for being able to discuss issues among different stakeholders, between different hierarchical levels and they are used to work in a horizontal way (Interview Sieben 2016, p. 12). Van der Stoep (Interview 2016, p.

6) also mentions that especially in Amsterdam sharing of data has already been important in the golden age when ships shared their data to in order to exchange their stocks. Furthermore, Sieben (Interview 2016, p. 12) mentions that even within the Netherlands there are differences in the way of living. As the Amsterdam people are very outgoing and like to show what they have, in the other urban metropole of the Netherlands, Rotterdam, people have a totally different way of living. Van der Stoep (Interview 2016, p. 6) emphasises that within Amsterdam there is great acceptance of technology. New contexts also hamper the replication of different projects. Therefore, cultural differences make it more difficult for a smart city to trigger energy transition on a broader scale (van Winden, et al., 2016).

4.3 Sub-Conclusion Amsterdam

Role of Energy Transition

The ASC project has a very broad focus in which energy transition rather plays an indirect role. ASC aims to find solutions for urban challenges. Among those energy transition is seen as an important challenge which can improve the quality of life within Amsterdam. Despite the broad thematic focus the project has clear focal points and guidelines in different projects. Here, the collaboration of different actors as well as the scaling play an important role for ASC. Those focal points also influence energy transition in a rather indirect way as roles within the energy market are changing. The enlargement and replicability of certain projects enlarge their effect on energy transition.

Vision/Goals and Energy Transition

In the vision of ASC energy transition is not directly mentioned. Neither does the project itself have clear energy targets. The project has a certain role within the urban contexts. It rather serves as an accelerator for practical change by bringing together actors from different backgrounds. Here, the focus is on the starting of new projects and less on the outcomes those projects have. The project rather is seen as a tool which helps to fulfil the energy targets set by the municipality. Even though the project does not have clear visions and targets concerning energy transition every projects is implemented with the goal to be scaled up at some point. This general goal of scaling up has great influence on energy transition as it clearly enlarges the effect of the projects. Furthermore, it has been shown that different projects within ASC do have goals concerning energy transition or focus on a more transparent energy use.

Important Factors which Influence Energy Transition

Throughout the case study several things have been mentioned which can be seen as crucial points why ASC has been so successful. It has been stressed that a major challenge in the energy sector are the changing roles. Therefore, the approach of bringing certain actors together and encouraging discussions is highly valuable when it comes to energy transition.

Furthermore, the role of the government can also be seen as an enabler for energy transition. On the one hand, the municipality gives a framework for ASC projects and has a clear alignment towards sustainability and energy transition. Therefore, it focusses on deregulation and tries to trigger the economic aspect of energy transition. This enables several energy projects in ASC.

Besides that the clear focus on scaling which can be seen in many large scale energy projects as well as in the international cooperation, can be seen as a great enabler to increase the contribution to energy transition. The success of collaboration between different levels and sectors has been emphasised through many interviewees as typical Dutch, respectively typical for Amsterdam. Therefore, cultural differences came up in all interviews and have great influence on the success of the projects.

Projects which Contribute to Energy Transition

About one third of the overall projects in ASC have a clear link to energy transition. Among those projects a thematic focus on energy efficiency and energy supply projects can be seen. Most of the projects are implemented on a large scale and some projects are executed in international cooperation. Furthermore, the case study has shown that several projects have been initiated from the bottom up, and clearly see the citizen as an important partner of the project. It can also be seen that next to big energy companies also small energy companies collaborate in energy projects which shows that projects take the change in the energy sector into consideration. Here also projects with energy cooperatives and citizens are involved.

5. Results and Analysis Cologne

5.1 Cologne

The city Cologne is located in West Germany and belongs with just over one million inhabitants to the four biggest cities in Germany (Information und Technik NRW, 2015; Figure 4.8). Cologne is part of the federal state “Nordrhein-Westfalen” (NRW) which is the area with the highest population and greatest industrial density in Germany. The “Energiewende” is of great importance as next to the transition to low carbon energies also the exit from nuclear energy is planned in 2022 for the whole of Germany (Siegemund, Köring, Schulz, & Hanses, 2013).



Figure5.1: Map Germany, Cologne
Reprinted from: Travel1000Places.com (n.d.)

History

50 A.D. the Roman Emperor Claudius declared Cologne a city. In Cologne the Roman history is nowadays especially obvious because the Roman road network still structures the city. Due to its strategic location the city specialised in and was coined by trade. With the industrial revolution Cologne has grown beyond the previous city borders. New technologies and incorporation of surrounding parts made Cologne an industrial city. The growth of the city also caused an expansion of energy systems. This was linked to a resettlement of warmth-, energy- and water providers into peripheral areas (cologne.de, n.d.).

Economy

Cologne’s economy is coined by a great diversity. The city hosts several industries for instance motor vehicle industry or chemistry industry and has, next to global players, also a lot of local entrepreneurs. Furthermore, Cologne is known for its media production sites and became the digital capital of Germany 2015. Because of that a lot of start-ups are drawn to the city (Economist Intelligence Unit, 2011; Pwc, 2015). In addition to that the economy is known for its service sector such as in the areas of insurances, finances, science and tourism (Economist Intelligence Unit, 2011).

Society

Cologne has an average age of 42 which means that its population is rather young compared to the national average of approximately 44 years (Stadt Köln, 2015; Bundesinstitut für Bevölkerungsforschung, 2014). A reason for this could be the great variety of possibilities for education like the University of Cologne which coins the city and makes it attractive for students (www.hochschulen-köln.de, n.d.). The great amount of students add to the city’s human capital which also serves as a breeding ground for new technologies and start-ups. In 2011 16.5% of Cologne’s population had a foreign nationality. This is more than the federal state NRW (9.2%) and Germany (7.7%) and emphasises the cultural diversity of the city (Information und Technik NRW, 2013; Statistisches Bundesamt, 2011).

Since 2015 Henriette Reker, previous councillor of the Department for Integration, Social and Environmental issues, is mayor of the municipality Cologne (Stadt Köln, n.d.). The Green party (Die

Grünen) are with almost 20% of the seats the third strongest party and have 18 (out of 90) seats in the city council. (Stadt Köln, 2014).

Energy

Cologne’s energy is provided by the energy provider “RheinEnergie” which has its origins in the GEW (Gas- Elektrizität- und Wasserwerke Köln). Since 2002 the RheinEnergie provides Cologne but also the whole area close to the river Rhein with energy (Bund der Energieverbraucher e.V., 2015; RheinEnergie, n.d.). 2014 the RheinEnergie had a share of renewable energy of about 25% which is similar to the German average (Bund der Energieverbraucher e.V., 2015; Agentur für Erneuerbare Energien, n.d.). In the table below a few numbers from 2007 concerning Cologne’s economy, energy and CO₂ emissions are listed. Even though the numbers are from recent years, they provide a good overview of the energy aspects in Cologne before the project SCC has started. Here, it is striking that the emissions per head are with 10 tons clearly higher than the average in the 41 European cities (Economist Intelligence Unit, 2011). This can be explained through industries which have settled in the city as well as with the industrial density of the federal state NRW (Siegemund, Köring, Schulz, & Hanes, 2013).

Table 5.1: Energy Table Cologne
Adapted from: Economist Intelligence Unit; IT NRW

<i>Category</i>	<i>Cologne</i>
Inhabitants	2014: 1 046 680 (IT NRW)
GDP	2011: 37 500 €
CO ₂ Emission per unit GDP	2007: 260 t
CO ₂ Emission per person	2007: 10.2 t
Percentage of renewable energy per head	2007: 3.93 %



Figure 5.2: Logo SCC
SReprinted from: Stadt Köln; RheinEnergie AG (n.d.)

5.2 Smart City Cologne

The SCC project was initiated by Cologne’s local energy provider and the municipality of Cologne. In 2011 the project officially started with three projects: refurbishment of old buildings in Cologne, Climate Street and an overall energy management of the municipality’s buildings (Interview Kahl 2016, p. 2). Within the RheinEnergie the initiative became a part of the corporate development (Kreitsch 2016, p. 3). In the municipality the project management is carried out by the “Koordinationsstelle Klimaschutz” (Coordination Unit for Climate Protection) (CUCP). This coordination unit was an action introduced in the “Integriertem Klimaschutzkonzept” (Integrated Concept of Climate Protection) for energy which was instructed by the municipality of Cologne in 2009 (Wuppertal Institut für Klima, Umwelt, Energie GmbH; Stadt Köln, 2011; Gertec Ingenieurgesellschaft; ifeu, Stadt Köln, 2012). The CUCP is responsible for the strategic management of the whole climate protection process in Cologne and serves as a meeting point for

the city administration and subsidiary companies. The task of the CUCP is to initiate, supervise and moderate climate protection (Gertec Ingenieurgesellschaft, Institut für Energie- und Umweltforschung, Stadt Köln, 2012). It is not authorised to issue, and is subordinated to the department V of “integration, social and environmental issues” (figure 5.3). The coordination unit has a cross-sectional orientation which means that they serve rather as a manager of the climate process and try to cooperate with other responsible departments.

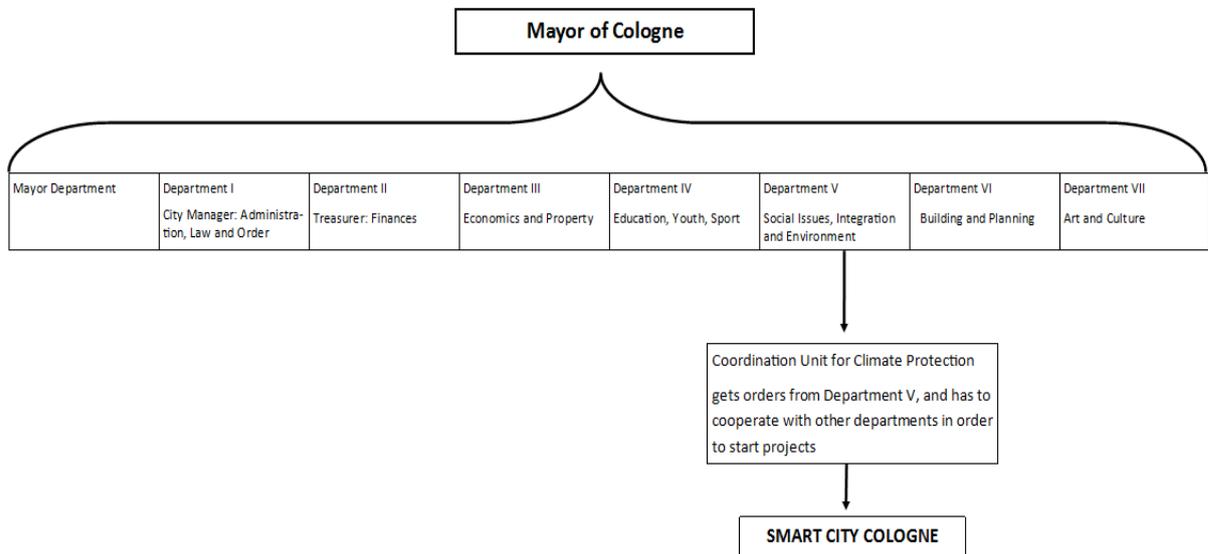


Figure 5.3: Hierarchy municipality Cologne
Adapted from: Paulic (2014)

SCC has a project structure (Interview Kahl 2016, p. 14) which means that there is a steering committee authorised to legitimise different projects and decisions. In this committee the mayor of Cologne, councillors of different departments, as well as the board of the RheinEnergie and the public transport company “Kölner Verkehrsbetriebe” (KVB) are present. They legitimise the decisions which have been made by the two parties of the project management group which is the municipality of Cologne on the one hand, and the RheinEnergie on the other hand. They both manage 50% of the project (figure 5.4). The two project management groups supervise different projects which are part of the initiative SCC. For these projects they realise projects with partners which support the project financially and through innovative ideas (Interview Kreitsch 2016, p. 10). Furthermore, there exists an advisory committee with different partners who can influence the project thematically, and work in exchange with the project management (Interview Kreitsch 2016, p. 12; Interview Kahl 2016, p. 12). The project has started with five main projects and now includes up to 30 projects (Interview Kreitsch 2016, p. 3).

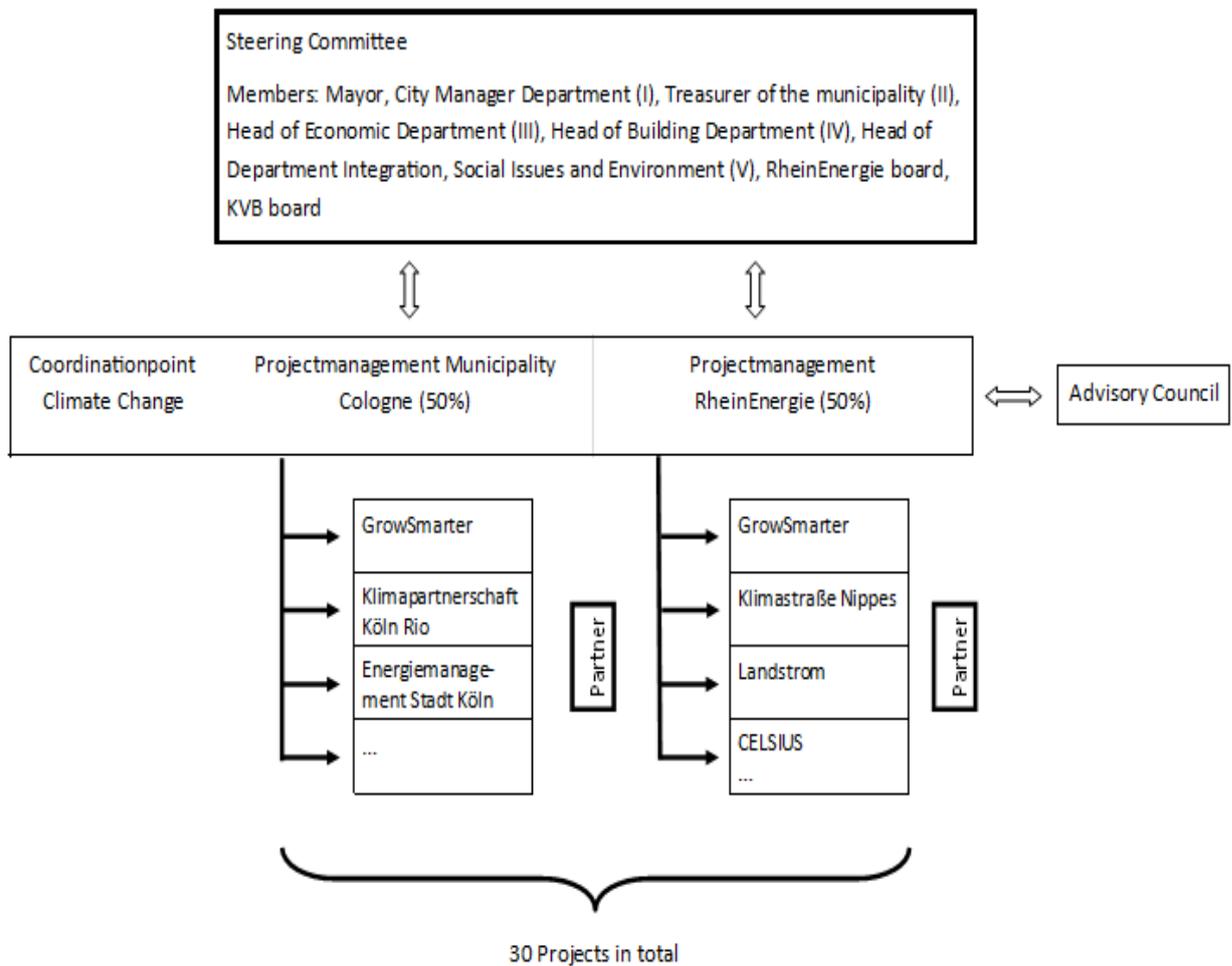


Figure 5.4: Structure SCC

5.2.1 Actors

Different Actors

The project SCC includes a lot of different actors which work together on different levels. There are the two founding partners, the municipality Cologne and its energy provider RheinEnergie. Kreitsch (Interview 2016, p.1), a representative of the CUCP points out that its task is to collaborate with different departments of the administration in order to empower them on a political level. Then there are different project partners. These can be seen as partners who come up with own ideas for the SCC project or participate in other ways in a project. According to Kreitsch there is a broad range of different partners. The types of economic partners range from start-ups to small and medium sized companies, creative economy, local companies and global players (Interview Kreitsch 2016, pp. 6-7). Next to economical actors associations, scientific actors, institutions, political actors as well as organizational actors are mentioned (Interview Kreitsch 2016, p. 23). Another important group of actors are the citizens of Cologne who have to know about the projects and support them. Here Kahl (Interview 2016, p. 5), a representative from the RheinEnergie, states that they are not involved sufficiently in the project yet.

