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Only for the rich?

Low-carbon energy transition in the Vauban

(Freiburg, Germany)

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Abstract

This thesis examines a local low-carbon energy transition in an urban context with regard to energy justice. It takes the Vauban district in Freiburg (Germany) as a case study which has been described as a successful case of energy transition and a model for sustainable urban development. From a theoretical point of view, energy justice encompasses a fair distribution of costs and benefits of an energy system (distributive justice) and a fair decision-making process (procedural justice). This study aims to increase knowledge about the degree of energy justice within the context of an effective energy transition. It hypothesises that the development of the transition has been framed not only by active citizen participation and policy issues, but also due to political affiliations and high income and educational levels. The research questions seek to answer to what extent the Vauban energy transition can be considered consistent with procedural and distributive justice. The methodology is composed by process tracing and descriptive statistics. Data was collected through a literature review, a survey and interviews. Findings reveal that the Vauban's participative approach of citizen involvement showed a high level of consistency with aspects of procedural justice. However, the population of the district is found to have indeed a high level of education and a far above average income compared to the rest of the city. This aspect raises issues of fairness and equity, which are key elements within the distributive justice dimension. Underlying causal mechanisms can be traced back to a variety of national policies and developments that shaped the tense local housing market. Findings suggest that projects such as the Vauban influence the public opinion about energy transitions benefitting only the rich, increasing social segregation in Germany. It poses a threat to the success of the energy transition when social and environmental concerns are played off against each other. Further research is urgently needed on how to design policies and projects to counteract this development. The thesis provides knowledge for the ongoing debate in Germany about energy-related modernisation of districts and buildings in the context of gentrification and inequality.

Keywords: Energy justice, Vauban, Freiburg, Energy Transition, Urban development, inequality, renewable energy

Executive Summary

Given the **problems** of an increasing population and energy demand, related greenhouse gas emissions, economic growth and effects on the planet's climate, a low-carbon energy transition is urgently needed. Within this context, a high number of low-carbon energy projects that failed due to local resistance demonstrate that this transition is not only a technological but also a social and ethical challenge. While there is a rich body of knowledge regarding failed energy projects and initiatives, very few successful cases have been analysed to understand how decision makers and communities dealt with ethical issues of justice and equality during the transition process.

Albeit not new, **energy justice** has been rediscovered by scholars and practitioners as an analytical framework to describe and understand energy projects and policies and their impact on social (in)-equality. From a theoretical point of view, energy justice encompasses a fair decision-making process with unbiased decision makers, an inclusive consultation phase and transparent information sharing between decision makers and the affected population (procedural justice). It also encompasses a fair distribution of costs and benefits of the transition and resulting energy system (distributive justice).

In the context of Germany and the national energy transition *Energiewende* the issue of energy justice is particularly **relevant** because the transition has been found to increase social segregation. Mainly by burdening low-income households through taxes and potentially increasing housing prices and rents after energy-related refurbishments and modernisations of buildings or districts take place. The crowding out of low-income tenants due to energy-related modernisation has been a polarising subject in the public debate where environmental and social concerns are played off against each other. Empirical data about those cases and the underlying causal mechanisms are however rare.

This thesis aims to increase the knowledge about energy justice in successful local energy transitions. It takes the **Vauban** district in Freiburg (Germany) as a case study, which has been described as a successful case of energy transition and a model for sustainable urban development. Triggered by protests against a planned nuclear power plant in proximity to Freiburg and the tense housing market situation, the city of Freiburg decided to develop the new district Vauban in 1994. The Vauban has been constructed on an old military base in southern Germany and belongs to the City of Freiburg. The district has around 5500 inhabitants and is based on a holistic sustainability concept that includes low-carbon transport and traffic as well as waste and storm water management. Special emphasis is given to the innovative energy concept of the city district. It encompasses a woodchip-based cogeneration plant, high energy efficiency standards for all buildings, solar and PV installations, zero and passive houses as well as energy-plus houses. Even though the Vauban has received international attention and a number of awards for the participative approach and the sustainable project outcomes it is criticised on the local level to be a district for the *"rich and green"* only.

Therefore, this thesis **hypothesises** that the development of the transition has been framed by active citizen participation and policy issues, and eventually resulted in a district whose inhabitants are characterised by political affiliations and high income and educational levels. The

research questions seek to answer to what extent the Vauban is consistent with procedural and distributive justice.

The **methodology** is composed by theories of justice (procedural and distributive), process tracing, and descriptive statistics. Process tracing is used to primarily identify underlying causal inference leading to the observed project outcome over time. Data was collected through a survey among Vauban citizens with regard to their income and education level and interviews with key stakeholders of the transition process in the Vauban. A literature review about the subject was also carried out. Main data sources for the literature review were planning documents and evaluations from the city of Freiburg and the Vauban district association.

Findings confirmed the hypothesis and revealed a high level of consistency with aspects of procedural justice but shortcomings with regard to aspects of distributive justice.
With regard to procedural justice the decision making process was found to be transparent and the citizens were able to not only voice their opinion but also alter the plans of the city according to their ideas. Even though the city has been perceived as biased in terms of being more interested in profits through property sales than in the well-being of the community by the citizens, information was fully disclosed, timely and objective and the citizens of the Vauban were highly involved in the design of the district. This was supported by the institutional representation through a new found NGO, the *Forum Vauban*. The NGO organised amongst others an energy working group that informed citizens about financing and installing energy infrastructure, developed suggestions for the energy supply of the district and facilitated a dialogue between the city and citizens
With regard to distributive justice, and from a private point of view, it was found that financial costs were (through property sales) mostly paid by the citizens of the Vauban who also enjoy the benefits of living there. Critical were the survey findings with regard to the distributive justice dimension that the citizens indeed have far above education and income levels. This raises issues of equity and fairness on the city level regarding affordability of the energy transition which questions the Vauban as a district for the "green rich" only. Reasons for the lack of diversity in the Vauban population could be traced back to political and demographic developments during the German reunification in 1990 and resulting policy changes during the project execution. In particular the withdrawal of the state from social housing that lead to severe cuts in the federal housing promotion act, the abolition of the housing allowance that used to support low-income families, and the defined rent control of only ten years. These policy changes resulted in less social housing being realised than initially planned. The short rent control caused these social housing units to be rented out for the (high) market margin after ten years only. Consequently, affordable housing is hardly accessible anymore in Vauban.

The thesis **contributes knowledge** in the field of energy justice where despite high consistency with procedural justice outcomes seem to lack distributive justice particularly from a broader societal perspective. The Vauban case suggests that accessibility and affordability of (successful) local energy transitions are key issues that need to be considered in the energy justice discourse, particularly from a social equity point of view. The case also illustrates the impact of national policies - as alternative explanations for the transition - and the withdrawal of the state from social housing on the local level. That is to say, despite the goal of a socially mixed district and

active citizen participation the Vauban became a district for the privileged only. This provides valuable insights for the ongoing debate in Germany about energy-related modernisation of districts and buildings in the context of gentrification and inequality. It stresses the role of the local housing market that superposed the goal of a socially mixed sustainable model district. Even though empirical evidence about other districts is rare, the thesis indicates that in growing urban areas with tense housing markets strong local policies and resources to support affordable housing are needed if a social mix in energetically modernised districts is considered an important development goal. These policies could include prolonged rent control and financial support for low-income households for acquiring property and home. Without effective policy changes expensive model districts such as the Vauban will continue to shape the public opinion that sustainable development and the energy transition in particular only benefits and can be afforded by the rich. This affects the acceptance for the urgently needed energy transition and poses a threat to its success.

Further research on other cases is needed to understand the processes in different contexts and give evidence-based recommendations on how to design local and national policies to counteract the observed developments. A comparative evaluation of cases and further hypothesis testing are also needed.

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Abbreviations

BZ	Badische Zeitung (Baden Newspaper)
BRD	Bundesrepublik Deutschland (Federal Republic Germany)
CO_2	Carbon Dioxide
DDR	Deutsche Demokratische Republik (German Democratic Repbulic)
GHG	Greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
kWh	Kilowatt-hour
S.U.S.I.	Selbstorganisierte Unabhängige Siedlungsinitiative (Self-organised Independent Settlement Initiative)

1 Introduction

1.1 Background

Even though climate change has been recognised to be a major threat for ecosystems and societies all over the world, green house gas emissions which were found to be the major driver of climate change continue to increase (IPCC, 2014a). The largest and steadily increasing share of the GHG is linked to the energy sector, approximately 35% of the global GHG emissions (IPCC, 2014a). Rapid population growth, scarcity of resources, economic growth and an increasing energy demand that is estimated to cause between 24 and 33 $GtCO_2$ per year in 2050 require strategies on a global and local level to supply energy in a manner that is safe for humans and the environment (GEA, 2012).
This becomes particularly relevant in urban regions where the energy demand is high due to dense population and economic activities (IPCC, 2014b). Furthermore, urban economies, infrastructure, services and residents are highly dependent on electricity (IPCC, 2014b). If energy supply is interrupted or unreliable the consequences are far-reaching and impact many peoples everyday life.

Currently, energy systems are linked to climate change, pollution and related health issues (GEA, 2012). The need for a rapid decarbonisation of the energy sector and a transition towards low-carbon and renewable energy sources is vital for climate change mitigation (IPCC, 2014b). Renewable energy sources include wind and solar power as well as biogas, biomass or geothermal power (EU Directive 2001/77/EC, 2009). Their low CO_2 output allows to mitigate climate change and maybe even foster sustainable and equitable economic development by addressing issues of energy access, supply and local environmental and health impact (IPCC, 2014a). Low-stabilisation targets require an increase of low-carbon electricity supply to approximately 80% of the energy mix until 2050 (IPCC, 2014a).

The transition towards low-carbon energy solutions needs to ensure a safe, affordable and environmentally-friendly energy supply. Past experiences have shown that realising energy projects poses not only technological and economic but also social and ethical challenges (Gross, 2007; Thele, 2008). While the civil society in Germany continues to support renewable energy in general (Rückert-John, J., I. Bormann, R. John, 2014) the transition towards renewable energy is characterised by a large mobilisation of resistance against modernisations and construction of power generation and grid infrastructure. This residence is not only against high-risk nuclear energy (Thiel, 2011) or the modernisation of coal fired power plants e.g. in western Germany but also against wind parks (Twardella, 2013), geothermal and biogas plants (Leßner, 2010) and high-voltage direct-current overhead power lines (Dehos, Grosche, Pophof, & Jung, 2013). The debate evolves around landscape values, health risks and restricted quality of life. While there is widespread recognition of the goals of the energy transition (Rückert-John, J., I. Bormann, R. John, 2014), the observed resistance and mobilisation point towards a lack of social concensus on *how* to manage a sustainable energy transition on the local level (Großmann, Schaffrin, & Smigiel, 2017). Transition and conversion processes are seldom uncontested processes. Renewable energy projects are often accompanied by protests on the community level because of large infrastructure or lack of consultation and transparency (Gross, 2007; Thele, 2008).

Developing low carbon energy systems requires consideration of social justice otherwise the transition process might even increase social inequality (Heindl, Schüßler, & Löschel, 2014). This impacts acceptance and success of the energy transition process.

Adaptation of energy systems is often regulated on the national level but urban governments and residents themselves can also play a key role in the process (Hammer et al., 2011). The importance of participation during the transition process has been stressed by researchers from various disciplines; but even participatory approaches bear the risk of exacerbating inequality within cities by favouring those neighbourhoods with high social capital who are able to benefit the most from participation opportunities and community-led action (Pelling, Manuel-Navarrete, & Redclift, 2012; United Nations Human Settlements Programme, 2007).

In the context of urban development in Germany energy justice has emerged on the political agenda after the United Nations Earth Summit on Environment and Development in Rio 1992. At the international level community initiatives and actions have been inspired and justified by the IPCC reports and the Paris agreement in 2015, while on the national level they are encouraged by the ambitious goals of the *Energiewende* (the German transition from fossil and nuclear based energy supply to renewable energies and increased energy efficiency). All federal states in Germany have set climate protection goals and many municipalities introduced and implemented strategies for sustainable urban development. Energy justice in urban development consists of urban building and planning to decrease emissions and increase energy efficiency. Another goal is to curb effects of energy poverty in Germany.