Role of different Actors

The various actors have different tasks within the smart city project. Institutional actors support the network building in Cologne (Interview Kreitsch 2016, p. 13), academic actors are doing research on the projects or collaborate with the RheinEnergie in different projects like project-management or architecture projects. Through this the company tries to gain new interns (Interview Kahl 2016 p.

6). Important scientific partners are the “Technische Hochschule” (TH) and the University of Cologne. While the TH cooperates in several projects with the RheinEnergie, the University of Cologne could help with impartial certificates and reports in the future (Interview Groennerud 2016, p. 4; Interview Kahl 2016, p.6). Organisational actors are involved in projects which create awareness such as for special events (Interview Kreitsch 2016, p. 13). Among the economic actors especially local actors are of importance (Interview Kreitsch 2016, p. 4; Stadt Köln, 2016). They ensure that the project smart city is rooted within the area. However, also global players play an important role in the project as they usually have proven technology. This is especially important in the implementation phase of projects on a larger scale (Interview Kreitsch 2016, p. 16). The thought is that especially big companies advance the project (Interview Kahl 2016, p. 12). Nevertheless, the CUCP involves them without giving them a great amount of power in the project. For instance they refuse to let them design the smart city concept or do the marketing of smart city (Interview Kreitsch 2016, p. 13). Furthermore, Kreitsch (Interview 2016, p.14) and Groennerud (Interview 2016, p. 4), who is a representative of the University of Cologne, stress that it is important that the SCC project is not taken over by another big economic partner. The project has to be advanced through different big companies, however every project also has to add value to the city (Interview Kahl 2016, p. 12).

Motives

There are many different motives for partners to join the mentioned project. On the one hand, there is an economic interest, but on the other hand there is also a certain “corporate social responsibility” (Interview Kreitsch 2016, p. 12) among partners. Some companies want to sell their technology or want to improve their image by having the municipality as an official partner. This has advantages as it enables certain funding for instance (Interview Kreitsch 2016, p. 12). Others are motivated through the possibility to foster sustainability, because they see sustainability as a new business opportunity. Kahl (Interview 2016, p. 6) states that for many companies it is attractive to be one of the first to advance Cologne. The interview with den Heijer (Interview 2016, pp. 1-2), who represents the project partner “Immo Projektmanagement”, showed that he was especially interested in joining the project to advance the city, and to promote the smart city project in Cologne. He is therefore a representative of an entrepreneur with local responsibility. In his company sustainability is seen as an important value, and he influences energy transition through energy sufficient housing. He is aiming to create self-sufficient settlements. Therefore he is participating in different projects which support energy transition. The RheinEnergie states that their motivation was to try out new technologies within the frame of SCC. Kreitsch also assumes that the RheinEnergie has an interest in the project in order to find a new role in an energy sectors where the roles of big energy companies are rapidly changing (Interview Kreitsch 2016, p. 8). Also Groennerud (Interview 2016, p. 1) who stresses the laboratory character of a smart city project where certain technologies can be tried out in an urban context.

Requests and Projects

There are different preconditions for partners to join the project. Kreitsch (Interview 2016, pp. 9, 17) and Groennerud (Interview 2016, p. 6) point out that it is most important that the requests for smart city have a high quality and do support the thought behind SCC. They have to keep the project flexible for instance. Kahl (Interview 2016, p.10, 13) emphasises several times that for him it is of great importance that potential partners support the project in several ways if they want to be part of the thought behind smart city. This support can be for instance that the partner makes a good offer for smart city. The contribution to the project is always dependent on the kind of partner.

From a start-up there is less financial support requested than from a rather large company (Interview Kahl 2016, p. 12).

He also points out that there are different forms of collaborations in the smart city projects. On the one hand, there are projects which are initiated through SCC and therefore actively change something. Here Kahl (Interview 2016, p.2) names the project of Climate Street as an example. On the other hand, there are collaborations where a company itself comes up with a project which is then adapted through smart city. The SCC project does not have a direct influence on these projects, and they are usually managed by the municipality (Interview Kahl 2016, p. 6). Here, the municipality works in an advisory way and therefore influences the project rather indirectly (Interview Kreitsch 2016, p. 5). These projects aim for representing and promoting SCC. However, they do not influence energy transition in a direct way as they would have been done anyway by the company according to Kahl (Interview 2016, p. 6).

Collaboration between different Actors

According to Kahl (Interview 2016, p. 11) the communication between the RheinEnergie and CUCP works well. They communicate on a weekly basis. However, Kahl (Interview 2016, p. 8) claims that the communication with the different departments of the municipality could be improved because it causes delays for example when a project needs authorisation of a different department. This has also been mentioned by Kreitsch (Interview 2016, p. 14) who assumed that there is a lack of understanding in other departments on how different actors work together in the project. Here, certain tensions between governmental and industrial actors within their form of working become visible. Also den Heijer (Interview 2016, p.8) points that out by stating that there is a clear difference in the form of working between the governmental and the economic sector. In his opinion in the economic sector companies are forced to think result-oriented while the governmental sector does not have to. This also has the effect that parts of the governmental sector are rather conservative and close-minded when it comes to different ways of working and thinking. Projects are hindered and therefore he requests more willingness of change within the administration of Cologne (Interview den Heijer 2016, p. 6). The third interest group are scientific actors. Groennerud (Interview 2016, p. 5) stresses they usually have different views on the urban challenges in Cologne than the municipality has. This is due to the fact that the municipality has a broader view and has to take into consideration different urban challenges which may contradict the points of view of the scientists.

Improvements

Despite the fact that there are still challenges within the administration of Cologne small changes have already led to improvement for instance in the form of an architect who helps to approve buildings in energetic ways (Interview Kahl 2016, p. 9). The CUCP also tries to include people from other backgrounds in their team. Kreitsch (Interview 2016, p. 1) for example has a rather economic background. Also Groennerud (Interview 2016, p. 1) who represents scientific interests works as a consultant and sees things from a rather scientific perspective. The CUCP also stresses that there have been lessons learned so far which led to improvement, for instance that they sometimes need to act independently in order to bring things forward. Even though this may lead to tension within the administration the overall feedback is rather positive (Interview Kreitsch 2016, pp. 20-21).

Interests

The diversity of different partners may also lead to different interests within the projects. This can be seen in the collaboration of the municipality and the RheinEnergie. As Kahl (Interview 2016, p. 1) points out it is quite unusual that a traditional energy provider is included in such a project.

Within the project the RheinEnergie has a focus on projects concerning energy (Interview Kahl 2016, p. 6). Therefore, the important role of the RheinEnergie, as an energy provider, ensures the focus on energy transition within the project. Den Heijer (Interview 2016, p. 6) sees this as a clearly positive aspect that an important energy provider of Cologne is involved in the project and has started to think in a rather sustainable way. In the collaboration of the two founding partners the company RheinEnergie takes an economic interest whereas the CUCP takes a rather public interest. Kreitsch (Interview 2016, p. 14) points out that it is in some ways challenging to bring all these different interests together. However, the CUCP learned to openly discuss contradicting viewpoints with the RheinEnergie and in the end one of the parties pushes their interest through or in the ideal case a compromise can be found (Interview Kreitsch 2016, p. 19).

Next to economic and administrative viewpoints Kreitsch (Interview 2016, p. 13) points out that the inclusion of several organisational partners could be further improved. Some organisational actors have a rather bounded and isolated view on certain topics or their political orientation contradicts with the political government in Cologne. Here it is the task of the CUCP to find a compromise which is suitable for the whole citizenship of Cologne. Kreitsch as well as Groennerud (Interview 2016, p. 4) are of the opinion that it does not lack any sort of actor in the project as they say “wir haben eigentlich alles was man sich wünscht” (we have everything you can wish for) (Interview Kreitsch 2016, p.13). The challenging part is to bring those different interests together.

Citizens

Another group of actors which is supposed to be better involved in the project are the citizens of Cologne. Even though every citizen has the opportunity to suggest his or her ideas to the SCC project this has not happened so far (Interview Kreitsch 2016, p. 11). According to Kahl (Interview 2016, p. 1) it is the task of the municipality to support the communication with the citizens. Kreitsch (Interview 2016, p. 13) also mentions that they try to involve the citizens more by creating awareness, through painting competitions, events and other activities. By doing so the municipality wants to support the bottom-up thought of the project. In a way Kreitsch (Interview 2016, p. 12) already sees the bottom-up approach in the project through different local companies who actively involve themselves in the project. Also in the Climate Street project, Kahl (Interview 2016, p. 7) as the project manager tries to create awareness through making it “visible”. Through information points and posters they are trying to raise awareness for the project (Interview Kahl 2016, p. 15).

Actors in Energy Projects

Even though the founding actor RheinEnergie plays an important role in those projects, the municipality is not that visible among those projects (appendix C2). The interviews have shown that RheinEnergie has a clear focus on energy and support projects in a financial way, and therefore explains the present focus among energy projects (Interview Kahl 2016, pp. 6-7). The municipality compared to this has few financial resources and has a broader perspective on the smart city project (Interview Kreitsch 2016, p. 8).

Furthermore the private sector is very dominant among the actors in energy projects. Here, the statement of Kreitsch (Interview 2016, p. 4) who emphasises the involvement of local businesses in smart city project is stressed. It shows that there is a lot of corporate social responsibility among businesses in Cologne concerning energy transition. The German Green City index has shown that Cologne’s industry causes a great share of the CO₂ emissions (Economist Intelligence Unit, 2011). This makes the economy and especially industrial partners important players in the reduction of the CO₂ emissions in Cologne.

Even though different organisations from the society were mentioned as partners such as Bürgerverein Nippes for the energy project Climate Street (Interview Kahl 2016, p. 16), they are not listed as an official partner on their website. This implicates that they do not play a major role in the majority of energy projects (appendix C2). Even though SCC is trying to increasingly involve citizens and wants to shift from a top-down structure towards a bottom-up structure, there are no bottom-up projects concerning energy transition noticeable (Interview Kreitsch 2016, p. 12; annex C2). Also the interviews have shown that even though the citizen is seen as an important partner in smart city projects, there is not enough awareness yet (Interview Kahl 2016, p. 5).

Among the projects there is an emphasis in bilateral projects, such as sustainable, public and economic buildings (e.g. Kita Finkenbergring, TÜV Rheinland Zentrale). In these projects there are often only two actors involved and citizens are not included at all. In other projects like sustainable housing projects such as "Sürther Feld" citizens get the opportunity to contribute to energy efficiency and energy supply through their choice of housing. However, citizens are not included in the planning process of the projects they rather get technological offers from the RheinEnergie and therefore they play a rather indirect role in those projects. In the housing project GrowSmarter there are attempts made to further involve citizens through a consultation hour from the municipality which is held in the settlement (Interview Kreitsch 2016, p.11). In the energy project Climate Street citizens are included through an annual "Klimastraßenfest" (Climate street festival) (Observation Climate Street, 14th June; appendix B2). Especially when it comes to the refurbishment of old buildings, the citizens are asked to actively participate. Here, the RheinEnergie offers consultancy hours (Stadt Köln; RheinEnergie, n.d.).

The RheinEnergie as the traditional energy provider in Cologne and project founder of SCC, has a great emphasis on energy in the smart city project. The company is producing parts of its energy themselves, and are furthermore active as an energy seller. RheinEnergie is not the local energy grid provider any more, this part belongs to the subsidiary company Rheinische NETZGesellschaft mbH (RheinEnergie, n.d.). The grid provider is independent from the energy sellers and suppliers. Therefore it is a rather neutral instance in the energy market. However the grid provider does not play any role in the smart city project. It is striking that apart from the RheinEnergie there is no other company from the energy sector involved in the project. Kreitsch (Interview 2016, p. 6) claims that the changing role of energy providers in times of energy transition could be a factor which motivated the RheinEnergie to take part in this project.

5.2.2 Rules

New Projects

To become a partner of SCC a company, organization or other potential actor, has to have an idea for a smart city project. The idea first is sent to the CUCP of the municipality Cologne which decides if the idea is led further to the responsible department of the city administration. If that is the case the CUCP meets with the responsible department as well as the party which brings in the idea and discusses how a project can be implemented. Sometimes it is possible to agree on a strategy right away, in other cases further conversation via telephone or mail is necessary. If everyone agreed on a strategy it is finally necessary that the project and the project partner get its formal legitimisation from the steering committee (Interview Kreitsch 2016, p. 9-11). The RheinEnergie also gets requests from start-ups for projects they want to include in the smart city project, or the council requests a new smart city project (Interview Kahl 2016, p. 10).

Vertical vs. horizontal

The different working strategies of the public and private sector got obvious throughout the interviews. As the administration is forced to work in a rather vertical way, with strict steps of hierarchy, the RheinEnergie has the possibility to work in a horizontal way (Interview Kahl 2016, p.8). Even though the CUCP was introduced in order to encourage the horizontal way of working within the climate change process of the city (Interview Kreitsch 2016, p. 1), Kahl (Interview 2016, p. 8) still claims that the municipality is too hierarchic, and that there is still not enough cross oriented, problem-oriented thinking.

Formal/Informal Rules

Usually the communication works in a rather informal way. In most projects there are no contracts made and collaborations are often based on oral agreements. In the projects of the RheinEnergie some contracts are signed, however these contracts do not directly concern the SCC projects but rather certain measures which are made within the project. These contracts are made between the RheinEnergie and the different partners of the project. Another case are EU projects like GrowSmarter. For this project the leading parties as well as all partners of the project signed a contract. Den Heijer (Interview 2016, p. 7) sees the absence of a contract as a rather negative aspect. He states that this shows that there are no binding commitments the municipality agrees on. That he describes as “unbewusst strategisch” (unintentional strategic) (Interview den Heijer 2016, p.7).

All the respondents stress that there are no formal rules within the smart city project. Kreitsch (Interview 2016, p.19) mentions that this makes the collaboration sometimes difficult for example that flows of information are sometimes problematic. The municipality tries to deal with this by being a good example through working in a transparent way and communicating good and bad behaviour. Den Heijer (Interview 2016, p. 7) sees this as the next step of the project to develop a letter of intent which explains how different parties work together within the project.

Power Relations

Within the project the power relations become quite obvious in the project hierarchy (figure 5.4). Kahl (Interview 2016, p. 12) points out that there are no other parties which can actively influence the project for example through different resources. This is because every agreement is made in cooperation with the project manager of the RheinEnergie and collaboration is not discussed on a round table. According to Kahl (Interview 2016, p. 12) the only way to exercise power is through the advisory council of SCC where different partners are included. The power of the municipality is often stressed through the power of authorisation they have within the project (Interview den Heijer 2016, p. 7; Interview Kahl 2016, p. 8, 15; Interview Kreitsch 2016, p. 15). Den Heijer (Interview 2016, p. 1) points out that the decisional power is not always comprehensible to him as it is embedded within the structure of the administration in Cologne. Here it can be seen that the two founding actors remain to have a great amount of power. This has a positive effect on energy transition on the one hand, because the energy provider remains focussed on it, however it can also, on the other hand, hinder innovation through the collaboration and exchange of different actors.

Role of the municipality

Even though money plays a great role in power relations within the project (Interview den Heijer 2016, p. 4; Interview Groennerud 2016, p. 4), the most powerful actor seems to be the municipality of Cologne despite its few financial resources: “Alles steht und fällt mit der Verwaltung” (everything depends on the administration” (Interview Kreitsch 2016, p.15). The municipality decides about projects and the interviews have shown that this has already influenced projects, as some ideas

were not legitimised or the authorisation took too long (den Heijer 2016, p. 6; Interview Kahl 2016, pp. 8, 15). Here, Kahl names several examples like pedelec stations, photovoltaic and transformation stations for ships. The majority of those examples have a direct influence on energy transition (appendix C2). This shows that, the hierarchic structures and rules within the project have the power to complicate certain energy projects. Furthermore Kahl (Interview 2016, p. 5) points out that the RheinEnergie wishes for more active cooperation of the city and that the smart city thought is also included into the city development in Cologne for example through supporting photovoltaic in new construction areas. This shows that the smart city thought has not arrived in all areas of the municipality sufficiently (Interview Kreitsch 2016, p. 14). However the past years have shown that the CUCP managed to spread the smart city thought among the other departments so that nowadays different departments in the administration bring in own smart city ideas (Interview Kreitsch 2016, p. 5).

Laws and Restrictions

The project is influenced on many levels by governmental decisions, rules and regulations. In the following some rules and restrictions are going to be named which have been mentioned in several interviews and are relevant for this topic. On the federal state level den Heijer (Interview 2016, p. 3) points out that especially in NRW there are a lot of possibilities for financial support in projects dealing for instance with sustainable housing especially in the area of social housing. Furthermore, Groennerud (Interview 2016, p. 8) emphasises that in the future regional ways of substitutions should be preferred as especially European projects require a great bureaucratic effort. NRW is also the first federal state which developed a law for climate protection (NRW, 2013). However Kreitsch (Interview 2016, p. 2) points out that this does not set clear regulations as known in other environmental areas as for example in air pollution and therefore does not directly influence energy transition. However, the environmental legislation has increased a lot within the last years and aims at making climate protection a compulsory matter everyone has to get involved with (Interview Kreitsch 2016, p. 3).

Kahl (Interview 2016, p. 4) points out that in order to make a city 100% sustainable and self-sufficient regulations and changes on a national level are necessary because a city is always dependent on external energy supplies. Furthermore, there is the European level which influences the project through CO₂ aims. In addition to that, it influences the project through different substitutions and bringing in certain projects like GrowSmarter or CELSIUS (GrowSmarter, n.d.; Celsius, Smart Cities, n.d.).

All in all, it can be concluded that the hierarchic structures within the project, but also rules from higher levels such as legislation influence the energy contribution in the project.

5.2.3 Resources

Financial Resources

In all interviews it was striking that especially the municipality only has few financial resources for the project (Interview den Heijer 2016, p. 4; Interview Groennerud 2016, p. 3; Interview Kreitsch 2016, p. 18; Interview Kahl 2016, p. 3). The only resources they have within the CUCP are salaries and therefore the city can mainly bring manpower into the project (Interview Kreitsch 2016, p. 18). Kreitsch (Interview 2016, p. 8) claims that there is too little money for those activities which should be pursued. Therefore, the CUCP is working on new financing strategies for smart city projects (Interview Kreitsch 2016, pp. 1, 7-8). The municipality is not willing to assume any financial risk in the project and therefore is dependent on companies who are willing to do so (Interview Kahl 2016, p. 4; Interview den Heijer 2016, p. 5). Den Heijer (Interview 2016, p. 5) also notices the absence of

financial resources within the project. His project is not supported financially in any way. Kreitsch also sees that as something which should be improved and points out that they want to achieve a lot of changes so they have to be willing to pay for those (Interview Kreitsch 2016, p. 21). Here, Groennerud (Interview 2016, p. 3) emphasises that the few financial resources are mainly due to the low city budget of the municipality. However, in the past years the CUCP has still been prioritised, which can be seen in the increase of city officials within the CUCP from one to four people (Interview Groennerud 2016, p. 3). In order to grant the project more financial resources, it can be assumed that the project has to receive more political support.

Compared to this RheinEnergie is directly financing certain projects and has a budget of two million Euros for the project Climate Street (Interview Kahl 2016, p. 11). The different views on giving financial contribution to smart city projects lead to challenges in the collaboration of the two founding partners. Kahl (Interview 2016, p. 7) points out that the impression is created as if the municipality shifts projects which require financial investments to RheinEnergie. RheinEnergie invests predominantly in energy projects, which has been clearly communicated to the municipality. Through financial involvement of RheinEnergie in energy projects a certain focus is set which has been seen in the evaluation of energy projects (appendix C2).

Another way of financing the projects is through funding as for example by the EU. Here the project GrowSmarter can be named which is financed partly through the EU (Interview Kahl 2016, p.14). Kreitsch (Interview 2016, p. 20) also mentions that it is important for the project to better inform the economic sector about the financial opportunities within these projects. Here, he also points out that the knowledge differs a lot among different actors and therefore everyone should have the same opportunity to benefit from these ways of financing (Interview Kreitsch 2016, p. 20). For those financial possibilities the project partner Immo-Projektmanagement can be seen as a good example. Den Heijer (Interview 2016, pp. 3-4) states that there is a lot of potential in energy efficient social housing as it is substituted by the federal state. There are also several ways to obtain loans which are substituted for energy sufficient housing. He also stresses that those possibilities have a great potential for energy projects as an unlimited amount of those projects can be implemented as long as the properties are available. Therefore, there is a lot of potential in energy projects and energy transition if those financing programmes are further supported. Furthermore, those ways of financing are an opportunity to overcome problems of financing in the municipality. Groennerud (Interview 2016, p. 8) underlines that it might be better to focus on local or federal financing projects instead of European as European projects usually require a lot of bureaucracy throughout the project.

Ideational resources

Kreitsch (Interview 2016, p. 16) mentions political support as an important resource for SCC. This can be connected to the earlier mentioned power of the municipality. If there is no political support projects are not legitimised and financially supported by the government. He thinks that it is of importance that there is a concept which is well understood and accepted by different departments of the administration and leads to a flow of information (Interview Kreitsch 2016, p.20). Indirect authorisation can be seen as another important resource. Several examples have shown that the authorisation process complicates some projects (Interview Kahl 2016, p. 8; Interview den Heijer 2016, p. 2).

Furthermore, Kreitsch (Interview 2016, p.16) mentions different partners of the project. Here, he again stresses the importance of local actors in Cologne. He also mentions broad citizen participation as a resource which is of great importance for the smart city project in Cologne. This

is also an important point for Kahl as he names the human who have to advance the project (Interview Kahl 2016, p.11). Kreitsch (Interview 2016, p.11) as well as Kahl (Interview 2016, p. 5) see this as a problem and Kreitsch points out that the CUCP aims to support the participation in several ways, for instance through the use of social media.

Den Heijer (Interview 2016, p. 6) points out that in the first place, the project lacks ideational resources. For instance, he mentions ideas as one of the most important resources for a smart city project. He misses the platform thought in smart city through which ideas can be exchanged which he thinks is a central part of a smart city project as well as the urge of change within the municipality. Because of the lack of ideational and financial resources he claims that he has hardly any benefits from joining the smart city project (Interview den Heijer 2016, p. 4). The interviews and the observation of energy projects within smart city have shown that there are many projects in which only a few actors, mostly from the business sector actively participate (appendix C2). This shows that the exchange of ideas and knowledge is not prioritised in most of the energy projects.

In order to improve the exchange of scientific resources like knowledge the CUCP plans to develop a “think tank” of different scientific actors which are involved in the process of climate protection in Cologne. In such a “think tank” all actors can come together and discuss their interests (Interview Groennerud 2016, p. 1-2).

Furthermore, den Heijer (Interview 2016, p. 5) claims that companies need to have a personal ambition in order to do something special like joining a smart city project. This has also been pointed out by Kreitsch (Interview 2016, p. 12) who states that many companies which get involved have a certain “corporate social responsibility”. However, den Heijer gives a good example by saying that the social responsibility can often be combined with an ecological, environmental responsibility. This stresses the resource of open-minded partners which has also been mentioned by Kreitsch (Interview 2016, p.16).

5.2.4 Concept

Kreitsch (Interview 2016, p. 4) underlines a rather vague concept of SCC and states that the project is rather seen as a process. He claims that the underlying conception is less a concept than a strategy (Interview Kreitsch 2016, p. 4). The interview has shown that this strategy is adapted in two different phases. First the project aimed to bundle and connect different actors. In that phase they aimed at spreading the image of Cologne as a city which reacts to climate change by using smart city innovations. In a second phase they wanted to implement those projects on a larger scale (Interview Kreitsch 2016, p. 7). The ability of scaling up is often seen as an important point which shows the success of a project and has a great influence on energy transition (Manville, et al., 2014).

Motivation for the Project

Kahl (Interview 2016, p. 2) stresses that RheinEnergie’s main motivation to start the project was to support a holistic development of the city and by doing this appear smarter and more intelligent for the citizens. The energy provider sees the project from a rather economic point of view and tries to promote energy efficiency through the project. Marketing was also a motive for participating in the project as the company wants to show its customers what is possible in the energy sector through different smart city projects.

Another motivation for joining the project was that RheinEnergie wanted to urge the need for CO₂ reduction. Kahl (Interview 2016, p. 3) says that although the targets for CO₂ reduction became stricter on a political basis they still felt the urge to forward this process in the municipality of Cologne. Kreitsch (Interview 2016, p. 1) states that climate protection has been constantly improving on a political and administrative level. This point was not really obvious according to

Kahl (Interview 2016, p. 3). This fact shows that the advancing energy transition was an important motivation to start the smart city project. The need for change concerning climate protection is also shown by the integrated climate concept of the municipality, which was requested in 2009 (Gertec Ingenieurgesellschaft, Institut für Energie- und Umweltforschung, Stadt Köln, 2012). However, it has also been mentioned that the measures listed in the climate concept were too many to be legitimised through the council. Therefore, there were ten measures prioritised which could be implemented. This emphasises the point of Kahl (Interview 2016, p. 3) that climate protection in Cologne has been rather difficult and not very successful. Thus, the aspect of climate change and CO₂ reduction has been clearly a driving force for the SCC project.

The SCC project became part of the integrated climate concept of 2013 in which it is listed as one of the measures in Cologne which aims for a sustainable future in Cologne (Stadt Köln, 2014). To improve this smart city is supposed to bring new impulses into the administration of Cologne where the CUCP serves as an interface between the governmental level and other actors of the projects. Here, the CUCP stresses the ecological aspects and tries to bring them together with economic and social aspects (figure 5.5) (Stadt Köln, 2014; Interview Kreitsch 2016, p.7).

Den Heijer defines the concept and underlying idea of the concept as “wir müssen etwas tun” (we have to do something) (Interview den Heijer 2016, p.2) for the environment. In his eyes the project shows that the initiators adopt to contemporary social and political topics and strategies.

Focusses

While RheinEnergie has a clear focus on energy within the smart city project, CUCP has a broader view on the vision of SCC. The CUCP adds to the two aspects of economy and ecology a social aspect (figure 5.5) (Interview Kreitsch 2016, p. 7). Den Heijer (Interview 2016, p. 2) also emphasises the social aspect of smart city by claiming that there is a lot of potential concerning social housing in the low energy sector.



Figure 5.5: Areas SCC
Reprinted from: Stadt Köln (2016)

Social housing can also be seen in the project GrowSmarter in which a workers’ settlement is renovated. Here the focus of including everyone in the smart city project becomes apparent again. Therefore the project is also described as a “blueprint” for a sustainable urban development (Stadt Köln; RheinEnergie, n.d.). However, it is striking that the inhabitants of the settlement are not really aware of the project and complain about the project related changes (Observation GrowSmarter, 14 June, 2016; Schäfer, 2015; appendix B1).

The CUCP defines the topic area of smart city as broader in terms creating climate protection for everyone and in all areas of living. Therefore they defined different topic areas in which SCC is active in form of projects or through coordination. These are: Human/Education, Buildings and Living, Energy, Mobility, Economy, Environment and Health (figure 5.6) (Interview Kreitsch 2016, p. 9). Within Cologne’s administration there are different strategies like a mobility or sustainability strategy. Here the project’s task is not to choose a superior strategy over the other strategies but rather seeing the smart city aspects in all of these different strategies in order to connect them (Interview Kreitsch 2016, p. 9). Groennerud (Interview 2016, p. 7) points out that the project is very broad intentionally in order to make sure that nobody and no ideas are left out in the project.