1.2 Towards energy justice in Vauban?

The current transition process allows rethinking of how to allocate costs and benefits of energy production and consumption among citizens and generations. While there is a rich body of knowledge regarding criticised and failed energy projects and policies very little is known about successful cases and how communities and decision makers dealt with justice and equality during these successful projects. This paper aims to explore the case of the Vauban and analyse the role of energy justice in this case.

Justice does not only relate to the distributive outcomes of a project or a policy but also to procedural aspects that lead to the outcome. Procedural justice is concerned with how decisions are made and who can participate in the process (Sovacool & Dworkin, 2015). Important cornerstones for the analysis of procedural justice are therefore the *decision making* process, the role of *consultation* with the community and the issue of *information sharing* during the process. Distributive justice is concerned with the *outcomes* of the decision making process and their distribution among the affected population (Todd & Zografos, 2005).

The problem of acceptance of energy infrastructure development on the community level is illustrated by the high number of projects that have been hindered or prevented by local resistance. Examples can be found in Nepal where Maoist rebels bombed various hydroelectric power stations owned by those they perceived as corrupt and unfair (Sovacool, Dhakal, Gippner, & Bambawale, 2011) or in Norway where the resistance of the local community prevented the erection of the world's largest planned wind park by a company who would gain most profits

while the local community would be stuck with negative externalities such as visual and noise impact, the Havsul-project (Thele, 2008). These cases show that the social challenge is linked to values of fairness and equity.

The Vauban is a mixed-use district in the city of Freiburg in south western Germany. The university town of 220 000 inhabitants is marketing itself as "Green City" and is among other things known for the strong influence of the Green Party, the tense housing market and the solar power hub consisting of a number of larger and Europe-wide operating institutions such as the Fraunhofer Institute for solar energy systems (one of Europe's largest application-oriented research organisations), and the Eco Institute, a research and consultancy organisation for sustainable development (Fraker, 2013).

The tense housing situation is caused by the constant growth of the city due to birth surplus and the influx of students. The mild climate, Freiburg's function as the regional economic centre and its picturesque location between the Black Forest, the Kaiserstuhl vineyards and the Rhine Valley give the city a high quality of life which is demonstrated by local surveys with highest satisfaction values and overnight accommodation numbers (City of Freiburg, 2015b). Freiburg is also located close to Switzerland, around 5000 citizens commute to the neighbour country to work (Hochstetter, 2013). While German citizens spend on average 35% of their net income on rent in Freiburg they spend on average 44% of their income on rent. This is not necessarily a result of high rents only but is also influenced by the comparatively low average income of the university town (Der Spiegel, 2015).

During the 1990s the city bought the former French military base *Vauban* and converted the area into the Vauban district which is known today for it solar architecture, low-energy passive houses and other sustainability concepts such as water protection, green spaces and low-carbon transport. The Vauban project is particularly famous for the bottom-up approach and the local participation during the decision-making process. Today there are around 5500 residents living in the district and the neighbourhood has been described as socially cohesive and architecturally diverse. The Vauban received international attention and several awards and is often cited as a pioneer in creating new patterns of user-developed ecological urban design. The district has set new low energy standards for buildings in Freiburg as well as for the rest of Germany (City of Freiburg, 2014). It has been estimated that the energy supply in the Vauban is around 93% renewable energy and around 7% natural gas (Fraker, 2013). The Vauban has been subject to numerous studies that examined a variety of sustainability related aspects; including the transport concept (Minh, 2016), the technological achievements, the building group approach and the tenement trust (Horlitz, 2012) and the engagement of the local community in the planning process (Bagaeen, 2006; Coates, 2013; Hamiduddin, 2015; Kronsell, 2013; Ornetzeder & Rohracher, 2006)

A selection of national and international awards with the according links can be found in table 1. Listed are awards granted to the city with special regard to the Vauban, awards given to the Vauban itself, and to the solar settlement, a particular famous project within the Vauban that consists of housing units and a commercial centre that generate more energy than is used.

Table 1 Selection of energy related awards for the Vauban

	Year	Award/Mention
Freiburg	2010	European City of the Year
	2010	German Climate Capital
	2012	German Sustainability Award
Vauban	1996	Best practice at UN Conference on Human Settlements in Istanbul
	2002	Dubai International Award
	2010	Best practice at 'Better City-Better Life' EXPO in Shanghai
Solar Settlement	2002	European Solar Prize
	2003	Energy Globe
	2008	Special Award for Energy and Architecture

The case of Vauban has not been examined from an energy justice perspective although it has been cited as a role model for sustainable and modern development (Coates, 2013; Hamiduddin, 2015; Kronsell, 2013).

While the results of the model district Vauban seem to be remarkable at the first glance, the success of the district has been critically discussed at the local level and occasionally in national newspapers where the Vauban inhabitants were compared to the patrician, wealthy townspeople of the Middle Ages (DIE ZEIT, 2011), the Vauban itself was described as an "El Dorado" for the eco-bourgeois (Die Welt, 2011), and a paradise with a shady side because people with average income could barely afford to live there anymore (Die Welt, 2014) . A key issue is that urban sustainability is plausible, but something that only the rich can afford. According to the local newspaper *Badische Zeitung* (BZ) in 2016 the Vauban officially became the most expensive district in Freiburg with regard to rent/m² (BZ, 2017). Even though a target of 25-50% social and subsidised housing and a social mix were originally goals of the project (Vauban Actuel, 1996, 1996, 2001a), the Vauban is perceived as a neighbourhood for highly educated citizens with above average income (BZ, 2012; Die Welt, 2011) who vote for the Green Party. In the local debate about the Vauban and its citizens it is often referred to the election outcomes in the Vauban to stress the unique clientele living in the district. During the last Bundestags elections 44.2% voted for the Green Party. That is twice as much as the city average (which is also very

high compared to the rest of Germany where they have 8.4% at the moment) (City of Freiburg, 2015b).

Table 2 Election results Vauban

Election 2013 (last federal election)							
Bundestagswahl 2013	**CDU**	**SPD**	**FDP**	**GRÜNE**	**DIE LINKE**	**Other**	**Turnout %**
Vauban	10.7	19.1	1.8	44.2	15.0	9.2	85.8
Freiburg	31.1	23.0	4.6	22.1	9.2	10.1	76.1
Germany	41.5	25.7	4.8	8.4	8.6	11	71.5

So far, this perception and its implications for the acceptance of the project have been widely neglected in the evaluation of the district by the city (City of Freiburg, 2014) as well as in academia. Only one paper has been published by researchers who lived in the solar settlement in the Vauban and provided some anecdotal evidence about the high education level of their neighbours (Freytag, Gössling, & Mössner, 2014).

The role of increasing energy standards and gentrification and related issues of social segregation has been debated in Germany but there is a lack of empirical studies to specifically examine correlations. The main barrier is the insufficient data situation since social-statistic characteristics of households, building's energy efficiency standards and costs are non-existent at the small-scale local level in Germany (Großmann et al., 2017).

A critical examination of the Vauban case is needed with regard to its role as model project that is inspiring similar urban energy transition projects in Freiburg and all over Europe.

1.3 Research Objectives

The aim of this thesis is to increase the knowledge about energy justice in the context of urban development and local energy transitions. Albeit not new, energy justice has been rediscovered by scholars and is particularly important in the context of Germany because the ongoing transition towards renewable energy has been estimated to exacerbate social conflicts and thereby threaten acceptance and success of the energy transition of the country (Gawel, Korte, & Tews, 2015; Großmann et al., 2017; Heindl et al., 2014; Schlör, Fischer, & Hake, 2013).

This paper aims to examine the case of the Vauban by applying the energy justice framework. The results of this study could foster the understanding where ethical questions in energy systems appear and how to achieve a sustainable solution based on equity and fairness.

So far, there are few empirical studies only about social consequences of energetically ambitious projects and the threat of increased social segregation through energy-related modernisation and more empirical evidence is needed (Großmann, K. et al., 2014; Holm, A., 2011).

The deductive approach of this thesis encompasses a hypothesis and two research questions.
This thesis hypothesises that triggered by the beginning anti-nuclear-power protests in the 1970s and the German reunification in 1990 the Vauban district was developed with a high level of citizen involvement but became a district for a privileged segment of society only.

The methodological framework to evaluate the Vauban project was composed by aspects of procedural and distributive justice. The hypothesis was tested by a survey that collected quantitative socio-economic data about the Vauban inhabitants. Process tracing was used to identify causal inference that lead to the hypothesised outcome of the Vauban project, key research foci were social and demographic processes and events as well national and regional policies.

The research questions are:

1. To what extent was the decision making process consistent with aspects of procedural justice?
2. To what extent was the allocation of outcomes consistent with aspects of distributive justice?

1.4 Scope and limitations

This study focused on the Vauban as a case study so, naturally, results can only be generalised to a very limited extent. Even though the study focused on one case only it was not possible to capture the true complexity of the development, certain elements or influential factors were certainly overlooked. Furthermore, the focus of this study was on energy related issues in terms of heat and electricity - transport was not considered. The sustainability concept of the Vauban comprises many more aspects and discussions and consultation and decision-making evolved around all of them. Therefore, sometimes it was not possible to untangle perceptions and developments since they were intertwined with all aspects of the project.

Interviews were conducted with a very limited number of stakeholders. Extremely active characters and initiatives probably received more attention in the newsletter or local news coverage which affects the analysis of this study.

In the course of this study sensitive data about income, rent and education level were collected. People were surveyed at their door which means they might feel disturbed in their everyday life by the data collection. During the survey people were clearly informed up front that participation is absolutely voluntary. The same is true for conducted interviews where interview partners also signed a letter of acceptance (see appendix I) stating that they received information about the study and agreed to be interviewed.
Unlike in other countries there is usually no transparency regarding other peoples income, and money is regarded a highly private matter that is not discussed. It seemed unlikely that the Vauban citizens would give out this kind of information to a stranger on the phone or fill out an online survey where they cannot ask questions about the background of the study. The personal

contact with the researcher provided an opportunity to explain the study, answer questions and create a trusting atmosphere. The willingness of people to participate in the survey was possibly positively influenced by a perceived trustworthy, well-educated and non-threatening appearance of the researcher (a high number of participants commented on one or more of these attributes before filling in the survey). Furthermore, telephone interviews wouldn't reach young people who possibly mostly use cell phones, and online-surveys would not reach older people and others who are not actively using the internet. The pen and paper version theoretically allowed contact with every single household in the district. People filled in the survey straight away with the researcher waiting at the door. That provided the opportunity to clear questions and made sure there were only valid responses. On the other hand people might have liked to have more time to read and learn about the topic.

1.5 Audience

The audience for this thesis includes policy makers, urban planners, municipalities as well as practitioners and communities who are facing a transition process and are interested in designing it in a fair and inclusive manner. Obviously, the Vauban district and the City of Freiburg are part of the audience so, for this purpose, the researcher agreed with the district association to write a summary in German for the local newsletter Vauban Actuel. Therefore, the citizens who helped to realise this study get the results delivered to their homes, for free and in their native language.

1.6 Outline

In chapter 2 the methodology is described. The framework of energy justice that serves as an analysis tool is presented and the Vauban district introduced; special emphasis is given to the energy concept and infrastructure. Data collection methods are described and justified. Finally, the data analysis methods are explained and discussed.

Chapter 3 presents the findings. The Vauban, its development and its outcomes are presented from the energy justice perspective. The framework introduced in chapter 2 is applied to organise and present findings from interviews, an in-depth document analysis and a survey.

In chapter 4 the findings are discussed and placed in the ongoing debate in Germany about the national energy transition *Energiewende*. They are contrasted with findings from recent studies in the context of energy poverty, energy-induced gentrification and social segregation.

Chapter 5 concludes with reflections on the thesis procedure, final remarks regarding research questions, hypothesis and audience, and recommendations for further research.