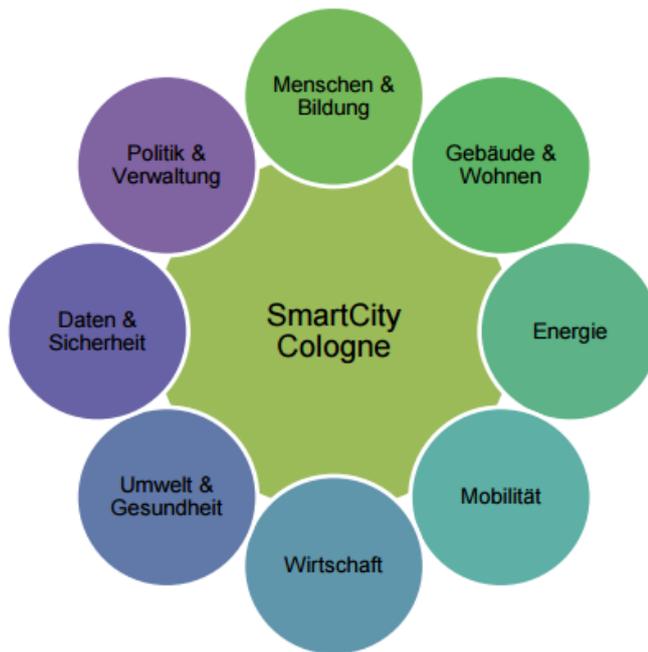


Figure 5.6: Theme Fields SCC
Reprinted from: Stadt Köln (2016)

Vision

One of the visions in SCC according to Kahl (Interview 2016, p. 4) was to raise awareness among companies. The CUCP aims to strengthen the local economy with that project (Interview Kreitsch 2016, p. 4). This is done through including different companies in the project and by supporting the local economy of Cologne as well as its diversity (Interview Kreitsch 2016, p. 7). This makes SCC a platform where different actors are involved. For Kahl (Interview 2016, p. 4) SCC is primarily a platform, which includes different projects. Groennerud (Interview 2016, p. 3) defines the project rather as a forum where citizens, as well as entrepreneurs can contribute ideas for the urban development of Cologne. He says that the platform SCC especially focusses on climate protection, energy transition and citizen participation. Here, it can be seen that for him energy transition is a central part in the vision of SCC (Interview Groennerud 2016, p. 1). Kreitsch (Interview 2016, p. 4) stresses SCC as a vision in itself. This has been formulated in the beginning of the project and introduces Cologne as a city which includes citizen while becoming energy-conscious (Interview Kahl 2016, p. 4). Within that vision as well as in the motto of the project “zusammen Energiewende umsetzen” (implementing energy transition together) (Stadt Köln, 2014) the stress on energy transition becomes obvious.

Cologne has signed the covenant of mayors and therefore committed itself to ambitious energy targets by using an integrated approach (Covenant of Mayors, n.d.). In the beginning of the project targets were introduced which were based on the national energy targets. However, those targets have not been adjusted throughout time (Interview Kahl 2016, p. 4). This shows that despite the municipality's claims to have energy ambitions those are not fully adopted and applied in the smart city project. Nonetheless, Kreitsch (Interview 2016, p. 21) points out that they aim to have measurable visions and targets for the future, which clearly show the effect of smart city. The administration requests a clearer description of smart city. So clearer visions and targets can help to raise political awareness within the political level of Cologne (Interview Kreitsch 2016, p. 17, 21).

The messages Cologne wants to support with the project have been written down (2014). Those are:

- "SCC ist eine Initiative für die Menschen" (SCC is an initiative for the people)
- "SCC sucht die Innovation und geht neue Wege" (SCC searches for innovation and new pathways)
- "SCC nutzt allen Akteuren in der Stadt" (SCC is useful for all actors in the city)
- "SCC lebt von der Vernetzung und dem Austausch" (SCC lives off networking and exchange)
- "SCC hat zwei Impulsgeber" (SCC has two initiators) (Stadt Köln; RheinEnergie , 2014)

It is striking that those messages are quite broad. Even though most of the aspects have appeared in the interviews, some parts are rather new. Especially the point concerning network and information exchange seems to be hampered through bilateral projects and bilateral communication among the partners.

Awareness

Both founding partners of the project stress the inclusion of citizens in the project. However, even though the project gets a lot positive attention through the lighthouse project GrowSmarter (Interview Kreitsch 2016, p. 3) the project lacks awareness from the inside. This was further emphasised through the observations of the GrowSmarter project (14th June, 2016; appendix B1). However, the observations have also shown that there are attempts to gain attention for the project (figure 5.7, 5.8; Observation GrowSmarter Climate Street, 14th June, 2016). Also Kahl (Interview 2016, p. 15) sees the problem that citizens do not know sufficiently about the project. According to him SCC is not known well enough within Cologne and therefore has not evolved from a logo to a label yet. The CUCP aims to promote smart city as something which can be experienced. They try to visualise the complex and theoretical term through splitting it up into different parts which aim to make it visible for citizens (Interview Kreitsch 2016, p. 22). For den Heijer (Interview 2016, p. 6) the most important aspect within a smart city project is to create awareness on different levels. He criticises that the project should be handled in a rather compelling way in order to create this awareness especially among different departments in the municipality. For him a project like smart city is indispensable in supporting energy transition and other environmental topics in the administration. Here he speaks from a rather social point of view and objects to the earlier sayings of Kahl (Interview 2016, p. 5). He states that from an administrative point of view it is currently not possible to create energy transition on a municipal level as a city always has to import energy. This can be seen as a good example showing the different angles the project SCC can be regarded and analysed.



Figure 5.7: Poster GrowSmarter Consultancy Hour



Figure 5.8: Poster Climate Street

Energy Transition

The evaluation of energy projects has shown that the majority of these projects concern intelligent use or energy efficiency. Furthermore, there are several projects concerning energy supply in the city. There are projects including mobility in all forms like sustainable shipping, encouraging cycling in the city and stressing e-mobility. There are only few projects concerning energy storage among the projects in Cologne. The evaluation highlighted especially the energy project GrowSmarter in which all of the different areas of energy transition are included (appendix C2).

The majority of projects is implemented on a small scale. Nonetheless, projects such as “Kita Finkenbergr” have inspired other entrepreneurs to create buildings which contribute to energy efficiency as well as energy supply (Interview Kreitsch 2016, p. 21; Observation SCC Conference 20 June 2016; appendix B3). Furthermore, the EU project GrowSmarter can be seen as an example of a project which has been implemented on a larger scale (Interview Kreitsch 2016, p. 7; Observation GrowSmarter, 14th June; appendix B1). Additionally, there are other EU projects like “CELSIUS” which aims at implementing new technologies in the heating systems of big buildings and therefore provides new forms of energy supply (Stadt Köln; RheinEnergie AG, 2016; Wagner, 2013; Celsius, Smart Cities, n.d.). Here energy is mainly gained from urban sewage (Celsius, Smart Cities, n.d.). In those EU projects Cologne cooperates as a lighthouse-city with other cities and partners on an international basis (GrowSmarter, n.d.; Celsius, Smart Cities, n.d.). Despite the numerous projects concerning energy supply Kahl (Interview 2016, p. 5) states that it is not possible to make a city self-sufficient on a municipal level, as a city cannot manage their whole energy supply.

Throughout the evaluation as well as in the interviews it became obvious that RheinEnergie has a focus on energy transition. However, Kahl (Interview 2016, p. 4) states that for the RheinEnergie energy transition has a rather indirect role in the smart city concept. Kahl (Interview 2016, p. 4) emphasises that the energy provider has already invested in renewable energies before, irrespective of the smart city project. However, Kahl (Interview 2016, p. 2) also points out that RheinEnergie uses smart city as a platform to show and bundle modern technologies it has developed.

Although Kahl (Interview 2016, p.5) states that energy transition rather plays an indirect role in the project, the municipality promotes energy transition as a central element of the project through formulating the motto of SCC (Stadt Köln, 2014).

Strengths and Weaknesses

Throughout the research it became clear that the broad concept of SCC has its strengths and weaknesses. On the one hand, the CUCP stresses that the broad focus keeps the project flexible and not bound to a clear concept or system (Interview Kreitsch 2016, p. 17). It allows Cologne to find its own way of becoming a smart city and promotes the open and rooted values of the city. The project tries to emphasise this by including local companies and trying to find an authentic way of implementing the project SCC. Groennerud (Interview 2016, pp. 7-8) also stresses the broad conception has the advantage of having a flexible working structure and therefore includes all kinds of ideas and projects.

On the other hand, the past years have shown that there is an increasing number of requests for a definition of the term smart city in the context of the project SCC (Interview Kreitsch 2016, p. 17). Kahl (Interview 2016, p. 9) also criticises the vague concept behind SCC and that the project does not have a goal for the next ten years. For him this is an obstacle because project partners do not know what is behind smart city. RheinEnergie wishes for the municipality to include the smart city thought more actively within the city planning of Cologne. To get a rather unified view of the topic smart city and to let the smart city thought spread in the administration, the CUCP develops a short paper which represents the thoughts of smart city (Interview Kreitsch 2016, p. 17).

5.3 Sub Conclusion Cologne

Role of Energy Transition

The challenge of energy transition has been an important motivation to start the SCC project. Therefore, the project has a direct focus on energy transition which can be seen in the motto of the project as well as in the involved projects. Next to the municipality, the second founding partner is the energy provider RheinEnergie. While the municipality has a rather broad focus within the smart city project, the RheinEnergie stresses the energy focus of the project. The company supports the projects financially and is committed to them as a project partner. Also the municipality focusses on the aspect of energy transition, however, as they have to have a broader focus other factors like economic, ecological and social factors are included. The reason for this is that they have to advance the whole city with its citizens in the first place. Nevertheless, the case study has shown that the project smart city could sometimes be prioritised in the different departments.

Visions/Goals and Energy Transition

Within the conception of SCC energy transition is often mentioned as a direct goal. The case study has also shown that SCC does not have any clear targets concerning energy transition. Even though the city signed the covenant of mayors where certain energy targets are regulated, SCC Cologne does not have any own targets concerning energy transition. The project has oriented itself on national/international goals in the past, but has not adjusted them.

The case study has shown that the overall vision of smart city as well as the motto (implement energy transition together) are linked to energy transition. However, it has been shown that clear targets and visions are missed by different actors within the project. It has been stated that within Cologne's administration it is requested to have clearer visions concerning the SCC project. In the project, political as well as administrative support plays a great role and therefore targets can help to gain this support. A clear vision could also help to spread the smart city thought in the administration and help to gain awareness from inside and outside the municipality. However, clear visions also have the effect that they restrict the project and exclude certain projects.

Important Factors which Influence Energy Transition

One important factor which has often been mentioned is the rigid administration within Cologne. A lot of projects have to be legitimised by the administration and the municipality has a majority within the steering committee. Therefore, it is an important actor for the SCC project. Here certain interviews have shown that the smart city thought has not yet fully arrived the municipality, and that the view of the municipality is sometimes contradicting with the opinion of rather economically oriented actors. Especially energy projects require approvals from the administration. It has often been complained that the municipality has complicated energy projects. This stresses the importance that the smart city thought has to be present in the whole administration in order to create an integrated approach within the energy sector.

Furthermore, there are only few financial resources for energy projects from the municipality. Even though the past years have shown that the project has gained importance which is reflected through the increase of salaries which is linked to the responsible CUCP; there are, however, still very few financial resources of the municipality to invest into smart city projects. However, the research has shown that RheinEnergie is giving financial contribution to several energy projects. In addition, there are several ways to get regional subsidies for projects including energy transition. Therefore, the aim of the CUCP to spread knowledge of those financial instruments is a valuable tool to support new projects which contribute to energy transition.

Another factor which had an influence on energy transition in the project are ideas and open partners who want to advance the city. Here, it is obvious that there is a great range of different actors which are involved in the smart city project. However, it became clear that there are many bilateral projects in which the initiators did not have a great advantage through the smart city project, and would have been done without SCC. Furthermore, there are very few projects which directly involve citizens. As the roles within the energy sector, and citizens have to advance the projects, further involvement of citizens would be important. Those points are supported by the fact that there is no direct exchange of ideas within the project yet. However, this is going to be improved through a think-tank which is planned.

Projects which Contribute to Energy Transition

Throughout the energy projects bilateral projects are very present. Those projects are usually initiated by the big companies and SCC cannot be seen as the main motivation for the projects. A lot of those projects have only been initiated through large companies and very few projects directly address citizens. There has been no project where a clear bottom-up structure was noticeable.

Furthermore, the case study has shown that there are a lot of projects which influence energy efficiency in different forms. There are also several projects which aim for energy supply. Here unusual and innovative forms of energy supply have been shown in the energy supply project "CELSIUS" where sewage is used as an energy source.

Many projects are implemented on a rather small scale and only few projects like GrowSmarter have been implemented on a larger scale, or have already been replicated.

6. Conclusion

After the two cases have been analysed separately in the following and concluding part the findings of the two projects are going to be compared. First some sub-conclusions are going to be drawn based on the sub-questions and in a main conclusion an overall résumé of this research will be provided. Furthermore, recommendations for further research will be given.

6.1 Sub-Conclusion

6.1.1 Role of Energy Transition

Both projects claim to have a rather broad approach in their smart city concept. Amsterdam as well as Cologne developed different topic areas on which the smart city projects focus. The investigation has shown that in Amsterdam those topics reflect the range of different projects whereas the project in Cologne has a clear focus on energy projects. ASC has a very broad thematic focus and aims to improve the quality of life in Amsterdam. SCC is thematically rather bound to energy projects. This is mainly due to the presence and importance of the energy provider RheinEnergie in the smart city project. In Amsterdam the project founders come from different sectors and therefore they support several aspects. Even though ASC has no direct focus on energy transition the research has shown that energy transition is seen as an important societal goal and plays an important role for future ambitions. Despite the broad thematic perspective of ASC the project seems to have a clear focus on their form of working, and projects they add to the programme. Especially the focus on scaling within the program has a high influence on energy projects. In Cologne there is no clear focus concerning the organisation of the project, which leads to a broad range of project types.

While Cologne has a more direct focus on energy transition within their project, Amsterdam in contrast has a rather indirect focus on the topic.

6.1.2 Vision/Goals and Energy Transition

Neither the project ASC nor SCC have own visions and goals concerning energy transition. They support the energy targets set by the municipality. Amsterdam and Cologne signed the covenant of mayor and therefore are committed to ambitious energy targets through an integrated approach. However, in both cities the smart city concept is only a part of the municipality's climate protection programme. Therefore, the smart city projects are seen as a tool to reach those targets. Nonetheless, it became obvious that there are different stresses on energy transition within the administration of both. While the municipality Amsterdam manages to create a sustainable framework (Sustainable Amsterdam) for the projects and supports certain projects deregulating at several points. It also takes own actions considering regulations in the energy sector. In Cologne a common understanding and ambition for energy transition is missing in the departments.

Both projects have formulated a vision for the project. Especially in Amsterdam, this vision is thematically very broad, however has an emphasis on the working structure within ASC. In Cologne the vision is thematically more focussed on energy transition. However, the project does not have a clear outline concerning the organisational aspects. Within this context visions can help to distinguish smart city projects from other projects, but they could also exclude important projects for energy transition like several bilateral projects.

Several interviews have shown that some sort of clear visions and targets are missing in both cases. However, it has been striking that visions and goals are requested for different reasons. In Amsterdam it has been stressed that it is important to align some sort of focus through clear visions

in the future in order to prevent a loss of focus. Compared to this in Cologne visions and goals are seen as an important tool to show the success of a project and to gain attention from the municipality as well as the population of Cologne. Goals and visions also give the project a clear structure and help to align focus.

Even though there is a lack of visions and goals in the main projects ASC and SCC have clear targets or are aiming to make the use of energy more transparent. ASC has shown that especially energy projects with a lot of partners are likely to lose focus which may have a negative effect on their contribution to energy transition. Here, goals and visions can help to create a clear framework the partners agree on.

All in all, it can be said that goals and visions are an important tool for the contribution to energy transition. They are a tool which creates awareness for projects and gives implications about the success of a project. Therefore, they motivate people and enable them to unify and focus their forces.

6.1.3 Important Factors which Contribute to Energy Transition

The analysis has shown that there are many aspects which influence energy transition in an urban context as well as on higher scales. In the following part those aspects are going to be discussed.

Both projects benefit from a great range of actors. Nonetheless, in Cologne energy projects are mainly initiated by the economic sector. It has been observed that the smart city project does not always add value to energy projects. Some of those projects are initiated by only one company. Those projects have a limited influence on energy transition as those projects would probably have been done anyway by the initiators. The Amsterdam way differs in their approach to the one of Cologne. Through a clear emphasis on projects where more than two stakeholders are involved partners from different backgrounds are included. Here also citizens are listed as important partners to advance the projects. Even though Cologne puts a lot of emphasis on citizens, within the project this actor has limited influence on energy projects. Therefore, the inclusion of several actors can be seen as important in order to create projects which would not be possible on a bilateral basis.

Another important aspect is the political and administrative framework the smart city project is operating in. In Cologne the lack of a unified sustainable approach within different departments of the municipality has a rather negative impact on energy projects. The municipality in Amsterdam sets a lot of regulations benefitting energy transition and also actively supports smart city projects through financial support or other sorts of commitment. Here, the Amsterdam Energy Fund plays an important role. In Cologne the smart city project has not arrived within the whole municipality yet. This has caused complication in the implementation of energy projects.

Throughout the research it became obvious that different resources play an important role for energy transition in smart city projects. In Amsterdam there is a great emphasis on the collaboration of different people and therefore the exchange of ideational resources like ideas and opinion play a striking role here. In both projects there are sufficient ideas and technology available. However, both face the challenge to implement the projects in the social context. Next to ideational resources, especially the case of Cologne has shown that financial resources have an important influence on energy projects. Despite the fact that there are several financing methods in the federal state of NRW, on a national level, and through the support of the EU, financial contribution of the municipality is missing. In Amsterdam several projects are financed through commitment of

the different actors who join the project. Therefore, only projects are implemented someone is committed to and which are valuable for the actors.

Furthermore, it turns out that there are several aspects which influence energy transition in the conception of a smart city project. Here, it becomes clear that especially the aspect of scaling which has been emphasised in Amsterdam, but also in some projects in Cologne plays an important role for increasing the impact of energy projects. In Amsterdam scaling is seen as a clear goal for every smart city project and has been stressed by several parties throughout the case study. In comparison to Cologne there is also the ambition to enlarge some projects; however this has only been done in some isolated cases.

In addition, the research has shown that differences within cities play an important role. This fact is often seen as a reason for the hierarchical orientation in the SCC project and the rather open structure in ASC. This also explains the stress on collaboration in the ASC project.

6.1.4 Projects which Influence Energy Transition

The analysis has shown that both projects have a great range of energy projects. However, in Cologne almost all projects have an emphasis on energy transition, while in Amsterdam only one third of the projects contribute to energy transition in a direct way. In Cologne as well as in Amsterdam the majority of energy projects are focussed on energy efficiency as well as energy supply. Especially, the energy supply projects provide innovative ideas how energy can be gained in an urban context.

Furthermore, the energy projects in Amsterdam are not bound to Amsterdam, but include the neighbour municipalities, too. In Cologne energy projects are mainly implemented in the city borders, with respect to some projects supported by the EU where international collaborations take place. In addition to that, it became obvious that while the projects in Amsterdam have great targets caused by the ambition of scaling in the project, projects in Cologne are mainly implemented on a smaller scale.

6.2 Main Conclusion

In this research the underlying factors influencing smart city projects have been investigated. Special attention has been paid to the role of energy transition within those project. To answer the main question of this research a comparative case study has been conducted with the cases ASC and SCC. Based on the findings of the sub-questions the main question is going to be answered. The main question is:

In how far can different smart city projects contribute to energy transition?

The research has shown that smart city projects contribute to energy transition in several ways. The investigated projects implicated that smart city can be an important tool to support different actors in the energy market. Energy transition causes a shift of roles in the energy market. Therefore, a smart city project where knowledge and interests are exchanged can be helpful for actors to find their new role in the energy market. Within the smart city framework, new collaborations and roles can be tested. Furthermore, smart city projects provide a platform for innovative ideas which can be implemented in the social context. This supports the city as laboratories of change in which new technologies but also new collaborations among actors can be experimented with.

In both cities the smart city project is only a part of the integrated climate protection concept. Within that integrated climate concept smart city projects are a unique possibility to involve actors on a voluntary basis and enable projects which could not be done only through regulation.

Therefore, it is an important tool which supplements the administrative and regulatory contributions to energy transition.

Throughout the case studies it became obvious that the different approaches of smart city projects influence the potential contributions to energy transition of cities. Important factors for a smart city project to have a great influence on energy transition are:

- The project has to be embedded in a sustainable administrative framework of the city. On the one hand, it is important that deregulation in certain domains enable a more open way to deal with energy and roles within the energy sector. On the other hand, it is important that there are regulations concerning energy transition in the city, and that there is a common interest and priority for energy transition within the administration.
- Furthermore, it is important that there is sufficient commitment among the stakeholders of the project and that there are enough financial resources to implement innovative ideas contributing to energy transition.
- Within the smart city project a certain focus on energy has to be aligned and supported by an uncommitted actor. This ensures that the topic of energy transition is prioritized also in smart city concepts with a broad thematic focus.
- Furthermore smart cities usually have a broad focus. Therefore it is important that energy projects can be combined with other urban challenges.
- The aspect of scaling plays an important role for energy projects as they have a great influence on the contribution to energy transition. Moreover, it is important that the smart city project does not stay within the boundaries of the city but also includes the region in order to gain more possibilities for energy supply and enlarge the scale projects are implemented on.

All in all, it becomes obvious that smart city projects have a great potential to contribute to energy transition; however, smart cities are not a goal in itself but need support through a sustainable framework of the administration, actors from the economic and the knowledge sector as well as the civil society. Furthermore, the research has shown that there is no perfect smart city project. Rather every city has to develop its own smart city project, as different cities face different urban challenges but also differ in their potential to contribute to energy transition.

6.3 Recommendations for further Research

In this research the concepts of smart cities and energy transition have been analysed. Those two concepts are relatively broad and therefore the investigation only showed a broad overview of the relevant aspects. Future research could therefore further elaborate those aspects. Hence, possible research topics could deal with the influence of the administrative framework within smart city concepts on energy transition, what role laws and regulations play and how collaboration can influence the aspect of energy transition. Additionally research could be interesting to elaborate certain aspects of energy transition like the aspect of mobility. This topic forms a complex topic in itself and research on the influence of regulation and cooperation in this sector could be interesting.

Furthermore research has shown that there is a great range of different smart city projects. Despite certain differences, both projects had a clear platform thought of smart city and aimed for diverse partners and their ideas. Hence, an elaboration of other smart city projects which are more top-down held or which rather come from the economic sector could be interesting.

Finally the aspect of cultural differences has been a factor which came up at several points of this research. This aspect has been quite surprising and therefore has not been covered in the

conceptual model. Here, further research on the important aspects of the cultural and physical conditions of a city and how those can be measured could be an interesting implication.

7 Reflection

After conducting the research it should be pointed out that it includes several weaknesses as well as strengths. In the following parts first general restrictions of this research are going to be discussed, followed by a personal evaluation of the research.

7.1 Restrictions of this Research

First of all it should be mentioned that the topic of analysis was very broad covering the two broad concepts of “smart city projects” and “energy transition”. Therefore, within the short framework of the bachelor thesis it was only possible to get a broad overview about the important aspects of those topics. The selected theory has been a good tool in order to get an overview of the topic and therefore many different aspects were collected. Through the lack of time it was not possible to deeply research all of those aspects. For example, it was not possible to have an in depth analysis of the laws which influence those projects or analyse the contribution of every energy project in detail.

Throughout the project different interviews and documents have been collected and enabled a good insight into different projects. The respondents in Amsterdam showed that they had similar positions within the project as they all belonged to a founding partner of the project. Here, it could have been interesting also to include the view of a project partner which is committed in a different form to the project. However, this has been noticed throughout the research process and additional interviews would have exceeded the scope of this work.

Furthermore, the framework of this research has only allowed a comparative case study. Due to the broad topic of smart cities more cases would have had to be studied in order to come to a result which can be generalised for other contexts. Therefore, the external validity of this research is restricted (Vennix, 2006).

The data collection has been done according to triangulation which is recommended for research in order to get an objective view of certain topics (Vennix, 2006; Verschuren & Doorewaard, 2007). The secondary data which was used was carefully selected, here it was paid attention to the scientific relevance of those sources as well as their validity.

7.2 Personal Reflection

This research has given me new insights on doing research on my own. During the process I faced several challenges and lessons which I have learned.

Throughout the research I learned how to conduct a research in a theoretical way. Already quite early in the research process it became clear that I underestimated the importance of theory within a scientific research. I struggled to fit in the aspect of a theory and how to connect this to my main research question. This has led to a loss of track at several points of this research.

Furthermore, I learned that it is important to conduct a research in an iterative way. The assumptions about the two cases I had in the beginning of the research changed throughout the research. Therefore, it was necessary to make several adjustments concerning the research questions and other parts of the introduction. Besides, there was always further information which had to be implemented into the parts of the research. Thus I learned that working in a linear way is not very useful for conducting research and the fact that you have written an introductory chapter does not mean that it has to stay the same throughout the research.

Another point I have learned in this research is to find interviewees for the research. Even though some people responded immediately, other respondents only responded after several e-mails or

phone calls. Here, I learned to be confident about my research and not shy away from contacting people several times in several ways.

Apart from that I gained a lot of knowledge about different smart city projects. I found it very interesting to investigate the underlying structures of the different smart city projects. Here, especially the differences between German and Dutch projects appeared to be very interesting to me as this is a point which has accompanied me throughout my whole study in the Netherlands. I was quite impressed about the range of projects in Amsterdam and how the city has managed to foster sustainability to make the city more attractive. In Cologne the project is not that known yet, however, I think it is interesting to follow up this project in the future, as it bears a lot of potential.

All in all it can be said that despite the challenges I faced throughout this research I learned a lot of lessons and I got the opportunity to apply several aspects I learned during my studies at the Radboud University in Nijmegen.

References

- Agentur für Erneuerbare Energien. (n.d.). *Strommix in Deutschland 2014*. Retrieved June 14, 2016, from <https://www.unendlich-viel-energie.de/strommix-deutschland-2014>
- Alliander. (n.d.). Over Alliander. Retrieved June 28, 2016, from <https://www.alliander.com>
- Amsterdam Economic Board. (n.d.). Over de board. Retrieved June 2016, 15, from <https://www.amsterdameconomicboard.com>
- Amsterdam Smart City . (n.d.). Amsterdam smart city. Retrieved March 10, 2016, from <http://amsterdamsmartcity.com/>
- Amsterdam Smart City. (2011). *Smart stories*. Amsterdam: Amsterdam Smart City. Retrieved from <https://issuu.com>
- Amsterdam Smart City. (2016). FAQ amsterdam smart city.
- Amsterdam Smart City. (n.d.). Amsterdam smart city concept introduction. Retrieved June 9, 2016, from <http://www.piio.pl>
- Amsterdam Smart City. (n.d.). Projects. Retrieved July 1, 2016, from <https://amsterdamsmartcity.com>
- Amsterdam.org. (n.d.). Die Entstehungsgeschichte. Retrieved June 6, 2016, from <http://amsterdam.org>
- Bridge, G., Bouzarovski, S., Bradshaw, M., & Eyre, N. (2013). Geographies of energy transition: Space, place and low carbon economy. *Energy Policy*, 53, 331-340. doi:10.1016/j.enpol.2012.10.066
- Bund der Energieverbraucher e.V. (2015). Informationen über energieanbieter. Retrieved June 14, 2016, from <http://www.energieanbieterinformation.de>
- Bundesinstitut für Bevölkerungsforschung. (2014). *Durchschnittsalter der Bevölkerung*. Retrieved May 21, 2016, from <http://www.bib-demografie.de>
- Caragliu, A., Del Bo, C., & Nijkamp, P. (2011). Smart cities in Europe. *Journal of Urban Technology*, pp. 65-82. doi:10.1080/10630732.2011.601117
- Celsius, Smart Cities. (n.d.). District Heating and Cooling. Retrieved March 16, 2016, from <http://celsiuscity.eu>
- Centraalbureau voor de Statistiek . (2014). *Bevolking; ontwikkeling in gemeenten met 100 000 of meer inwoners*. Retrieved March 10, 2016, from <http://www.cbs.nl>
- Centraalbureau voor de Statistiek. (2015). Sharp increase in the share of renewable energy. Retrieved July 6, 2016, from <https://www.cbs.nl>
- City-zen. (n.d.). City-zen. New urban energy. Retrieved July 1, 2016, from <http://www.cityzen-smartcity.eu/>
- City-zen. (n.d.). Westpoort warmte. Retrieved June 29, 2016, from <http://www.cityzen-smartcity.eu>
- Cohen, B. (2014). The 10 smartest cities in Europe. Retrieved June 23, 2016, from <http://www.fastcoexist.com/>
- Cohen, D., & Crabtree, B. (2006). Qualitative research guidelines project. Retrieved June 30, 2016
- cologne.de. (n.d.). History of Cologne. Retrieved July 2, 2016, from <http://www.cologne.de/>
- Coppez, G., Chowdhury, S., & Chodhury, S. (2010). The Importance of energy storage in renewable power generation: a review. *Universities Power Engineering Conference (UPEC). 2010 45th International IEEE*, 1-5. Retrieved from <http://ieeexplore.ieee.org/>