2 Methodology

For this study a variety of methods for collecting and analysing data has been applied. While examining a case study, data is collected through document analysis, interviews and a survey. Process tracing is applied for the data analysis.

2.1 Analytical framework: energy justice

The analysis is based on a framework around the concept of energy justice. Albeit not new, energy justice as such has recently received increasing attention discussed and has been (re)defined by a number of researchers (Heffron & McCauley, 2014; McCauley, Heffron, Stephan, & Jenkins, 2013; Sovacool & Dworkin, 2014). They provide different conceptualisations but they all agree on the importance of two conceptual and analytical key aspects: procedural justice and distributive justice.

The term energy justice originates in the concept of environmental justice (Finley-Brook & Holloman, 2016). Environmental justice has activist origins and emerged in the 1970s due to increased awareness of American citizens regarding the unequal distribution of environmental ills from industrial sites; pollution and other externalities which were found to impact poor and/or coloured communities disproportionally often (Davies, 2006). The result was a social movement concerned with fair or just treatment of all parts of society with regard to environmental impacts (Schlosberg, 2013).

2.1.1 Procedural Justice

Procedural Justice refers to equitable procedures that engage all stakeholders in a non-discriminatory way and ensures access to the decision making process (Walker, 2009). Key evaluation aspects are mobilisation of local knowledge, information disclosure and institutional representation (Jenkins, McCauley, Heffron, Stephan, & Rehner, 2016).

Procedural justice deals with the process of *decision making*. Decision making can be top-down or bottom-up. It is an ethical and political, rather than a scientific and technical task (Hillman, 2004). Fair decision making has been found to be key to develop and maintain legitimacy of rules and outcomes (Fondacaro, Dunkle, & Pathak, 1998). Fair decision making procedures encourage cooperation with all stakeholders (Heffron & McCauley, 2014) and procedural justice requires lack of bias on the part of the decision maker as well as meaningful participation of stakeholders in the process (Gross, 2007; Sovacool & Dworkin, 2015). This means institutional representation of stakeholders (Jenkins et al., 2016) and the ability to be heard (Gross, 2007). In practice it is not only the design but also the timing of this *consultation process* that influences community acceptance. Consultation after decisions were made could trigger protests; early intervention is paramount to consultation (Jenkins et al, 2016).

A key part of the consultation process is *information sharing*. Access of stakeholders to information has been known to potentially encourage democracy, minimise corruption, increase business confidence and foster social stability (Sovacool & Dworkin, 2015). Information sharing can be voluntary or state-induced (Matisoff, 2013). With regard to energy projects special emphasis should be given to timeliness, scope, objectivity and availability of information provided by the proponent (Gross, 2007). Information sharing encompasses not only the disclosure of project

details from the part of the project developer (Davies, 2006) but also the mobilisation of local knowledge (Jenkins et al., 2016). Information sharing can be a driver for encouraging more ethical (Hall, 2013) and sustainable (Hobson, 2006) energy consumption practices as well as for a society's choice of energy production (Schwanitz, Piontek, Bertram, & Luderer, 2014).

2.1.2 Distributive Justice

Distributive Justice is concerned with the allocation of ills and benefits as well as allocation of related responsibilities such as risks (Walker, 2009). In practice, this can refer to the siting of infrastructure, access to energy services, subsidies, electricity pricing, ownership and the share of their income that people pay for energy costs. Distributive justice also looks at allocation of risks and whether poor and less-powerful groups suffer from externalities more than others. This could, for example, apply to children who are more vulnerable to air pollution or low-income groups who suffer more from increased energy prices (Todd & Zografos, 2005). The *outcomes* of decision making can be material outcomes, public goods or bads (Sovacool & Dworkin, 2015). Distributive justice refers to the allocation of these outcomes between entities and the mode of distribution (Sovacool & Dworkin, 2015). Outcomes of an energy transition can be the quantitative energy produced by windmills or the siting of the infrastructure (Jenkins et al., 2016). Distributive justice can also take into account the spatial characteristics of the project outcome. Geographical segregation has an impact on energy justice due to the multiple spatially-embedded characteristics of the location people live in (Bouzarovski & Simcock, 2017). This holds true for the kind of energy, energy consumption levels, and discrimination or stigmatisation. Distributive inequalities are not only manifested in space (Walker, 2009) but space can produce and maintain inequality and discrimination (Bouzarovski & Simcock, 2017). Distributive justice aims at rectifying injustices on the one hand and identifying the underlying causes of these injustices on the other (Dikeç, 2002).

In summary, procedural justice is concerned with how and by whom decisions are made, and encompasses participation and legitimacy as common concepts (Todd & Zografos, 2005). Distributive justice is concerned with allocation of environmental goods and bads; it is based on equity and fairness as common concepts (Todd & Zografos, 2005).

In a nutshell, and in the context of this research, energy just urban development can be understood as an ideal scenario where a decentralised low (or emission-free) carbon energy system supports an interconnected urban/local economic system (and vice-versa) to enhance the quality of life for its citizen. This development is reached without the externalisation of the emissions (i.e. negative externalities) and related social costs and where the potential of renewable energies and sustainable infrastructure is designed in a socially responsible way entailing both supply and demand side issues. Spatial inequalities between and within cities, as well as socio-structural and construction-related inequalities are mitigated and there are fair chances for citizens to participate and design the process (Großmann et al., 2017).

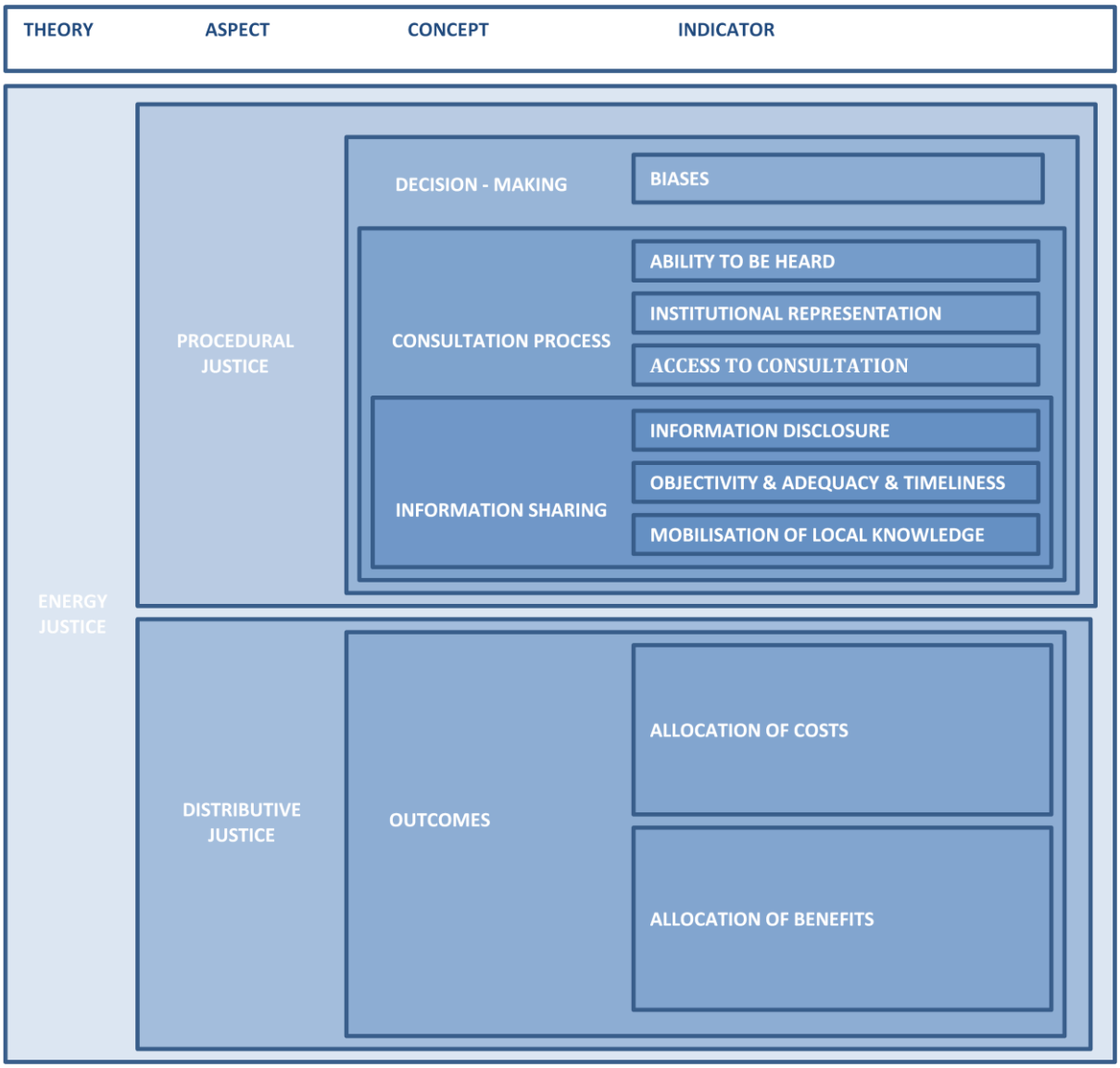


Figure 1 Analytical framework of energy justice (developed by the author)

In the literature, additional aspects of energy justice can be found such as recognition justice (Jenkins et al., 2016), cosmopolitan justice (Sovacool & Dworkin, 2015) or relational justice (Hillman, 2004). Recognition Justice requires equal political rights and representation of individuals with regard to social, cultural, ethnical and gender aspects. Violations of recognition justice are expressed as disrespect, insult or physical threats towards opposition groups (Jenkins et al., 2016). Cosmopolitan justice emphasises the global nature of energy systems and their effects and applies procedural and distributive justice on this large scale (Sovacool & Dworkin, 2015). Relational Justice is concerned with the relationship between stakeholders and the impact of social dynamics on the decision-making process including emotional aspects that are often less tangible than financial interests or formal representation (Hillman, 2004).

This study applies the framework to a project in an urban context with the energy infrastructure being largely integrated in the building and district architecture.

2.2 Case study

This paper focuses on the case of Vauban in Freiburg and will examine to what extent it is consistent with theories of justice**.**

Qualitative case studies provide the opportunity to study a phenomenon within its often complex context by using a variety of data sources (Baxter & Jack, 2008) This single-case study follows a linear-analytic structure, starting with the issue of energy transitions and methods for data collection and analysis before presenting and discussing the findings and their implications for energy transitions (Yin, R. K., 2014). The Vauban case is investigated and analysed in-depth, no claims for generalisability are made (Walliman, 2006). A case study methodology was chosen because the boundaries between the studied phenomenon and the context was not clear and the contextual conditions of the Vauban needed to be covered since they were believed to be relevant to the studied phenomenon; for these circumstances case study designs are recommended (Baxter & Jack, 2008; Yin, R. K., 2014). The unit of analysis is the urban development measure *Vauban* as described below and defined by the city of Freiburg (City of Freiburg, 2014). The examined time frame is between 1994 (the start of the Vauban project) and July 2017 (when the data for this thesis was collected).

2.3 Vauban's development process

The environmental conscience of Freiburg can be traced back to the 1970s when citizens, wine-makers and farmers engaged in joint protests against a planned nuclear power plant in Wyhl, 30km from Freiburg. The protests were directed against irresponsible energy systems, and top-down policy approaches that chose economic value over people. The protesters demanded more opportunities for public participation and transparency in the decision making processes (Mössner, 2015). The Wyhl protests were the beginning of the anti-nuclear power movement in Germany and triggered the development of the Green Party.
The Vauban area has been a military base since the 1930s until the withdrawal of the French troops after the cold war in 1990 (Bagaeen, 2006).