- Covenant of Mayors. (n.d.). Covenant of Mayors. Retrieved June 9, 2016, from <http://www.covenantofmayors.eu>
- Creswell, J. W. (2013). *Qualitative Inquiry and Research Design*. London: SAGE .
- Creutzig, F., Baiocchi, G., Bierkandt, R., Pichler, P.-P., & Seto, K. C. (2015). Global typology of urban energy use and potentials for an urbanization mitigation wedge. *Proceeding of the National Academy of Sciences*(112), pp. 6283-6288. doi:10.1073/pnas.1315545112
- de Jong, M., Joss, S., Schraven, D., Zhan, C., & Weijnen, M. (2015). Sustainable-smart-resilient-low carbon-eco-knowledge cities; making sense of a multitude of concepts promoting sustainable urbanization. *Journal of Cleaner Production*, pp. 25-38. doi:10.1016/j.jclepro.2015.02.004
- Driessen, P., Goverde, H., & Leroy, P. (2007). Milieubeleid als interactievraagstuk. In P. Driessen, & P. Leroy, *Milieubeleid Analyse en Perspectief* (pp. 159-184). Bussum: Coutinho.
- Droege, P. (2011). *Urban energy transition: from fossil fuels to renewable power*. Elsevier. Retrieved from <https://books.google.nl>
- Economist Intelligence Unit. (2009). European green city index. (S. AG, Ed.) München. Retrieved from <http://siemens.com>
- Economist Intelligence Unit. (2011). German green city index. (S. AG, Ed.) München. Retrieved from <http://realestate.siemens.com>
- European Comission. (n.d.). Paris Agreement. Retrieved Febuary 13, 2016, from <http://ec.europa.eu/>
- European Commission. (n.d.). 2030 Energy strategy. Retrieved June 26, 2016, from <http://ec.europa.eu/>
- Geels, F. W. (2014). Regime resistance against low carbon transitions: Introducing politics and power into the multi-level perspective. *Theory Culture and Society*, pp. 1-20. doi:10.1177/0263276414531627
- Gemeente Amsterdam. (2015). Covenant of mayors. Retrieved June 9, 2016, from <https://www.amsterdam.nl>
- Gemeente Amsterdam. (n.d.). Amsterdam & innovatie. Retrieved July 6, 2016, from <https://www.amsterdam.nl>
- Gemeente Amsterdam. (n.d.). Wat doet economie? Retrieved June 6, 2016, from <https://www.amsterdam.nl>
- Gemeente Amsterdam, Buerau Onderzoek en Statistiek. (2014). Verkiezingen 2014 gemeenteraad amsterdam. Retrieved June 6, 2016, from <http://www.ois.amsterdam.nl/>
- Gertec Ingenieurgesellschaft, Institut für Energie- und Umweltforschung, Stadt Köln. (2012). Integriertes Klimaschutzkonzept für den Teilbereich Energie. Retrieved from <http://www.stadt-koeln.de>
- GrowSmarter. (n.d.). Our vision. Transforming cities for a smart sustainable Europe. Retrieved from <http://www.grow-smarter.eu>
- Hall, P. (2014). *Cities Of Tomorrow. An Intellectual History of Urban Planning and Desingn Since 1880*. West Sussex : Wiley Blackwell .
- Hollands, R. G. (2008). Will the real smart city please stand up? *City*, 12, pp. 302-320. Retrieved February 11, 2016, from 10.1080/13604810802479126

- Hoppe, K. (2015). Der Smart City Ansatz. Frankfurt am Main: Klima Bündnis e.V. Retrieved from <https://www.bundesverband-smart-city.de/>
- I Amsterdam. (n.d.). Amsterdam society. Retrieved June 6, 2016, from <https://www.iamsterdam.com>
- I Amsterdam. (n.d.). Die Stadtgeschichte. Retrieved June 6, 2016, from <https://www.iamsterdam.com>
- Information und Technik NRW. (2013). Zensus 2011: 1.6 Millionen Ausländer Leben in Nordrhein Westfalen. Retrieved May 21, 2016, from <https://www.it.nrw.de>
- Information und Technik NRW. (2015). *Einwohnerzahlen im Regierungsbezirk Köln*. Retrieved March 17, 2016, from <https://www.it.nrw.de>
- Inglis, D., & Thorpe, C. (2012). *An Invitation To Social Theory*. Cambridge: Polity Press .
- Intergovernmental Panel on Climate Change. (2014). Summary for policymakers. *Climate change 2014: mitigation of climate change. Contribution of Working Group III to the Fifth Assessment Report of Intergovernmental Panel on Climate Change*. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press. Retrieved from <https://www.ipcc.ch>
- International Energy Agency . (2014). Energy policies of IEA countries. The Netherlands. Retrieved from <https://www.iea.org>
- Interview Cloosterman, T. (2016, June 2). Amsterdam Smart City. (L. Dulisch, Interviewer)
- Interview den Heijer, G. J. (2016, May 12). Smart City Cologne. (L. Dulisch, Interviewer)
- Interview Groennerud, S. (2016, June 2). Smart City Cologne. (L. Dulisch, Interviewer)
- Interview Kahl, H. (2016, May 11). Smart City Cologne. (L. Dulisch, Interviewer)
- Interview Kreitsch, T. (2016, April 19). Smart City Cologne. (L. Dulisch, Interviewer)
- Interview Sieben, B. (2016, June 3). Amsterdam Smart City. (L. Dulisch, Interviewer)
- Interview van der Stoep, A. (2016, May 25). Amsterdam Smart City. (L. Dulisch, Interviewer)
- Kenis, P., & Schneider, V. (1991). Policy networks and policy analysis: scrutinizing a new analytical toolbox. In R. M. Bernd Marin, *Policy Networks. Empirical Evidence and Theoretical Considerations* (pp. 25-59). Frankfurt: Campus/Westview Press. Retrieved from <https://www.researchgate.net>
- Klimaatbureau Amsterdam. (2010). Amsterdam: a different energy strategy. 2040 energy strategy. Retrieved from <https://www.amsterdam.nl>
- Knoke, D. (2011). Policy networks. In J. Scott, & P. J. Carrington, *Social Network Analysis* (pp. 210-222). London: SAGE. Retrieved from <https://books.google.nl>
- Madlener, R., & Sunak, Y. (2011). Impacts of urbanization on urban structures and energy demand: What can we learn for urban energy planning and urbanization management? *Sustainable Cities and Society*, 1, pp. 45-53. doi:10.1016/j.scs.2010.08.006
- Manville, C., Cochrane, G., Cave, J., Millard, J., Pederson, J. K., Thaarup, R. K., . . . Kotterink, B. (2014). Mapping smart cities in the EU. Retrieved from <http://www.europarl.europa.eu>
- March, H., & Ribera-Fumaz, R. (2014). Smart contradictions: The politics of making Barcelona a self-sufficient city. *European Urban and Regional Studies*, pp. 1-15. doi:10.1177/0969776414554488
- Municipality of Amsterdam. (2015). Sustainable Amsterdam. Amsterdam. Retrieved from <http://www.eumayors.eu>

- Munsch, E. (2015, May 26). Mit E-Auto gibt's den Parkplatz schneller. *Zeit Online*. Retrieved July 3, 2016, from <http://www.zeit.de/>
- Nam, T., & Pardo, T. A. (2011). Conceptualizing smart city with dimensions of technology, people, and institutions. *Proceedings of the 12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging times*, (pp. 282-291). New York. doi:10.1145/2037556.2037602
- Nikayin, F., & de Reuver, M. (2012). Organizing collective action in trans-sectoral business ecosystems: A network analysis of Amsterdam Smart City project.
- NRW. (2013). Klimaschutzgesetz NRW. Retrieved June 28, 2016, from <https://recht.nrw.de>
- O'Connor, P. A. (2010). *Energy Transition*. Boston : Boston University .
- Paulic, R. (2014). Aufbauorganisation. In R. Paulic, *Verwaltungsmanagement und Organisation* (S. 143). Verlag für Verwaltungswissenschaft.
- Pricewaterhouse Coopers . (2015). Ranking digitalste Städte Deutschlands. Retrieved May 21, 2016, from <http://www.pwc.de>
- Qurrent. (n.d.). Welkom bij Qurrent. Retrieved July 1, 2016, from <https://www.qurrent.nl>
- RheinEnergie. (n.d.). Aus der Geschichte der RheinEnergie. Retrieved May 21, 2016, from <https://www.rheinenergie.com>
- RheinEnergie. (n.d.). Netzanschluss. Retrieved July 2, 2016, from <http://www.rheinenergie.com/>
- Rhodes, R. A. (2009). Policy network analysis. In R. E. Goodin, M. Moran, & M. Rein, *The Oxford Handbook of Public Policy* (pp. 423-445). Oxford: Oxford University Press. doi:10.1093/oxfordhb/9780199548453.003.0020
- Schäfer, U. (2015, November 30). Stegerwald-Siedlung EU-Programm „Grow Smarter“ fördert Energiespar-Siedlung Kölns. *Kölner Stadt Anzeiger*. Retrieved June 15, 2016, from <http://www.ksta.de>
- Siegele, L. (2013, November 2). Mining the urban data. *The Economist*. Retrieved from <http://www.economist.com>
- Siegemund, J., Köring, D., Schulz, J., & Hanses, K. (2013). *Smart City Concepts - Konzepte für den energetischen Stadtumbau am Beispiel Köln* . (F. C. Köln, Ed.) Ludwigsburg: avedition.
- SNPC GmbH. (2014). Energiewende in Berlin - ein Organisationsmodell. Berlin: Industrie und Handelskammer. Retrieved from <https://www.bundesverband-smart-city.de>
- Solomon, B. D., & Krishna, K. (2011). The coming sustainable energy transition: History strategies and outlook. *Energy Policy*, 39, pp. 7422-7431. doi:doi:10.1016/j.enpol.2011.09.009
- Späth, P., & Rohracher, H. (2010). 'Energy regions': The transforamtive power of regional discourses on socio-technical futures. *Research Policy*, 39, pp. 449-458. doi:10.1016/j.respol.2010.01.017
- Späth, P., & Rohracher, H. (2011). The 'eco-cities' Freiburg and Graz - The social dynamics of pioneering urban energy and climate governance. In H. Bulkeley, C. V. Broto, M. Hodson, & S. Marvin, *Cities and Low Carbon Transitions* (pp. 88-106). Abingdon, Oxon: Routledge. Retrieved from <https://www.researchgate.net>
- Stadt Köln. (2014). Integriertes Klimaschutzkonzept Köln 2013. (S. Köln, Ed.) Retrieved from <https://ratsinformation.stadt-koeln.de>

- Stadt Köln. (2014). Kölner Statistische Nachrichten. Analyse der Kommunalwahl am 25. Mai 2014. Retrieved June 14, 2016, from <http://www.stadt-koeln.de>
- Stadt Köln. (2015). *Offene Daten Köln. Einwohner Durchschnittsalter*. Retrieved May 21, 2016, from <http://www.offenedaten-koeln.de>
- Stadt Köln. (2016). Klimaschutz für Köln. Fakten, Zahlen und Ergebnisse 2015 Ausblick 2016. Retrieved from <https://ratsinformation.stadt-koeln.de>
- Stadt Köln; RheinEnergie . (2014). SmartCity Cologne - Grundbotschaften.
- Stadt Köln; RheinEnergie AG. (n.d.). Smart City Cologne. Retrieved February 24, 2016, from <http://www.smartcity-cologne.de>
- Stadt Köln; RheinEnergie. (n.d.). Smart City Cologne. Retrieved February 24, 2016, from <http://www.smartcity-cologne.de>
- Stake, R. E. (1994). Case studies. In N. K. Denzin, & Y. S. Lincoln, *Handbook of Qualitative Research* (pp. 236-247). Thousand Oaks: SAGE Publications. Retrieved from <https://elearning.uky.edu>
- Statistisches Bundesamt. (2011). 80,2 Millionen Einwohner lebten am 9. Mai 2011 in Deutschland. Retrieved June 16, 2016, from <https://www.zensus2011.de>
- Travel1000Places.com. (n.d.). Cologne. Retrieved from <http://www.travel1000places.com/>
- Travellersspot. (2016). Netherlands. Retrieved July 6, 2016, from <http://www.travellerspoint.com/>
- United Nations. (2013). *World economic and social survey 2013*. New York. Retrieved from <https://sustainabledevelopment.un.org>
- United Nations Framework Convention on Climate Change. (2015). Adoption of the Paris Agreement. Retrieved from <https://unfccc.int>
- van Winden, W. (2016). Smart city pilot projects, scaling up of fading out? Experiences from Amsterdam. *Regional Studies Association Annual Conference*. Austria, Graz: Amsterdam University of Applied Sciences. Retrieved from <http://researchgate.net>
- van Winden, W., Oskam, I., Schrama, W., Dijck, v., Eckbert-Jan, Buuse, v. d., & Daniel. (2016). 12 smart city projects analysed in the Amsterdam region. preliminary report. Amsterdam: Amsterdam University of Applied Sciences.
- Vattenfall. (n.d.). The Netherlands. Retrieved July 5, 2016, from <https://corporate.vattenfall.com>
- Vennix, J. (2006). *Theorie en praktijk van empirisch onderzoek*. Pearson.
- Verbong, G., & Geels, F. (2007). The ongoing energy transition: Lessons from a socio technical multi-level analysis of the Dutch electricity system (1960-2004). *Energy Policy*, 35, pp. 1025-1037. doi:doi:10.1016/j.enpol.2006.02.010
- Verschuren, P., & Doorewaard, H. (2007). *Het ontwerpen van een onderzoek*. Den Haag: Uitgeverij Lemma.
- Vienna University of Technology. (2007). Smart Cities - Ranking of European medium-sized cities. Retrieved from <http://www.smart-cities.eu>
- Vincent, P. F. (n.d.). Amsterdam. Retrieved June 6, 2016, from <http://www.britannica.com>
- Wagner, J. (2013). Stadt Köln: EU Projekt "Celsius" startet noch im Sommer. Retrieved February 11, 2016, from <http://www.stadt-koeln.de>

- World Bank. (2010). Cities and climate change: An urgent agenda. Washington DC: The International Bank for Reconstruction And Development. Retrieved from <http://worldbank.org>
- World Energy Council. (2014). Global energy transition. A comparative analysis of key countries and implications for the international energy debate . Retrieved from <https://www.atkearney.com>
- Wuppertal Institut für Klima, Umwelt, Energie GmbH; Stadt Köln. (2011). Klimaschutzkonzept für die Stadt Köln. Teilbereich Verkehr. Retrieved from <http://www.stadt-koeln.de>
- www.hochschulen-koeln.de. (n.d.). *Hochschulen und Universitäten in Köln*. Retrieved May 21, 2016, from <http://www.hochschulen-koeln.de/>
- Yin, R. K. (2004). Case study methods. Retrieved from <http://www.cosmoscorp.com>
- Zoncoalitie. (n.d.). Zonnepanelen zoeke groete dakken. Retrieved July 1, 2016
- Zygiaris, S. (2012). Smart city reference model: assisting planners to conceptualize the building of smart city innovation ecosystems. *Journal of the Knowledge Economy*, 4, pp. 217-231. doi:10.1007/s13132-012-0089-4

Appendix

Appendix A: Interview guides

Appendix A1 Interviewleitfaden Stadt Köln

Einleitung

- Können Sie sich zu Beginn vorstellen und Ihre Rolle im Smart City Projekt beschreiben?
- Inwieweit können arbeiten Sie als Projektmanager für die Interessen der Stadt Köln?

Smart City Konzept

- Was ist die Geschichte/Motivation des Smart City Projektes? – Womit hat es angefangen?
- Was sind aus Ihrer Sicht wichtige Aspekte des Smart City Konzeptes in Köln?
- Wo ist das Konzept niedergelegt? (Broschüre?)
- Welche Mission/Vision hat das Projekt?
- Welche Parteien waren an der Entwicklung einer Konzeption beteiligt?
- Welche Rolle spielt die Energiewende in dem Projekt?
- Inwiefern ist das Konzept wichtig für eine erfolgreiche Reduktion an Treibhausgasen?

Akteure

- Welche Gruppen von Akteuren würden Sie unterscheiden die im Projekt involviert sind?
- Warum schließen sich Akteure diesem Projekt an? Was ist Ihre Hauptmotivation?
- Köln: Sie listen auf Ihrer Webseite verschiedene Partner auf. Was sind die Voraussetzungen um ein Partner des Projektes zu werden?
- Sie betonen dass viel Wert auf unterschiedliche Partner aus allen Bereichen der Gesellschaft gelegt wird. Auf der Internetseite sind vorrangig wirtschaftliche Partner gelistet, warum?
- Wie läuft die Zusammenarbeit zwischen den Akteuren, gibt es Interessensgemeinschaften bzw. gegensätzliche Interessen?
- Gibt es Situationen wo die Zusammenarbeit eher schwierig ist?
- Wie sind die Machtverhältnisse innerhalb des Projektes? Welche Akteure haben mehr Macht als andere und Warum?
- Inwiefern sind verschiedene Akteure von der Konzeption betroffen? (z.B. dient als Motivation, Leitbild)
- Wie wirkt sich dies auf die Zusammenarbeit verschiedener Akteure aus?

Ressourcen (Geld, Wissen, Informationen)

- Was sind wichtige Ressourcen die das Projekt beeinflussen?
- Welche Parteien unterstützen das Projekt finanziell, oder durch Wissen bzw. Beratung?
- Wie hoch ist das Budget des Projektes?
- Welche Ressourcen sind ausreichend vorhanden unter den Akteuren, welche Ressourcen sind eher knapp?
- Wie sind die wichtigen Ressourcen in Zusammenhang der Energiewende zu bringen?
- Welche Rolle spielt die Verteilung von Ressourcen bei der Smart City Konzeption?
- Wie wird sichergestellt dass die Ressourcen so verteilt sind, sodass nicht eine Partei die Verhandlungen dominiert?
- Entspricht der Tausch von Ressourcen den Grundsätzen und Zielen der Smart City Konzeption?
- Wie wichtig ist der Austausch von Fördermitteln bzw. ideellen Ressourcen um Energiewende herbeizuführen?

Regeln

- Wie läuft der Weg vom Ratsbeschluss bis zur Ausführung innerhalb des Projektes ab?
- Wie ist das Budget unter den verschiedenen Projekten verteilt?
- Sind verschiedene Akteure Vertraglich an das Projekt gebunden?
- Inwiefern wird das Projekt von Gesetzen/Ratsentscheidungen beeinflusst?
- Gibt es formelle und informelle Verhaltensregeln, an die sich die Akteure halten?
- Inwiefern sind Regeln unter den Akteuren vom Smart City Konzept beeinflusst?
- Wird gutes Verhalten während der Zusammenarbeit belohnt, wird schlechtes Verhalten bestraft?

Allgemeine Fragen

- Welche Schwierigkeiten bestehen bei der Umsetzung des Projektes?
- Welche Lehren hat man bis heute gezogen?
- Was ist Ihrer Meinung nach der wichtigste Aspekt in Köln welcher sicherstellt dass das Smart City Projekt einen wichtigen Beitrag zur Energiewende hat?
- Inwiefern ist Ihre Konzeption auch in anderen Städten anwendbar?
- Haben Sie noch Anmerkungen oder Fragen?
- Weitere Namen/Organisationen die ich für ein Interview fragen könnte
- Danke!

Appendix A2: Interviewleitfaden RheinEnergie

- Können Sie sich zu Beginn vorstellen und Ihre Rolle im Smart City Projekt beschreiben?

Smart City Konzept

- Was ist die Geschichte/Motivation des Smart City Projektes? – Womit hat es angefangen?
- Was sind wichtige Aspekte des Smart City Konzeptes in Köln?
- Wo ist das Konzept niedergelegt? (Broschüre?)
- Welche Mission/Vision hat das Projekt?
- Welche Parteien waren an der Entwicklung einer Konzeption beteiligt?
- Welche Rolle spielt die Energiewende in dem Projekt?
- Inwiefern ist das Konzept wichtig für eine erfolgreiche Reduktion an Treibhausgasen?

Akteure

- Welche Gruppen von Akteuren würden Sie unterscheiden die im Projekt involviert sind?
- Was war ein Motiv der RheinEnergie Projektpartner zu werden?
- Warum schließen sich Akteure diesem Projekt an? Was ist Ihre Hauptmotivation?
- Wie läuft die Zusammenarbeit zwischen der RheinEnergie und der Stadt Köln ab?
 - In verschiedenen Subprojekten
 - Allgemeine Veränderungen
- Wie läuft die Zusammenarbeit zwischen den Akteuren, gibt es Interessensgemeinschaften bzw. gegensätzliche Interessen?
- Gibt es Situationen wo die Zusammenarbeit eher schwierig ist?
- Wie sind die Machtverhältnisse innerhalb des Projektes? Welche Akteure haben mehr Macht als andere und Warum?
- Inwiefern sind verschiedene Akteure von der Konzeption betroffen? (z.B. dient als Motivation, Leitbild) -> sind die Akteure sich über das Smart city Projekt bewusst, haben Sie ähnliche vorstellungen, wie die Projektleiter?
- Wie wirkt sich dies auf die Zusammenarbeit verschiedener Akteure aus?

Ressourcen (Geld, Wissen, Informationen)

- Was sind wichtige Ressourcen die das Projekt beeinflussen?
- Welche Parteien unterstützen das Projekt finanziell, oder durch Wissen bzw. Beratung?
- Wie hoch ist das Budget des Projektes von Seiten der RheinEnergie?
- Welche Ressourcen sind ausreichend vorhanden unter den Akteuren, welche Ressourcen sind eher knapp?
- Wie sind die wichtigen Ressourcen in Zusammenhang der Energiewende zu bringen?
- Welche Rolle spielt die Verteilung von Ressourcen bei der Smart City Konzeption?
- Wie wird sichergestellt dass die Ressourcen so verteilt sind, sodass nicht eine Partei die Verhandlungen dominiert?
- Entspricht der Tausch von Ressourcen den Grundsätzen und Zielen der Smart City Konzeption?
- Wie wichtig ist der Austausch von Fördermitteln bzw. ideellen Ressourcen um Energiewende herbeizuführen?

Regeln

- Wie läuft der Weg vom Ratsbeschluss bis zur Ausführung innerhalb des Projektes ab?
- Wie ist das Budget unter den verschiedenen Projekten verteilt?
- Sind verschiedene Akteure Vertraglich an das Projekt gebunden?

- Inwiefern wird das Projekt von Gesetzen/Ratsentscheidungen beeinflusst?
- Gibt es formelle und informelle Verhaltensregeln, an die sich die Akteure halten?
- Inwiefern sind Regeln unter den Akteuren vom Smart City Konzept beeinflusst?
- Wird gutes Verhalten während der Zusammenarbeit belohnt, wird schlechtes Verhalten bestraft?

Allgemeine Fragen

- Welche Schwierigkeiten bestehen bei der Umsetzung des Projektes?
- Welche Lehren hat man bis heute gezogen?
- Was sind Ihrer Meinung nach die wichtigsten Aspekte die zu einem erfolgreichem Smart City Projekt
- Inwiefern ist Ihre Konzeption auch in anderen Städten anwendbar?
- Haben Sie noch Anmerkungen oder Fragen?
- Weitere Namen/Organisationen die ich für ein Interview fragen könnte
- Danke!

Appendix A3: Interviewleitfaden Immo-Projektmanagement

Einleitung:

- Können Sie ein bisschen was über Ihren Betrieb erzählen, und inwiefern Sie in dem Projekt Smart City Cologne involviert sind?

Konzept

- Wie haben Sie von dem Projekt Smart City Cologne erfahren?
- Wie würden Sie das Konzept des Projektes Smart City Cologne beschreiben?
- Inwiefern ist das Smart City Konzept, die Grundsätze, mit den Grundsätzen Ihres Betriebes zu vereinbaren?
- Hätten Sie Verbesserungsvorschläge für das Konzept hinter Smart City Cologne?

Akteure

- Aus welcher Motivation sind Sie dem Projekt beigetreten?
 - Welche Rolle hat in diesem Zusammenhang die Rolle der Energiewende gespielt?
- Mit welchen Akteuren arbeiten Sie innerhalb des Projektes zusammen?
- Erfahren Sie Interessensgemeinschaften, Interessensgegensätze in dem Projekt?
- In welchen Situationen erfahren Sie die Zusammenarbeit mit anderen Akteuren als eher schwierig?
- Haben Sie das Gefühl, das die verschiedenen Parteien die gleichen Machtverhältnisse innerhalb des Projektes haben?

Ressourcen (Geld, Wissen, Informationen)

- Welche Ressourcen beeinflussen Ihr Projekt und Ihre Zusammenarbeit?
- Wie sind die Ressourcen verteilt in den Projekten, wo Sie involviert sind?
- Gibt es ausreichende Ressourcen?
- Inwiefern bietet Ihnen die Initiative Smart City wichtige Ressourcen, die hilfreich sind bei der Verwirklichung des Projektes?
- Wie wichtig ist der Austausch von Fördermittel bzw ideellen Ressourcen für Ihr Projekt?

Regeln

- Wie laufen Entscheidungsketten innerhalb des Projektes ab?
- Haben Sie das Gefühl mit Ihren Projektpartnern auf Augenhöhe zu sein?
- Sind Sie vertraglich an das Projekt gebunden? – Erfahren Sie das als eher positiv, oder negativ?
- Inwiefern haben Sie das Gefühl, das bestimmte Regeln, Beschlüsse das Projekt beeinflussen? (vorrantreiben/behindern)

Allgemeine Fragen

- Welche Herausforderungen gab es in der Vergangenheit bei der Umsetzung Ihres Projektes?
- Haben Sie im Laufe der Zeit bestimmte Lehren gezogen?
- Was ist Ihrer Meinung die Wichtigsten Aspekte um Energiewende zu fördern?
- Haben Sie noch Anmerkungen oder Fragen?

Appendix A4: Interviewleitfaden Stefan Groennerud

- Vorstellung der Person und Ihrer Rolle im Projekt Smart City Cologne
- Seit wann ist die Uni-Köln in dem Projekt involviert – ist eine Zusammenarbeit geplant?

Allgemeine Fragen

- Welche Schwierigkeiten bestehen bei der Umsetzung des Projektes?
- Welche Lehren hat man bis heute gezogen?
- Was sind Ihrer Meinung nach die wichtigsten Aspekte die zu einem erfolgreichem Smart City Projekt
- Inwiefern ist Ihre Konzeption auch in anderen Städten anwendbar?
- Haben Sie noch Anmerkungen oder Fragen?
- Weitere Namen/Organisationen die ich für ein Interview fragen könnte
- Danke!
- Vorstellung der Person und Ihrer Rolle im Projekt Smart City Cologne
- Seit wann ist die Uni-Köln in dem Projekt involviert – ist eine Zusammenarbeit geplant?

Concept

- Wie würden Sie das Konzept hinter dem Projekt Smart City Cologne beschreiben?
- Welche Rolle spielt die Energiewende in dem Konzept?
- Haben Sie Verbesserungsvorschläge für das Projekt Smart City Cologne?

Akteure

- Warum glauben Sie, dass eine Kooperation der Uni Köln mit dem Projekt Smart City Cologne sinnvoll ist?
- Inwiefern sind wissenschaftliche Akteure in dem Projekt involviert?
- An welchen Akteuren fehlt es noch in dem Projekt?
- Wie läuft die Zusammenarbeit innerhalb des Projektes ab?
- Erfahren Sie Interessensgemeinschaften bzw. Interessensgegensätze?
- Wann ist die Zusammenarbeit mit anderen Akteuren eher schwierig?

Ressourcen (Geld, Wissen Informationen)

- Welche Ressourcen beeinflussen das Smart City Projekt?
- Gibt es finanzielle Unterstützung für Forschungsbeiträge innerhalb des Projektes Smart City Cologne?
- Wie wichtig ist der Austausch von Fördermitteln bzw. ideellen Ressourcen in dem Projekt?

Regeln

- Wie laufen Entscheidungsketten innerhalb der Zusammenarbeit ab?
- Gibt es einen Vertrag zwischen der Uni-Köln und dem Smart City Projekt? Bzw wird einer ausgearbeitet?
- Inwiefern haben Sie das Gefühl, dass bestimmte Regeln, Beschlüsse das Projekt beeinflussen? (vorrantreiben/behindern)

Allgemeine Fragen

- Welche Herausforderungen gab es in der Vergangenheit bei der Umsetzung Ihres Projektes?
- Haben Sie im Laufe der Zeit bestimmte Lehren gezogen?
- Was ist Ihrer Meinung die Wichtigsten Aspekte um Energiewende zu fördern?
- Haben Sie noch Anmerkungen oder Fragen?

Appendix A5: Interviewguide Amsterdam Economic Board

- How does the collaboration of Amsterdam Economic Board and the project Amsterdam Smart City work?

Concept

- How would you describe the Concept of Amsterdam Smart City?
- In what way does the working strategy of the Amsterdam Economic board reflect the principles of a Smart City project?
- What was the motivation to become a Partner of Amsterdam Smart City?

Actors

- What was the motivation for the economic board to join the project?
- Are there coalitions between actors, are there actors where collaboration is rather difficult within Amsterdam Smart City Projects?
- What are power relations between within the SC project? Which have more power than others?
- Are all partners of the Amsterdam Economic board included in the ASC project?

Ressources

- Does the Amsterdam Economic Board support the SC Project financially? (the other way round?)
- Which resources are sufficiently provided, which resources does it lack of in the project?

Rules

- What is the decision structure, chain of command?
- Is the Economic board/partner of the economic board involved through contacts in the ASC?
- Are there formal or informal rules among different Actors? project?
- Are there formal or informal restriction/punishments for bad behaviour or awards for good collaboration? -> if yes which ones

Conclusion

- Which difficulties does the SC project have to deal with?
- Which lessons have been learned?
- Could the SC concept of Amsterdam be adopted by other cities?

Appendix A6: Interviewguide Arcadis

Could you introduce yourself and what is your role in the project Amsterdam Smart City?

Smart City Conception

- What is the history of the Project Amsterdam Smart City?
- How would you describe the mission/vision of the project ASC
- What role plays Energy transition in the concept of the project?
- Does the Concept of Amsterdam help to trigger Energy transition? -> on which scale?

Actors

- What was the motivation of Arcadis to join the project Amsterdam Smart City?
- What is the motivation for other actors to join the project?
- Why is Arcadis mentioned as a founding partner? -> what is the role of Arcadis in the project?
 - In which projects is Arcadis involved?
 - Is Arcadis also a project partner? -> where do you see the difference
- What are power relations among actors? Which parties have more influence and why is that?
- Are there Coalitions between actors/actors where the collaboration is rather difficult?
- How do actors become Partners of Amsterdam Smart City?
- In how far does the interpretation on the smart city concept differ among different actors?
- What is the role of the municipality within the Smart City Project?

Ressources

- What are important resources which are used in the project?
- What is the budget of the project? -> Does Arcadis put own money into the project?
- Which parties are financing or contributing the project with capacity/knowledge (advice)?
- Which resources are there sufficiently which are?
- How important is the exchange of resources to trigger energy transition?