2.3.1 Development Process

After the French troops left the Vauban area, some of the former barracks were quickly occupied by students and a group of citizens who were interested in alternative, affordable, and environmentally friendly housing models (Coates, 2013). The garrison area of 38 ha became property of the federal state. 34 ha were bought by the city of Freiburg for some 20 million Euros in 1993 for an urban development measure to create housing around 5000 people. 4 ha became property of the Studentenwerk and S.U.S.I, an independent neighbourhood initiative aiming to provide affordable and alternative housing. The Studentenwerk and S.U.S.I bought that land, independently of the city, directly from the federal government (City of Freiburg, 2014). Therefore, the urban development measure did not include the student village and the S.U.S.I., even though they are located on the former military area. S.U.S.I and the student village are today part of the Vauban district but played a separate role in the urban development measure that is referred to as the *Vauban project* in this study. Even though (or maybe precisely because) they were not included in the urban development measure they contribute significantly to the social diversity of the district Vauban today.

When the number of interested citizens grew in 1994 the NGO *Forum Vauban* was founded to organise the different ideas and interests in working groups. The city acknowledged the Forum Vauban as planning partner that facilitated citizen participation.
The city launched a competition for the development of a new district on the area. Specifications for this new district encompassed a dense urban design concept, low energy standard for all houses, green spaces, good public access (including new tram) and further social infrastructure such as kinder gardens and a primary school (City of Freiburg, 2014). The competition was won by a team of architects, landscape and transportation planners from Stuttgart. They delivered a master plan that included 2000 housing units. The master plan provided the basis for the citizen participation process. Today the Vauban is called a sustainable model district with regard to not only energy and transportation but also high housing density, green spaces, water and waste management, social cohesion, urban design & architecture.

The citizens pushed for a community centre and a market place, for the option to build according to the passive house standard as well as for the car-reduced transport concept of the district (Stadtteilverein Vauban, 2009). These ideas were not included in the requirements of the city induced competition and the resulting original master plan (City of Freiburg, 2014). The inhabitants of the district enjoy a very high quality of life due to low traffic, a high number of green spaces and the concept of short distances that allows the residents to meet a large part of their daily needs within the neighbourhood (Stadtteilverein Vauban, 2009)..

2.3.2 Energy Infrastructure in Vauban

Several aspects have shaped the transition in Vauban. The innovative energy concept of the Vauban district started with the introduction of maximum energy use standard (or thresholds) in the level of 65kWh/m²/year. The city set the standard and it became an obligation under the purchase agreement with future investors and owners. Before 1995 the standard in Germany was 200kWh/m²/y and from 1995 to 2000 the standard was a maximum of 100 kWh/m²/y (Fraker, 2013). In the Vauban a number of private owners and property developers constructed their buildings voluntarily with a more stringent standard of a maximum of 55 kWh/m²/y. Additionally, there are 170 housing units in passive house standard of less than 15kWh/m²/y (City of Freiburg, 2014). Heating and warm water in the Vauban is supplied by cogeneration plant. This plant entails a short distance heating network which runs on locally sourced FSC certified woodchips and natural gas. All houses, except for the passive houses, are connected to the heating network (Fraker, 2013). Due to the many families in the district the average number of persons per household is higher than in the rest of the city. Research shows that per-capita energy demand of one-person households is almost twice as high as in three-person households and a third higher than in 2-person households (Gill & Schubert, 2012). In general the Vauban district has a comparatively low energy demand per capita since it is the most densely built district in the city despite its numerous green spaces (City of Freiburg, 2015b). An overview over energy standards and energy supply in the district is provided in Figure 1.

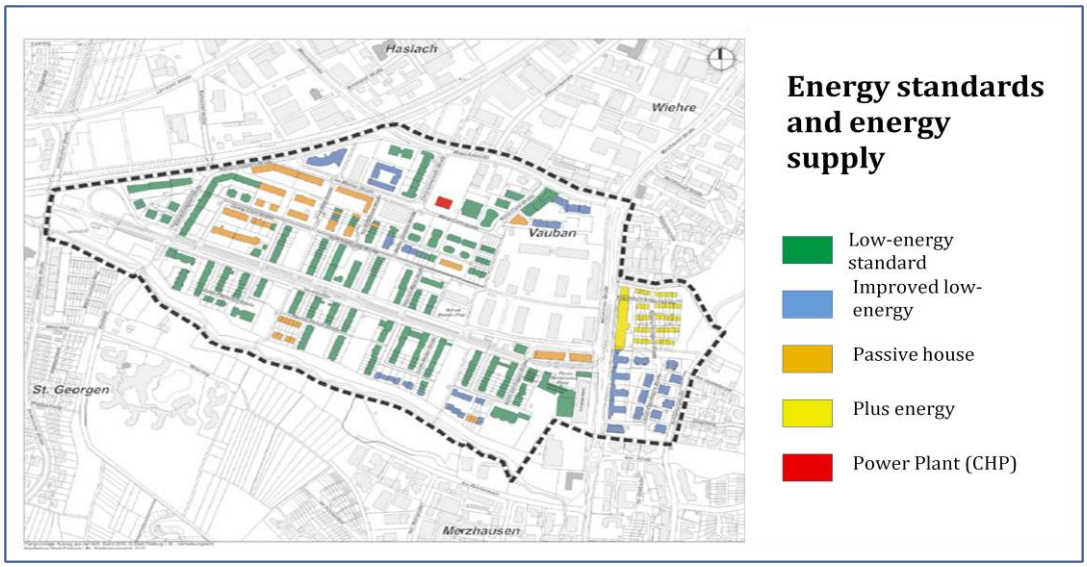


Figure 2 Energy standards and energy supply Vauban

The highest energy efficiency can be found in the ca. 59 housing units of the so called solar settlement. These energy-plus houses produce a positive energy balance due to large photovoltaic installations on the south-facing roofs. The excess energy is fed into the public grid (Stadtteilverein Vauban, 2009). Solar energy is used through around 150 installations in the Vauban. The high density of solar power installations was supported by two financing mechanisms. These led not only to small scale installations on private property but also to large installations on the 'solar garage' and citizen initiatives which realised installations on the neighbourhood centre and one of the two car parks. The latter are cooperatively owned by citizens of the district (Stadtteilverein Vauban, 2009).

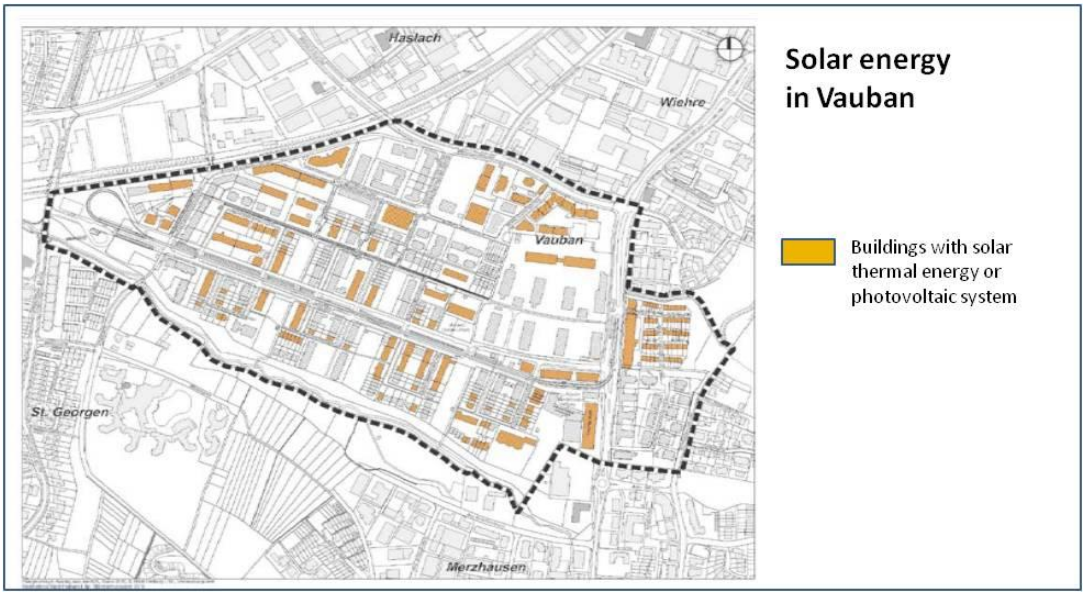


Figure 3 Solar energy in the Vauban

Overall, it is estimated that the energy supply mix feeding Vauban is composed by 93% renewable energy and around 7% natural gas (Fraker, 2013).

2.4 Methods for data collection

Data was collected in the form of documents and reports about the Vauban, interviews with stakeholders and a survey with the citizens of the district. Interviews and survey data was collected in German and translated by the author.

2.4.1 Literature review

Collected data included material about the decision-making process such as academic papers, the project's master plan, information brochures provided by the district association and the city of Freiburg, the local newsletter (bi-monthly from 1996 – today), regional as well as international newspapers and project evaluations conducted by the district association, the city of Freiburg and the university of Aachen. Additionally statistical demographic data collected by the city about the Vauban population was used to evaluate outcomes of the project. All the fore mentioned documents were coded and analysed according to the energy justice analytical framework described in the section above (section 2.2). The applied code is attached to this thesis as appendix I.

2.4.2 Interviews

Semi-structured interviews were conducted with the purpose of providing background knowledge for the researcher and pointing towards issues that were perceived as polarising by the involved stakeholders. The interviews were carried out with the following stakeholders: the mayor of the city of Freiburg, a representative of the district association, and a building cooperative. The actors were identified as critical because of the mayor represented the view of the city as the decision maker, the representative of the district association was a highly involved citizen during and after the consultation phase and could provide a variety of opinions that were expressed from the citizen side within the Forum Vauban and to the public. The representative of the building cooperative was involved in the project from the very beginning and particularly knowledgeable about the developments and policies regarding affordable housing and building cooperatives in the Vauban.

Table 3 Interview partner and contact details

Date	Interview partner	Description	Contact
29.05.2017	Almut Schuster	Building cooperative GENOVA	almutschuster@gmx.de
30.05.2017	Prof. Martin Haag	Mayor of building Freiburg	DEZ-V@stadt.freiburg.de
07.06.2017	Dr. Jörg Lange	District Association Vauban	webmaster@haus037.de

2.4.3 Survey

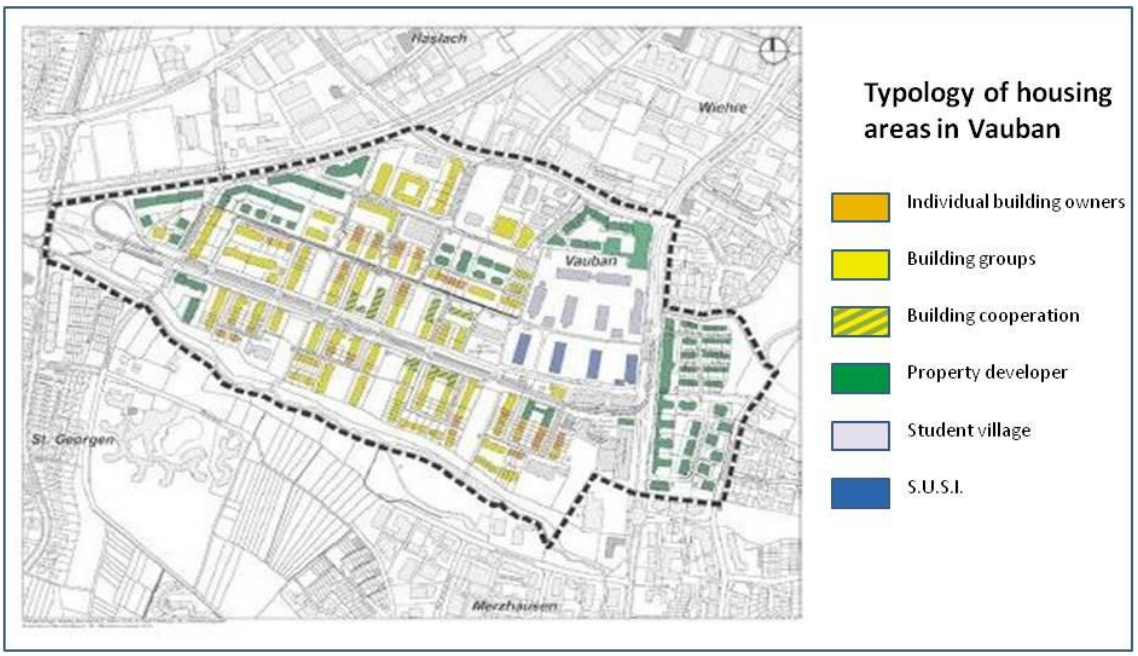
A survey was conducted in the district with the purpose to collect local socio-economic data per household that are not provided by the city or any other institution. The survey data contributes to the findings with regard to distributive justice. Since there was no data available about how much the citizens of the Vauban actually earn and pay for their housing it was pertinent to

conduct a survey. The survey questionnaire is attached as appendix 2. The questions covered the educational level, net household income, tenure or ownership, rent level or financing strategy for the acquired property. These data are considered to be very sensitive information in the German context.

During a two-day pilot phase the questionnaire was tested for comprehensibility and the optimal time during the day for data collection. According to the pilot phase results, data was then collected for two weeks, daily between 16:00h and 19:00h, after a majority of the people came home from work. Data were not collected on Sundays because it might have been perceived as disrespectful or disruptive to people's private life.

The Vauban district as a whole consists of 2531 households, 645 are located in the student village, 45 households or communities registered as households are located in the S.U.S.I. The Student village and S.U.S.I. are not part of the urban development measure and were therefore not surveyed. The 1841 households of the Vauban project were addressed and 171 households answered the survey. This means a margin of error of 7.24% and a confidence level of approximately 85.5%. An overview of the Vauban and different typologies of housing areas is presented in Figure 4 below.

The survey was distributed by the researcher in paper form at the door. It took people one to two minutes to answer the questions. The questionnaire was anonymous and could be folded and put into a closed box with a slit. The researcher collected all questionnaires personally because many citizens had detailed questions about the study before they would give out personal sensitive data such as their income. Every single household in the district was visited once; participation in the survey was voluntary. In cases where nobody answered the door the household was not visited again. The survey was conducted with pen and paper.



All the maps in this study are published, translated and modified with the kind permission of the city of Freiburg © Vermessungsamt Freiburg i. Breisgau

Figure 4 Typology of housing areas in Vauban

2.5 Methods for data analysis

The data analysis included the coding of the documents and interviews and the statistical analysis of the survey data. The findings of these two steps were then analysed by applying the method of process tracing to identify and describe the causal inference that lead to the observed outcomes.

2.5.1 Process tracing

To analyse the findings, process tracing was used to approximate the temporal sequence behind the transformation and thus aspects of distributive and procedural justice. This is a qualitative tool to detect causal inference and involves analysing trajectories of causation and change (Bennett & George, 1997). It requires a full and in-depth description of the process under examination. The objective is to understand political and social phenomena and causal mechanisms and resulting outcomes (Bennett & George, 1997). Therefore, as an approach, process tracing aims at guiding the identification of key events or phases of the process under examination, subsequent outcomes, and whether events are (or not) causes of identified outcomes. Process tracing helps to understand and illustrate the importance of these events for the outcome of the process. In other words, process tracing analysis helps framing a chain of causal events that lead (potentially) to the observed outcome(s).

Process tracing is a methodical investigation of 'diagnostic evidence ', which is "often understood as part of a temporal sequence of events or phenomena" (Collier, 2011). The goal is to scrutinise and link, in this case, the Vauban project outcome (dependent variable) with explanations (independent variables) via the identified causal mechanisms (intervening variables). From a methodological point of view, the main analytical steps involved in process tracing are as follows: An initial event or process took place (1), a subsequent outcome also occurred (2), and the former was caused by the latter (3). Process tracing gives strong emphasis to the development of events and influential factors over time and whether (or not) diagnostic evidence supports a causal connection between dependent and independent variables.

The method of process tracing has some obvious limitations. Importantly, this includes the fact that it is impossible to predict what exactly would have happened in the absence of a certain event. This problem has been termed the "fundamental problem of causal inference" (Bennett & George, 1997). Furthermore, and qualitatively speaking, the complexity of a process cannot fully be causally explained due to issues of covariance of events (many variables combined lead to the observed outcome) and the issue of equifinality (different scenarios lead to the same observable outcome). There is also a certain risk of left-out variables, all the more because the conversion of a rich historical narrative into an analytical description necessarily results in losing certain characteristics (Bennett & George, 1997).

For the thesis at hand, process tracing helped to identify within-case inference about the presence of causal mechanisms. For this purpose the collected data was broken down into sets of relevant events or policies that constituted the process and the (potential) outcome of the Vauban project. As stated in the introduction, the hypothesis that the development of the transition has been framed by active citizen participation and policy issues, and eventually resulted in a district whose inhabitants are characterised by political affiliations and high income and educational levels, was derived from local expertise such as the critical news coverage about the Vauban. The upfront

interviews and the literature review pointed towards numerous policies, events and developments on the local, national and international level which could potentially impact the project outcome. The pre-identified events and policies constituted snapshot-like events that were described and analysed to reduce spurious correlation and to identify an uninterrupted causal chain of events and policies between the hypothesised causes and the observed outcome.

2.5.2 Descriptive statistics

The survey data regarding education level and income data of the Vauban inhabitants was analysed using descriptive statistics.

Income data was collected as ordinal coded data since the readiness of respondents to provide information is usually lower for stating the exact income. The analysis of the survey data encompassed the calculation of the median and mode of income and the comparison to income data on the city level (that is provided by the city of Freiburg). The education level data was used to compare the ratio of the educational level of the district to the city average. The average rent level of the district was calculated and compared to the official rent level for the district and the city of Freiburg. As far as possible, all data was eventually compared to values and the goals of the development master plan from the early 1990s.

From a statistical point of view, the data sample for, assuming a 5% margin of error and a confidence level of 95%, a representative sample size in Vauban for the survey would encompass 334 answers. However, with 171 responses out of 1841 households finally obtained, the results from the survey encompass a margin of error of 7.24% and a confidence level of 85.5% approximately.

3 Findings

The Vauban was examined from an energy justice perspective.
The analytical framework developed in chapter two was applied to the development and the outcomes of the process in Vauban. The hypothesis with regard to the socio-economic characteristics of the Vauban residents was tested and underlying causal inference was traced back to the anti-nuclear protests in 1970 and the German reunification in 1990.

The findings are based on an in-depths analysis of a wider range of documents including the evaluation by the city of Freiburg, literature and academic papers about the Vauban, the local newsletter 'Vauban Actuel', regional newspapers and a survey with the residents of the district.

3.1 Procedural Justice

The decision making process regarding the Vauban encompassed not only energy related issues but also a variety of other socially or environmentally relevant aspects. This study focuses on energy related issues, also because the participatory process and other topics such as the traffic concept have been described before (Coates, 2013; Fraker, 2013).

3.1.1 Decision Making

As described in chapter two a key element of a just decision making process is an unbiased decision maker (Gross, 2007; Sovacool & Dworkin, 2015). In the case of Vauban diagnostic evidence suggests that at least part of the citizens perceived the city (who is effectively the decision maker) as disproportionally "interested in profits" and less passionate about the sustainability idea of the district. This becomes clear by a high number of articles in the local newsletter (Vauban Actuel, 2004b, 2005a) and an interview with a citizen for a national newspaper where the citizen states that the mayor of Freiburg was in his opinion neither interested in ecological lifestyle nor citizen participation (DIE ZEIT, 2011). The local newsletter was reflecting this perceived bias in at least three particular cases: First, the citizens were voicing their wish for a community centre and a market square to enable social exchange and a space for district festivities. The city planned to sell the area for another construction but finally agrees to both, the community centre and the large market square; this was perceived as a higher interest in profits than in the well-being of the neighbourhood. The second issue was the forceful removal of the collective commando for the construction of a new hotel at the entrance of the district (Coates, 2013). The commando rhino was a collective of alternative box-car dwellers who lived in the Vauban for several years until they were forcefully removed by the police. While they certainly contributed to the social diversity and the open-minded esprit of the Vauban district they also settled on a property that the city eventually converted even into an eco-friendly hotel that also offered a number of jobs for disabled people. Again this was perceived as counterproductive for the social diversity and well-being of the neighbourhood. With regard to social housing there was the case of the initiative *Drei5Viertel* who wanted to convert old barracks in affordable housing but didn't get the approval of the city, the barracks were demolished instead. Even though this decision was justified by the city with reference to the financial planning of the initiative it was criticised by citizens that the city deliberately gave up an opportunity to provide affordable housing in this district that was according to them more and more becoming a neighbourhood for the privileged (Vauban Actuel, 2004a). Even though theses biases didn't directly emerge during discussions about the energy concept they are mentioned

here because they impacted the perception of the decision maker in general. The citizens repeatedly voiced their perception that they had to battle the city and fight for their ideas during the realisation of the Vauban. Some battles such as the community centre and the market place are perceived as successful, some other battles as lost (Vauban Actuel, 2006b).

It can be argued that the local newsletter was most likely written or at least influenced by individuals who took a very proactive role in the consultation process. Even though this opinion was evidently voiced doesn't necessarily mean that it reflects the majority of the citizens who were involved in or affected by the decision-making.

3.1.2 Consultation Process

A just consultation process according to the energy justice framework ensures access of the impacted population to the decision making, institutional representation of the population and their ability to be heard (Gross, 2007; Sovacool & Dworkin, 2015).

Access to the decision-making was ensured by a formal meeting at the town hall initiated by the mayor. This meeting was open to everybody and its purpose was to inform interested citizens and open the official participation process (City of Freiburg, 2014).

Soon after the initiation the citizens were **institutionally represented** by a new found NGO, the Forum Vauban which was funded by the City of Freiburg, the German Federal Foundation for Environment, and the EU's environment programme LIFE (Stadtteilverein Vauban, 2009). The city recognised the NGO as a formal partner that facilitated the participation process. The Forum Vauban organised several working groups as an opportunity for interested citizens to become active in the planning process and issued the local newsletter that became a steady information platform in the district. Of particular relevance for this study is the energy working group. Together with the energy supplier that is today known as Badenova (formerly called FEW, Freiburger Energie- und Wasserversorgung) the forum Vauban organised informative meetings about energy-efficient building systems, energy-efficient construction, district heating and solar energy and related funding opportunities for private households; invitations for the meetings and conclusive information was published in the local newsletter (Coates, 2013; Vauban Actuel, 1998a).

Other players with regard to institutional representation of citizens are S.U.S.I , the student service centre Studentenwerk and the building groups as well as cooperations such as Genova (Coates, 2013; Stadtteilverein Vauban, 2009). S.U.S.I and the Studentenwerk started using the barracks before the official district planning began and even though they are an important part of the district, they had a special external role in the planning process. The Studentenwerk turned barracks into student housing. Genova is a building collective providing 73 apartments, most of them rental, for intra-generational and community oriented housing. Their concept includes common spaces for the inhabitants as well as flexible arrangements that allow adjusting the flat size to the needs of different life stages e.g. reduced space after the children move out and barrier-free concepts for the elderly. Finally, influential institutional representation was reached through the concept of the 45 Baugruppen which consisted of between 10 and 20 families or parties and were free to set energy and insulation standards for their building and significantly contributed to achieving the energy goals of the district (Coates, 2013).

An important factor in terms of procedural justice is the question whether the citizen's **voice was heard** during the process, in other words whether their concerns or suggestions were taken into account and acted upon. A key contribution of the citizens was the addition of passive houses to the planning concept; the city adjusted the plot plan and the north-south orientation of a number of properties to allow construction of passive houses (City of Freiburg, 2014). The suggestion to introduce a collaborative ownership scheme for the district heating was not pursued, it is owned by the energy company Badenova. The consultation process was also evaluated and published by the Vauban citizen Carsten Sperling; even though he describes the participation process with all its difficulties in detail he comes to the conclusion that the participation was a positive experience and contributed significantly to the realisation of the project (Sperling, 1999). Additionally, the participation process during the consultation phase has been evaluated by a number of external researchers and was found to be setting a good example (Coates, 2013; Fraker, 2013).