Rules

- Do Partners have to sign a contract to enter the project?
- How is the decision structure, chain of command?
- Is there a certain formal or informal code of conduct for the collaboration of different actors?
- In what way does the Smart City Conception influence the collaboration of actors?
- Are there formal or informal restriction/punishments for bad behaviour or awards for good collaboration?
- Is the project influenced by laws?
- What is the role of the municipality within the Smart City Project? -> Is the municipality involved into laws and regulation?
- Possible to find out how high the funding of the different founding partners is?

Conclusion

- What are difficulties you have to deal with?
- What lessons are learned until now?
- What is in your opinion the most important aspect which ensures that a smart city project is going to be successful in Energy transition?
- In what way can your Smart City concept be adopted by other cities?
- Do you have any questions or remarks?

Appendix A7: Interviewguide Alliander

Could you introduce yourself and what is your role in the project Amsterdam Smart City?

Smart City Conception

- What is the history of the Project Amsterdam Smart City?
- How would you describe the mission/vision of the project ASC
- What role plays Energy transition in the concept of the project?
- Does the Concept of Amsterdam help to trigger Energy transition? -> on which scale?

Actors

- What was the motivation of Alliander to start the project Amsterdam Smart City?
- What is the motivation for other actors to join the project?
- Where exactly do you see the difference between founding, project and network partners?
- What are power relations among actors? Which parties have more influence and why is that?
- Are there Coalitions between actors/actors where the collaboration is rather difficult?
- How do actors become Partners of Amsterdam Smart City?
- In how far does the interpretation on the smart city concept differ among different actors?
- What is the role of the municipality within the Smart City Project?

Ressources

- What are important resources which are used in the project?
- What is the budget of the project? -> Does Alliander put own money into the project?
- How high is the amount which is financed through project partners and founding partners?
- Which parties are financing or contributing the project with capacity/knowledge (advice)?
- Which resources are there sufficiently which are?
- How important is the exchange of resources to trigger energy transition?

Rules

- Do Partners have to sign a contract to enter the project?
- How is the decision structure, chain of command?
 - In which relation is the steering committee towards the different projects and partners
 - What is exactly the task of the steering committee?
- Is there a certain formal or informal code of conduct for the collaboration of different actors?
- In what way does the Smart City Conception influence the collaboration of actors?
- Are there formal or informal restriction/punishments for bad behaviour or awards for good collaboration?
- Is the project influenced by laws?
- What is the role of the municipality within the Smart City Project? -> Is the municipality involved into laws and regulation?
- Possible to find out how high the funding of the different founding partners is?

Conclusion

- What are difficulties you have to deal with?
- What lessons are learned until now?
- What is in your opinion the most important aspect which ensures that a smart city project is going to be successful in Energy transition?
- In what way can your Smart City concept be adopted by other cities?
- Do you have any questions or remarks?

Appendix B: Observations

On 14th June 2016, there was an observation made in the Stegerwald Siedlung and Climate Street in Cologne. This Observations aimed to get better insights in the project which has been emphasised in many different interviews in Cologne. There were visual observations made and furthermore some citizen told their perceptions about the project. Furthermore on 20th June 2016 the SmartCity Conference in the historical city hall has been visited. In this part several notes which have been taken during the observation as well as photos which have been taken are

Appendix B1: Stegerwald Siedlung Köln Mühlheim

General information

- Stegerwaldsiedlung part of the GrowSmarter project
- Surrounded from a main street, with a tram line and an old factory building which is not in work any more

Buildings

- About 1300 Houses
- Buildings are 4-8 Floors high
- Settlement character emphasised through the consistency of the colours white and orange
- Majority of buildings has its origins in the 1950s

Citizen

- Complains that there are no shops and infrastructure any more
 - only bakery, hotel, a doctor, kindergarden, Lidl only at the edge
- Complains about the parking situation within the settlement
- Multicultural inhabitants -> different EM flags
- Citizen do not know what GrowSmarter is
- Complain about higher rent caused through refurbishment

GrowSmarter

- Houses are refurbished and get a photovoltaic and thermal insulation
- Modern mobility concept is not directly visible
- Only in the DEWOG office indications for growsmarter
 - Consultation hour
 - Poster with information and indications about European support

Pictures



Appendix B2: Climate Street

Project:

- The whole street is provided with lightinstallations
- Small information signs on buildings/store windows
 - Mostly about LED lightening
 - Measures how many % CO₂ is saved
- Parking place where it is possible to charge electric cars/ 4 parking space for rented cars from Cambio

Citizens

- Book store where the implementation of the project started
- Acc. to the book store other stores have changed their lightening
- Annual climate street celebration very popular
- Other shop owners could not associate any concrete projects to the term "Climate street" only the climate street celebration was named

Pictures



Appendix B3: Smart City Cologne Conference

Introduction Mayor Henriette Reker

- Project GrowSmarter has been stressed, where quality of life is going to be increased
- International attention of the EU project
- Implementation on a larger scale

Keynote; Smart Cooperation Roles and expectations from administration, Economy Science and Civil Society

- Different parties have to know why there are different behaviour patterns among different groups
- Clear Rules have to be created. They can be changed throughout the process
- Flexible cooperation where different groups are concerned with themselves and questioning the own interests and opinions

Project introduction Kita Finkenberg

- Project with focus on energy efficiency and energy supply
- Project has motivated a car-seller to refurbish its building the same way

Start-ups for Smart City Cologne

- Project 1: smart parking
- Project 2: biking platform which encourages people to take the bike
- Project 3: photoapp for electric meter
- Project 4: Circular Economy, phone batteries
- Project 5: Innovative solutions for driving a bike

Exhibition

- Different projects in the areas: Mbility, ICT, energy, financing, organisations concerning climate cooperations
- Emphasis of Networking

Pictures



Appendix C: Observation Energy Projects

Appendix C1: Amsterdam

Evaluation of the Energy Projects in Amsterdam Smart City.

Source: www.amsterdamsmartcity.com , Retrieved 4th July, 2016

Project	Theme Field	Supply	storage	Intelligent use	Thermal insulation	Mobility	Actors
City-Zen	Energy/Water /Waste	x	X	x	x		International main project with sub-projects Vito (S) Amsterdam Economic Board (O) University of Amsterdam (S) Delft Technical University (S) AEB (E) Westpoort Warmte, (E) Waternet - the water supplier Alliander (BE) Daikin (BE) Clicks & Links, (B) DNV GL, (B) Think-E, Ville de Grenoble (M) GEG CCIAG (B) CEA Hespul (B) Queens University of Belfast (S) University of Siena, (S) Atos Worldgrid (B)
City-zen: Comfort Cooling residential buildings in Houthaven district	Energy/Water /Waste	X	X		X		Westpoort Warmte (E) AEB (E) and City-Zen Partners
City-zen: Virtual Power Plant	Energy/Water /Waste	X	X	X			Greenspread (E) and Alliander (E), City-Zen Partners
City-zen: smart grid in Amsterdam Nieuw West	Energy/Water /Waste			X			Alliander (E) and City-Zen Partners
Smart cooling and heating systems for pharmaceutical processes	Energy/Water /Waste	x	x				Waternet-water supplier and Sanquin.(B)

City-zen Retrofitting	Energy/Water /Waste	x		X	X		City-zen, Home-owners home-owners associations (O) housing corporations (O) and property investors
Smart Electric Energy Boat	Mobility	X	X	X		x	Mastervolt (B) Greenitnet (S) Resourcefull (B) Alliander (E) Liander (E)
<u>E-Harbours - ReloadIT</u>	Infrastructure and Technology	X		X		X	Municipality of Zaanstad, (M) partners include EnergyGo, (B) Qpark, (B) Imtech, (B) Truckland,(B) Vito, (S) University of Amsterdam (S) and Alliander (BE)
E-harbours - Zaanstad	Infrastructure and Technology	X		X			Gemeente Zaanstad (V) E-harbours GreenChoice als contract partner (E)
City-zen urban Energy Transition Methodology (eher allgemeine Betrachtung der Energiewende)	Energy/Water /Waste						TU Delft (S) VITO (S) University of Siena, (S) Queens University of Belfast, (S) Think-E University of Amsterdam. (S)
Smart street lighting	Infrastructure and Technology	X	X	X		X	Port of Amsterdam, B Eneco, (BE) Luminext, (B) Citytec, ? Windchallenge, (B) Sunfloat (B)
Slim en Schoon door de stad	Mobility					X	Chamber of Commerce and „koplopers“ (see project page)
Ship to grid	Mobility					X	Financed EU Joulz, (B) Utiliq, (B) Liander,(BE) Alliander, (BE) Royal Haskoning, Port of Amsterdam

Fuel cell technology	Infrastructure & Technology	X					Cool endeavor,(B) Ceramic Fuel Cells Limited (B) GasTerra (E) Eneco (E) Tempus (E-Part of Eneco) Alliander (E), Liander (E)
Watt voor Watt	Energy/Water /Waste	X		X	X		Gemeente Haarlem (M) Ymere (B) Altera Vastgoed, (B) Woningcorporatie Elan, (O) Woningcorporatie PRE Wonen (O) VVE Tuinwijk Noord (O) Liander (E) Alliander (E)
Monumental Buildings	Energy/Water /Waste			X	X		Groene Bocht and user of the building
Flexible street lighting	Energy/Water /Waste			X			initiated by Alliander (E) different municipalities involved -> Leiden Zaltbommel...
Green nEtworkeD data centers	Infrastructure & Technology	x		x			GEYSER is a EU project with international partners, including two partners from the Netherlands, Green IT Amsterdam (consortium of <u>40 leading organizations</u> on sustainable IT infrastructures) and Alticom Datacenters (B)
Energy Atlas	Energy/Water /Waste			X			Accenture (B) TNO (S) Liander (E) Waternet Alliander (E) Gemeente Amsterdam, (M) Vattenfall-nuon (E)
Sunny Soccer ASV Arsenal	Energy/Water /Waste	X		X			Zuiderlicht (OE) Rabobank (BE) Alliander (E) and local energy networks & services

Transform	Energy/Water /Waste	X	X	X			EU Project: Amsterdam, Copenhagen, Genoa, Hamburg, Vienna, Grand Lyon// Energy and grid companies and Knowledge partners
Smart Sport Parks	Energy/Water /Waste	X		X			Hockeyclub Athena, (O) Jaap Eden Ijsbanen (O) WV-HEDW, (O) Duurzaam verenigen (O) Liander (E) Alliander (E)
Oosterlicht: The largest cooperatively organised solar roof in Amsterdam	Energy/Water /Waste	X					Zuiderlicht (OE) Alliander, (E) Amsterdam Investment Fund (M) Ijburg College (S) Zon&Co,(B) Gemeente Amsterdam (M)
Climate street	Energy/Water /Waste	X		X	X	X	ondernemersvereniging Utrechtsestraat (O) Vodafone,(B) JCDecaux,(B) Philips, (B) Tauw, (B) van Gansewinkel (B) PostNL (B) Club van 30 Ziut (B) and Duncker (B)
Zone Station 1	Energy/Water /Waste	X					Cooperation between GVB and Amsterdam Energie (M)
Amsterdamse Zon Coalitie	Energy/Water /Waste	x					solar (panel) suppliers (B) energy cooperations (OE) Alliander(E), Amsterdam Smart City (O) and the municipality of Amsterdam (M)
E-mobility & city logistics	Mobility					x	The Amsterdam University of Applied Science/Hogeschool van Amsterdam (initiator) (S)
Vehicle2Grid	Mobility		X	X		X	Cofely (B) Alliander, (E)

							Mitsubishi Motors Corporation,(B) Amsterdam Smart City, (O) Amsterdam University of Applied Sciences (S) and the borough of Nieuw-West (M)
Self-sufficient Pampus	Energy/Water /Waste		x				Alliander (E) ARN (B) Stichting Forteiland Pampus (O), DNV GL, (B) the University of Applied Sciences in Arnhem and Nijmegen, (S) the University of Technology in Eindhoven and Amsterdam Smart City (S)
City-zen Serious Game	Citizen/Living			x			Clicks & Links (B)

On the website www.amsterdamsmartcity.com are 88 projects listed in total. 30 of them had a direct link to energy transition.

Description:

S = Science and Knowledge

B= Business

E=Energieversorger/Netzbetreiber/Wäremversorger

M= Stadt/Gemeinde

O= Organisationen der Zivilgesellschaft (Wohnungskooperation/Sportclubs etc)

OE = Energiecooperationen

Appendix C2: Cologne

Evaluation of the Energy Projects in Smart City Cologne

source: www.smartcitycologne.de , Retrieved 4th July, 2016

Project	supply	storage	Intelligent use	Thermal insulation	E-mobility	Actors
Grow Smarter: nachhaltige Stadtentwicklung	X	X	X	X	X	Stadt Köln (M) RheinEnergie (E) Deutsche Wohnungsgesellschaft (B) AGT International (B) Cambio (B) Ampido (B)
KlimaStraße	X		X		X	RheinEnergie (E) KoelnLed (B) ManageE ((B) Rockethome (B) Hermann-Josef-Kastenholf (B) Proenso(B) Xtend-ecolight (B) Bootschaffft.de(B) And partners in different sub-projects
Landstrom für Boote	X		X		X	RheinEnergie (B)
Celsius: Energie aus Abwärme	X					EU project with 20 scientific companies; as well as cities London, Göteborg and Cologne Partners in Cologne: RheinEnergie (E) Stadt Köln (M) Stadtentwässerungsbetriebe Köln (M) Technische Hochschule Köln (S)
Sürther Feld: Neubaugebiet	X		X	X		RheinEnergie (E) ImmoProjektmanagement (B)

Concrete Apartment Cologne: Passivhäuser			X	X		Format Architektur (B) P2 (B) Lohmar-Heizung(B) MüllerGeorg-Möbel (B) Wallburger FensterTüren (B)
Transparenz beim Stromverbrauch			X			RheinEnergie (E) RhightEnergie (B) Startplatz (B)
Grüne Reifen					X	RheinEnergie (E) Lanxess (B)
Energiemanagement Stadt Köln			X			Energiemanagement der Stadt Köln (M)
Energiemanagement Dreikönigsgymnasium			X			Manage(B) BrunataMetrona (B) Netcologne (B) Ui! (B)
Wärmesaniierung Altbau				X		RheinEnergie (E)
Smarte Mobilität Fahrradleihsystem					X	Kölner Verkehrsbetriebe KVB (M)
Ökoquartier Widdersdorf	X	X	X	X		EVOHaus (B)
Brennstoffzellen-Heizung	X					RheinEnergie (E) Vaillant (B)
Moderne Arbeitswelt – RheinEnergie-Neubau	X		X	X		Rheinenergie (E)
Bürokomplex Kennedyplatz	X			X		Lanxess (B) Görg-Rechtsanwälte (B)
TÜV-Rheinland Zentrale	X		X			TÜV-Rheinland (B) Drees-Sommer (B)
Innovative Energieversorgung Köln- Finkenberg	X	X				No partner named
Elektromobil im Betriebsalltag					X	Stadt Köln (M) Peugeot (B)
Smartmeter Nutzung			X			RheinEnergie (B)

In total 23 Projects are listed on the website www.smartcitycologne.de. 19 of those projects have a direct link to energy transition.

Description

See description C1