A key concern regarding procedural justice and access to the decision-making process involves the premise of citizen involvement in the Vauban. Except for the S.U.S.I. who was primarily concerned with the occupied barracks the consultation process was mainly interesting for individuals or families who assumed they could be living in the district in the future. These were naturally those who (either individually or as part of a building group or cooperative) planned to buy property and build a house on the area. This requires capital: in the 1990s it was common to own at least 10% of the needed capital because otherwise the interest for a bank loan is substantially higher. This also constitutes one of the main reasons why Germany is a rental nation (Clark, Deurloo, & Dieleman, 1997). It can therefore be argued that the consultation process addressed primarily citizens of Freiburg who had (or had the prospect of having) enough capital to build a house. Thereby hindering involvement of low income groups who can't be sure to get access to a housing unit in the new neighbourhood and who might therefore be more reluctant to invest time and effort in shaping the district through their involvement.

3.1.3 Information sharing

Information sharing is a defining feature for procedural justice; important aspects are the full and timely disclosure of information as well as their objectivity and adequacy (Gross, 2007; Sovacool & Dworkin, 2015). Furthermore, information sharing includes more than a simple top- down information of citizens, it also requires the mobilisation of local knowledge (Gross, 2007).

In general, information was shared during public meetings, local newspapers and the local newsletter of the Forum Vauban, *Vauban Actuel*. The master plan of the Vauban project was fully disclosed early on in the process; (City of Freiburg, 2014; Vauban Actuel, 1996).
All information regarding energy costs, advantages and disadvantages of renewable energies or planned activities were found to be timely, objective and adequate. There were no complaints about unsatisfactory information found during this study.

Local knowledge about renewable energies, insulation material and installation of energy infrastructure was mobilised through the working groups of the Forum Vauban. They worked not only with issues of energy but also traffic concepts, social activities in the district and many more. Another mobilisation of local knowledge happened through the building collectives where local architects and engineers transferred their ideas into practice; examples are ecological insulation material for better energy efficiency and the application of solar power. The most

famous example is architect Disch who designed the solar settlement with the energy plus houses.

Findings reveal that the development of the district can be considered as mostly consistent with aspects of procedural justice even though the city has been perceived as biased by the citizens. Information and was fully disclosed, timely and objective and the citizens of the Vauban were highly involved in the design of the district. Citizens were mostly organised in building collectives or cooperatives. It is worth noticing that a certain amount of capital is needed to join these organisations. Citizens were institutionally represented by a number of associations such as the Forum Vauban and later the district association, as well as several working groups. These institutions ensured access to the decision-making process and the citizens voices were heard in not all but many cases.

3.2 Distributive Justice

Distributive justice refers to the allocation of costs and benefits (Walker, 2009). In the context of the Vauban project the **costs** include possible negative effects and externalities of the energy infrastructure and the financial costs of the project realisation.
The **benefits** of the project are technological benefits but also the quality of life in the sustainable model district.

With regard to distributive justice this thesis hypothesised that the benefits of the Vauban project are allocated to a privileged segment of society only. A survey collected socio-economic data about education and income level of the households in Vauban to test the hypothesis. The observed outcome was then traced back to developments, events and policies that caused this outcome. First of all, the allocation of costs and benefits is evaluated according to the analytical framework of energy justice. It turned out that that is was crucial to differ between private and social costs and benefits.

3.2.1 Allocation of costs

The costs of the project could include externalities due to negative effects of the solar installations such as mirror effects or visual impacts. However, no complaints about externalities have been reported, possibly due to the fact that most solar installations are installed on the roofs and are not visible for the inhabitants. A survey by the local newspaper Badische Zeitung furthermore found that the inhabitants accepted and were satisfied with the district heating system and the local power plant (Sommer & Wiechert, 2014). Not included in this analysis are the externalities that the production of the installations caused in other locations (such as mining for the building materials of the solar cells that are used in the Vauban today).

Financial and private costs of the realisation of the Vauban project have been documented by the city of Freiburg and a commissioned evaluation which was conducted by the University of Aachen in 2014. The results show that 84% of the project costs were financed by the property sales from the city (City of Freiburg, 2014). 5% were financed by a national restructuring programme (in German Landessanierungsprogramm), 11% were covered by other developmental revenues, and 1% was covered by the city budget (City of Freiburg, 2014). Financial support from the city was only used for site remediation of the old military area and the integration into the public transport network of Freiburg. Consequently, financially the district has been realised

with the capital of the citizens (and property developers) who bought property. No significant costs were burdening budgets of other districts or the city of Freiburg.

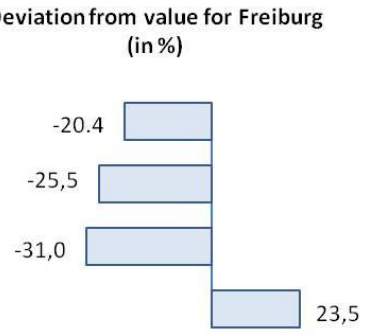
These findings reveal a high level of consistency with aspects of distributive justice.

3.2.2 Allocation of benefits

A critical issue with regards to energy justice is the allocation of **benefits** (Walker, 2009). The benefits of the district as mentioned above are naturally mainly enjoyed by the inhabitants. The original plan aimed at a fair distribution of the model district in terms of a socially mixed neighbourhood. In an ideal scenario, all parts of society would have the chance to live in the Vauban and enjoy the diverse benefits of the model district. Unfortunately, this goal has not been reached. The critical aspect here is the lack of diversity in the population of the Vauban which implies an unfair distribution of the social benefits. According to the city statistics (see table 3) the residents are mostly young German families. The district was by default attractive to young families due to the financing instruments and the location at the outskirts of the city. Foreigners and elderly people are underrepresented compared to the city average. The average age is 31.8 years which is 20.4% lower than the city average. The foreign population share is with 11.8% 19.2% lower than the city average. The average household size is due to the families 2.2 persons and thereby 23 % higher than the city average (City of Freiburg, 2015a). In an interview with the Vauban Actuel in 2001, a representative of the city of Freiburg stated that the goal of a mixture of all parts of society had definitely not been reached (Vauban Actuel, 2001b).

Table 4 Vauban in comparison with the city of Freiburg

Selected indicators (01.01.2015)	
Average age in years	31.8
Proportion of foreigners (in %)	11.8
Share of Germans with migrant background (in %)	8.2
Average household size in persons	2.2



So far, this homogeneity does not necessarily mean that there is a lack of distributive justice. New settlements are often attracting young families and the city of Freiburg deliberately encouraged this development by granting loans to families. This support was particularly targeting families with three or more children who were documented to be pushed out of the city by the ever increasing rent levels in the early 1990s (City of Freiburg, 2014). Family members grow older, children move out and so the age distribution changes accordingly.

A little more critical are the findings with regard to **education level** of the district. All in all, 82% of the Vauban citizens achieved a university degree (excluding the students and the SUSI), the city average is 27, 8%. While there are no data available for 45 households or communities in the S.U.S.I. the students however are all pursuing a university degree. Many of them might even already have one and as soon as they drop out of a study programme they lose the right to stay in

the student village and a new student moves in. These findings point towards benefits of the project being captured by a privileged segment of society that lives in the Vauban district. This is supported by the survey findings regarding the income of the Vauban citizens. The survey categorised the Vauban citizens in eight income groups: citizens could state whether their monthly household net income was: below 1000 €, between 1000 € and 1999 €, between 2000 € and 2999 € etc. or above 8000 €. The survey was designed this way because it was assumed that the citizens are more used to this question format and more willing and able to state an income group rather than providing their exact net income. On the one hand this simplified data collection; on the other hand it makes it slightly more difficult to compare the results to the city average because that is provided as a precise average Figure.

The average net income per household was calculated based on the average income per capita and the average household size. The average income per capita in Freiburg is 18.890 €/year and therefore 1574 €/month (Fischer B., 2015). The size of an average Freiburg household is 1.8 persons per household (City of Freiburg, 2015b). Therefore the **average income per household in Freiburg is 2833 €/month**. The income level distribution in the Vauban shows an above average income.

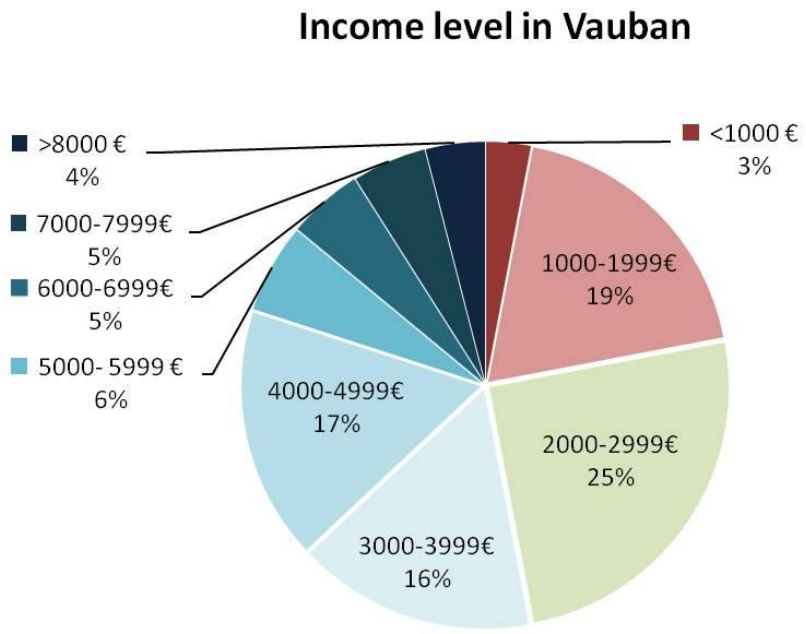


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Figure 5 Income level in Vauban

The results show that, assuming a uniform distribution of data within the classes, the median income of the Vauban households is 3104 €/month. The mean value or average income cannot be calculated due to the fact that survey data was collected as ordinal data (in income classes instead of exact values). However, the average income can be assumed to be even higher than the median income due to the fact that the data set is skewed to the right and the mean is more vulnerable to outliers such as exceptionally high incomes above 7000 €/month (see Figure 6).

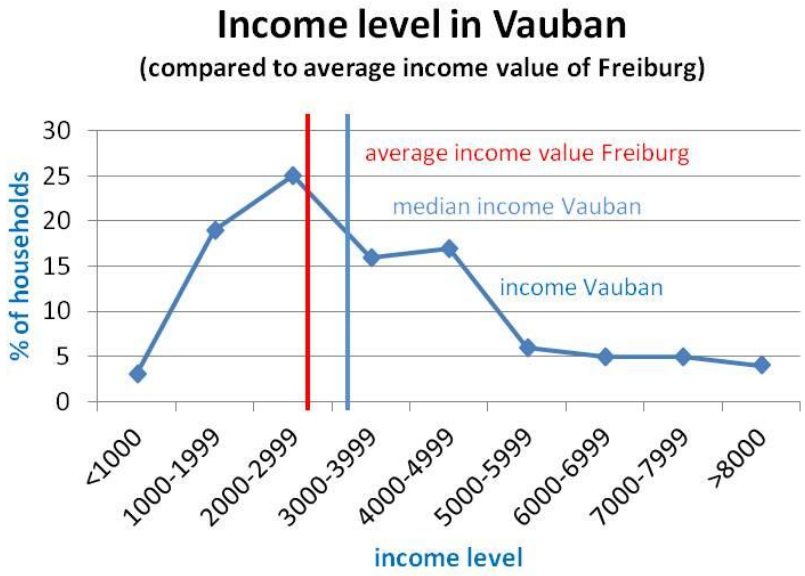

Figure 6 Income level in Vauban compared to average income value of Freiburg

The higher income of the citizens goes hand in hand with the high rent level of the district. While the rent index in 2016 estimated 13 €/m² in this district the survey found an even higher price of 14.31 €/m² this year (BZ, 2017).

Additionally, the cheapest housing options are offered by S.U.S.I. The students in the student village are facing very high prices of 15 €/m² which is outbalanced by the smaller room size and shared common rooms, kitchen and even terraces that allow more living space than the room that is rented. Due to financial restrictions, the barracks of the student village and the S.U.S.I. have the lowest energy standard in the neighbourhood.

Even though the master plan envisaged a strategy for social mix and a 25% goal for state-supported rental housing today there is no state-supported housing in the Vauban. It becomes evident why the local news coverage is more critical than the academic literature that is focusing more on technological outcomes and social cohesion (Großmann et al., 2017). On the other hand building was relatively cheap in the beginning of the urban development measure and the young families who initially settled there and realised their home often with many working hours on the construction site have moved on in their careers, increasing their household income over time. During the door-to-door data collection, the Vauban inhabitants repeatedly stated that while some households were able to increase their income and keep up with the increasing rents or even bought their apartment, other households were forced to leave the Vauban (mainly after the rent control of the social housing expired). This was not subject of this study but would be interesting to verify. The city of Freiburg is providing statistical data about the influx and exodus of the city districts but not about driving forces behind the movement. Further research would be necessary to evaluate the impact of the rent increase on these movements.

The social structure and homogeneity of the district was recognised and criticised early on by the inhabitants of the district and is a reoccurring issue in the Vauban Actuel (Vauban Actuel, 2000, 2001, 2001, 2005b, 2009). In fact, the Forum Vauban sent an open letter to the city as early as 1998 about the fact that the goal of social mixture will be missed if the city doesn't change its

strategy because there was no funding available to realise this goal (Vauban Actuel, 1998b). In 2012 when the last building sites in the area were sold the Vauban Actuel asked provocatively whether the Vauban would continue to be a luxury residential area (Vauban Actuel, 2012a).

In conclusion, the hypothesis that the benefits of the Vauban model district are captured by citizens who are highly educated and show an above average household net income could be verified. The private costs were burdening mostly those who also enjoy the benefits (which is consistent with distributive justice). The social benefits of living in the district are only affordable and accessible for a privileged segment of society; this is not consistent with distributive justice. The underlying reasons for this project outcome are intertwined with the housing market and can only be understood in the context of developments, policy changes and events that are not local but also national. Therefore, the policies and processes and their causal connection to the Vauban are traced back to events in the 1970s and 1990s:

The 1970s were not only the origin of the anti nuclear power movement and the German Green Party but also the time when the natural **population development** became negative in Germany; meaning that after the baby boom generations in the 1950s and 1960s the total fertility rate fell under the level of replacement in 1970 (Schlömer, 2009). While this development was at first counteracted by international immigration, longer living spans of the German population and so called echo effects from the baby boomers, the issue of the shrinking population became obvious in the 1990s and the early 2000 (Schlömer, 2009). Between 2003 and 2011 not even immigration could offset the losses and the Germany population was shrinking until the Euro Crisis in 2010 caused a new wave of immigration (Bertoli, Brücker, & Moraga, 2013).

The German reunification in 1990 when the German Democratic Republic (DDR or East Germany) joined the Federal Republic of Germany (BRD or West Germany) had an impact on the demographic development as well as on the population distribution within the country: While the eastern part of Germany suffered from significant population losses due to emigration to western Germany, the western federal states experienced population gains, especially Baden Württemberg where the strongest population increase of more than 11% since 1990 took place. Within Baden Württemberg, the immigration gains of Freiburg im Breisgau are among the ten highest out of the 44 city and rural districts since 1990. As stated in chapter 2 the university town has an exceptionally high appeal for citizens from Germany and abroad.

Furthermore, the reunification meant a significant financial burden for the united Federal Republic of Germany. Estimates put the total costs of the reunification as high as 2 trillion Euros, mainly consisting of DDR liabilities, transfer payments and other unification-related expenses (Fuest & Thöne, 2008; Ritter, G. A., 2007).

The prospect of a shrinking population was expected to naturally solve the issue of housing shortages and the need for social housing. Following the general trend of transferring responsibilities from the federal level to the state level while providing very little additional resources and competences, the federal state started to withdraw from supporting social housing. The federal housing promotion act, in German **Wohnraumförerungsgesetz (WoFG, 2001)**, transferred the responsibility of providing social housing to the federal states in 2002. The national government supported the federal states in a transition phase from 2002 until 2006 with

yearly financial aid and in 2006 social housing became the responsibility of the federal states alone. The housing allowance, in German **Eingenheimzulage (EigZulG, 1995)**, which was supposed to support low-income marginal households was abolished in 2006. This law also had implications for the building cooperations which were facing drastic and sudden financial cuts due to this policy change. The combination of the massive financial burden on the government budget since the reunification and the prospected natural relaxation of the housing market because of the shrinking population lead to a decrease in subsidies and the amount of realised rental apartments (Holm, 2006). The discrepancy between the responsibility of the federal states and their actual capacity to act has already been emphasised by the Council of Sustainability in 2004 (Institut für Organisationskommunikation, 2004). The state can influence social housing via property, funding and legal regulation. Property means public stocks and the state as public housing association; funding includes funding volume and support schemes; and legal regulation consists of rent control and protection against dismissal (Holm, 2006). The reduction of the state involvement affects particularly the aspects property and funding. The housing policies during the last decades were characterised by large scale privatisation and a significant reduction in subsidies for social housing (Holm, 2006).

While these changes in the social housing policy were induced by the overall development of the country, regions for which the demographic prospects didn't hold true were facing serious challenges with regard to housing provision. In Freiburg, these circumstances lead to at least two innovations: the tenement trust (in German Mietshäusersyndikat or MHS) and the idea of the building groups (in German Baugruppen). Both concepts can be seen as citizen's reactions to the lack of state involvement and the tense housing market.

The concept of the building group has been portrayed above as an association of home builders who cooperatively construct a building by applying for the site together, simultaneously reducing the building cost per group member by up to 20% or even 30%. This is, mostly because material could be purchased cooperatively, architect costs could be divided and the work force of the members themselves was often used for construction (City of Freiburg, 2014; Stadtteilverein Vauban, 2009). The tenement trust is an organisation connecting independent house projects that provide self-sustained affordable community housing while preventing privatisation of the housing project. The MHS concept has the main function to support new housing initiatives and transfer knowledge, experience and resources from mature projects to new initiatives. Even though the funding for social housing was cut back, a strong citizen movement in Freiburg prevented the city from privatising more than 8000 apartments by collecting signatures (Vauban Actuel, 2006a).

For the Vauban and its goal for affordable housing these two innovations became a key function. The building groups allowed relatively cheap construction for young families in the 1990s. The S.U.S.I who are part of the tenement trust (or MHS) are today providing, by far, the cheapest rental housing options in the district (5.30 €/m² in S.U.S.I and on average 9.90 €/m² in GENOVA). Despite this success, the developments took their toll in the Vauban: the 25% target of social housing was not reached due to lack of funding (Vauban Actuel, 1998b) and the cooperation GENOVA only realised half of their planned apartments (Vauban Actuel) due to the cut in subsidies for cooperatives in 1998(BZ, 1998).

One last but influential factor to consider is the **rent control**. Social housing is usually financed by private investors, communal enterprises or co-operatives. They get subsidies or attractive loans from the state. In exchange, these apartments are subject to rent control for a certain amount of time and, therefore, relatively low-priced. They can only be rented out to specific groups such as people with low income. The original rent control for many apartments in the Vauban has expired after 10 years (a comparatively short period of time, in 2015 the rent control was extended to 25 years) and could afterwards be rented out according to the competitive market price (Vauban Actuel, 2012b). Therefore, the limited rent control caused a long-term deterioration of the housing situation in the neighbourhood (Vauban Actuel, 2012).

Figure 7 summarises the developments: The reunification of Germany in 1990 meant a considerable burden on the German government's budgets. Furthermore, demographic factors indicated a shrinking population of Germany which was supposed to naturally relax the housing market situation (TAZ, 2016). Accordingly, funding has been cut for the state-funded housing programme which led to the reduced number of rental affordable apartments in Vauban. In addition, the rent control was limited to only ten years (also with regard to the expected relaxation of the housing market), which meant that the few apartments that were constructed as social housing turned into market priced housing options over time and are no longer affordable for low income households.

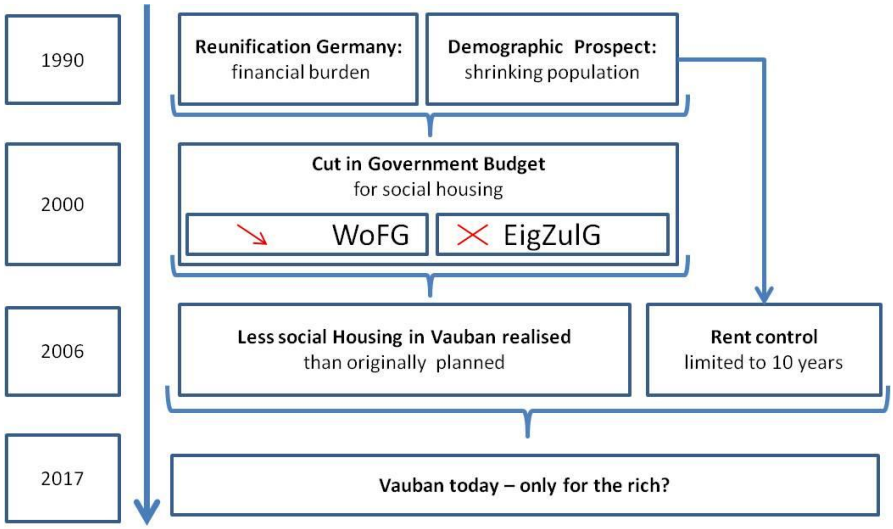

Figure 7 Overview analysis results

These developments show that the Vauban as the so far newest district in Freiburg (currently two more are under construction) evolved during a change in political circumstances and in a period of withdrawal from social and affordable housing.

Nevertheless, the Vauban case seems to lack distributive justice, in particular from a societal point of view. The findings question the 'accessibility' and 'affordability' of the successful local energy transition of the Vauban to people of (relatively) low-income and education. This fact didn't escape the public in Freiburg and there is cause for concern that it contributes to the perception that low-carbon energy in general is for the rich only.

4 Discussion

The findings are discussed in the context of the results of this thesis, the ongoing debate in Germany about the general issues of social justice, risk of poverty and segregation, and the energy related aspects of energy poverty and energy induced gentrification. Furthermore, the findings are briefly confronted with emerging energy justice literature.

In Germany, statistics clearly show an **increasing risk of poverty** as well as an **intensification of social segregation** within cities (PWV, 2017). This is illustrated by many western German cities with a strong north-south-division such as Düsseldorf and Dortmund. Reasons for the observed segregation have been found to be manifold: demographic and economic developments on the macro level, influence of stakeholders such as municipalities and housing enterprises on the meso level and behaviour and migratory related choices of individuals based on their social, economic and cognitive and cultural resources. Usually the upward trend in rents in large cities plays a much more important role than the heating costs (Großmann et al., 2017).
In relation to renewable energy in particular, the debate evolved around two main issues: energy poverty and gentrification through energy-related renovations and high energy standards of buildings (Heindl, 2014; Heindl et al., 2014; Welz, J. & Grossmann, K., 2017).

The discussion about **energy poverty** in Germany has focused mainly on the renewable energy law (in German Erneuerbare Energien Gesetz (EEG, 2000)) which has been found to severely impact low-income households (Grösche & Schröder, 2014; Heindl et al., 2014). The EEG promotes a renewable energy mix in the German electricity supply through a feed-in tariff. The tariff shapes the income distribution in Germany by charging a levy (in proportion to the household's electricity consumption) and transferring these resources to households who installed renewable energy installations and manage to feed in this electricity into the public power grid. The redistributive effects of the EEG have been found to be regressive with regard to a number of inequality indices, meaning that households who can already afford initial investments in e.g. solar energy are practically subsidised and supported by households who can't (Grösche & Schröder, 2014). The debate around energy poverty was inspired by the United Kingdom where energy poverty is defined as a state where a household is spending more than 10% of its income on energy services such as heat and lighting (Day, Walker, & Simcock, 2016). In Germany the term is not fully defined yet, it is based on the British definition but rather limits energy poverty to lower income groups while in the context of the British definition high income households with high energy consumption could theoretically still be considered energy poor. On the EU level there is an emerging definition of energy poverty as a state where households or individuals are not able to adequately provide required energy services (such as heating) in their homes at affordable costs (Team & Baffert, 2015). This definition is likely to develop further and impact the discussion about energy poverty across the EU member states. In the context of energy poverty, the Vauban seems to illustrate the fact that buildings with high energy-efficiency and low heating bills are inhabited by the wealthier and better educated parts of society while low-income households are forced to live in districts or buildings with lower energy standards and consequently higher heating bills.

The discussion around **energy-induced gentrification** and social segregation has been a prominent topic in the political debate even though there is very little empirical evidence so far (Großmann et al., 2017; Holm, A., 2011). The debate relates to energy-related refurbishment of buildings on one hand and to energetic modernisation of whole districts or areas on the other. The underlying issue seems to be that energy efficient buildings are designed to save energy consumption costs but new technologies that allow producing, storing and distributing energy within the building are still in an experimental stage. This requires initial investments that are usually added to the property price or the rent (Hallof, I. J., 2013). They initial investments are therefore burdening the private household and expected to be amortised through long-term energy savings (Großmann et al., 2017).
With regard to energy-oriented refurbishment or renovation of apartment buildings empirical studies indicate that these modernisations often come with an increase in rent that is inducing tenant changes and creating gentrification effects (Holm, A., 2011; v. Malottki, C. & Vaché, M., 2013; Welz, J. & Grossmann, K., 2017). These aspects were found to be also pertinent for the Vauban case, as the rent level of the former social housing suddenly and drastically increased after the rent control expired (Vauban Actuel, 2012), forcing the tenants two either spend a significantly higher part of their income on rent or to move out.

These developments have not only been observed for modernised buildings but also in the context of the energy-related modernisation of whole districts. New settlement projects with ambitious energy goals all over Germany such as the Bahnstadt in Heidelberg, the Rosensteinviertel in Stuttgart or the HafenCity in Hamburg are technologically convincing and meet the energy saving regulation by a substantial margin. However, it has been identified that all these projects target the needs of higher income households (Großmann et al., 2017).
The findings regarding the Vauban case stressed the need to evaluate the project outcome in consideration of the local housing market and to track policy changes on the national level. Otherwise, it wouldn't have been possible for the Vauban case to understand how the master plan with ambitious goals for social mixture, the tenement trust and the building cooperations could have resulted in a model district with such high rent levels and a population that shows above average education and income levels.
The importance of the respective housing market and the difficulty of untangling the overall housing market and energy related characteristics of a district were also faced in the context of **other case studies**:
A research team who tried to examine the social consequences of an ecological model project in Hamburg came to the conclusion that these consequences were closely connected to developments of the local housing market. In the case of Hamburg it caused people to move to the model neighbourhood even though there was no identification with the ecological approach or the energy-efficiency standards (Breckner, I., 2013; Krümmel, S., 2015).
Another study was conducted in the eastern German cities of Dresden and Delitzsch where the researchers tried to examine the relationship between energy and building structure and social-economic characteristics of the inhabitants of the cities. Similar to the situation in Freiburg, they expected to find a relationship between high energy-standards of buildings and income and education levels of the inhabitants. The research team had to conclude that there was no clear relationship found due to other factors that superposed the socio-economic characteristics. Their findings suggested that these factors included the local housing market, media and owners

strategies but didn't go further into the analysis of these factors (Welz, J. & Grossmann, K., 2017). Their findings support what the Vauban case illustrated: the local housing market easily superposes the influence of factors such as energy-efficiency and heating costs, and therefore needs to be addressed during the planning and execution of energy and modernisation projects.

So far, the results of the studies mentioned above are supported by the findings of this thesis: to achieve a social mix in a district with ambitious energy goals the **municipality has to become active** to counteract the influence of the tense housing market. This raises the question how much the decision-maker (in the Vauban case the city of Freiburg) considers social mixture and affordability of renewable energy for low-income groups an important development goal and how many resources are therefore allocated to this goal. Allocation of resources could encompass incentive structures for property developers to improve energy-efficiency in social housing, prolonged rent control for modernised buildings, or financial resources for low-income households to support efforts towards increased energy-efficiency.
Proof of the fact that German municipalities can effectively counteract energy-induced gentrification can be found in the example of the "Bielefeld climate bonus": The city of Bielefeld created incentive structures for energy efficiency investments in social housing that turned out to be highly effective and served as a role model for a number of other cities in Germany (Bauamt Bielefeld, 2011). The Bielefeld climate bonus was designed to counterbalance the arising differences net rent levels between renovated and non-renovated housing units. The bonus paid by the municipality adjusts the rent level to an appropriate amount per m^2 for the accommodation.

Community acceptance has been found to be strongly related to the two factors of procedural and distributive justice (Wüstenhagen, Wolsink, & Bürer, 2007). Community acceptance refers to the acceptance of projects at the local level. It addresses local authorities, affected population and other key stakeholders (Wüstenhagen et al., 2007). For the Vauban case, this has shown to be relevant because the perceived lack of fairness regarding who gets to live in the attractive sustainable model district not only aroused displeasure about the Vauban situation but also impacted the local discussion about future urban development: The Vauban case seems to indicate that overly ambitious sustainability goals result in districts for the rich. Consequently, urban planning would have to reduce environmental sustainability and energy-efficiency requirements to allow a socially sustainable urban development which can easily be seen as highest priority in cities with tense housing markets.

A well documented case illustrating the relation between community acceptance and energy justice can be found in a local energy transition of a community in Australia: the town Taralga in New South Wales which became divided by the proposal of a local wind farm (Gross, 2007). By applying an energy justice framework that is based on the same concepts, aspects, and indicators as the one applied to this thesis the researcher found strong evidence for the impact of perceived justice on the acceptance. For the Australian transition project, findings revealed perceived injustice with regard to the procedures as well as consequently perceived injustice of the outcomes. The procedural justice in Australia was perceived as insufficient with regard to perceived biases on the side of the decision maker and a lack of information sharing especially when it came to details about the size of the wind turbines. Plans for the project were announced

relatively late in the planning process without mobilization of local knowledge. The consultation process was perceived as non-existent or simple top-down information with no chance for the local citizens to voice ideas or to participate in the development process. The Vauban project development was characterised by a high consistency with procedural justice. As opposed to the Vauban, the result of the non-transparent project planning in Australia was the formation of a strong opposition against the project. Comparable to the Vauban, the distributive outcomes were perceived to create clear winners and losers within the community. The findings in Australia suggested that lack of justice was the central issue in the conflict and that aspects of procedural justice were perceived as essential for the legitimacy of an energy project such as the wind park (Gross, 2007).

In the context of low-carbon communities in the United Kingdom, researchers compared aspects of procedural and distributive justice in a number of support programmes and schemes led by the government, private or civil society actors. Their findings showed that government-led programmes recognised marginalised groups such as the fuel- or energy-poor whose interests needed to be taken into account but didn't involve these groups in the decision-making process. Private and civil society actor-led programmes on the other hand, emphasised an open process of decision-making but less often considered distributive outcomes of their initiatives. The researchers raised the question whether either of these approaches can realise the goal of a transition towards a low-carbon community that is consistent with distributive and procedural justice (Fuller, S. & Bulkeley, H., 2013). The Vauban case is a solid example for the importance of considering both, procedural and distributive aspects to achieve a just and successful transition. While the procedural aspects of the Vauban development were found to be consistent with theories of justice, the societal distributive dimension of the Vauban negatively influenced community acceptance in Freiburg.

To achieve legitimacy and community acceptance for projects such as the Vauban it seems pertinent to effectively address the **affordability and accessibility** issues of districts with modernised energy systems in an urban context with a tense housing market.

5 Conclusion

The aim of this thesis was to analyse the energy transition of the Vauban district in Freiburg within the context of energy justice. Its primary purpose was to broaden the understanding of low-carbon energy transitions in an urban context and how communities and decision makers deal with and perceive issues of justice and equality throughout the transition process. The Vauban has been hailed as a 'successful' case of sustainable urban development in academia. The thesis at hand examined to what extent this case is also consistent with theories of energy justice.

5.1 Reflection on methodology

A **case study** based research design offered a means to investigate a complex socio-economic phenomenon but it focused on a single unit at a certain point in time. It was rather helpful to describe this phenomenon than to make future predictions or generalisations about other cases. This case study is naturally limited by the sensitivity and integrity characteristics of the investigator. The researcher is identifying, selecting, collecting and analysing data and the case study research is therefore affected by biases due to the researcher's subjectivity.

The energy justice **framework** is a theoretical framework that is most likely not covering all relevant aspects. It has not been applied to many cases and it is most likely that it will be developed and improved in the future. Even though the energy justice framework was applicable to the case study in terms of an ex-post evaluation it was difficult to come to conclusions or recommendations for other cases.

The **survey** was conducted during only two weeks; travelling people did not get a chance to participate. A higher response rate would have added value to this thesis with a second round through the district addressing all the households who didn't open the door during the first round. Since the researcher was conducting the data collection alone for reasons explained in chapter 2, this would have consumed a significant amount of time and was decided against on by the researcher. The survey questionnaire was asking for net income per household (not "brutto"/ before taxes) to avoid disturbance from citizens who work in Switzerland and pay taxes according to a different tax system. In general, it is possible that people were biased and stated a higher or lower net income (depending on what they thought was socially desirable) even though the survey was anonymous.

The **process tracing analysis** might not cover all relevant variables. The impact of individuals or active groups during the process such as members of the city council or within a building group was most likely not credited enough during this study. Even though it is obvious that a project like the Vauban district was highly dependent on the dedication and commitment of individuals, this study did not go deeper into their specific contributions.

5.2 Results and recommendations

Findings based on interviews, a survey and an extensive document analysis revealed a high consistency with aspects of **procedural justice.** This is not necessarily coherent with the opinion of some of the citizens of the district who were involved in the process from the start. In conversations and interviews conducted for this study, and the local newsletter, they stress the "battle" with the city and intuitively state that it was not a fair procedure. While this study aimed to capture and include this point of view, the result is still an overall consistency with procedural justice based on the aspects and indicators of the energy justice framework. Procedural justice does not specify that there can't be conflict between decision makers and the affected population, in fact participation naturally means discussion and therefore also space for conflict. The planning and learning concept was relatively new at the time when the Vauban project was developed. The most critical factor in the consultation procedure was the fact that the design encouraged mostly individuals or households who could afford to build their own housing unit in the Vauban district.

With regard to **distributive justice,** concerns about the diversity of the district were found to be appropriate and the **hypothesis** of this thesis was confirmed: survey data showed clearly an exceptionally high educational level of the Vauban inhabitants and an above average income per household. The rent level was found to be even higher than estimated by the city of Freiburg.

An analysis of underlying causes for these project outcomes pointed towards a strong impact of national policies that were decided upon under the impact of the German reunification and with regard to a prospected demographic change. The results of this study indicate that these processes are either superposing participative attempts for sustainable urban development and social justice or are maybe even reinforced by projects such as the Vauban. Projects with ambitious energy targets such as the Vauban were found to have particularly high rents. The findings support other studies in Heidelberg and Hamburg, where similar projects were only affordable for high income groups and therefore possibly increasing social inequality within the city. So far, no research design managed to separate the impact of the local housing market from the effects of the sustainable or energy related concepts of the examined cases.

This thesis **contributes** to the ongoing debate by providing empirical data about a local urban low-carbon energy transition and its connection to segregation and equality. It provided evidence for the importance of understanding and considering the impact of the local housing market as well as national policies on affordable housing. These considerations could enable a local response by the municipality in terms of incentive structures, funding and policies targeting the affordability and accessibility of energy-related modernisation of buildings and districts for people of low-income and education.

The case of the Vauban highlights that policy makers on the local level need to react to national policies that are not suited for the needs of their area e.g. due to an exceptionally tense housing market. Even though urban planners and municipalities can design socially responsible projects and local participation processes or incentives, these efforts can easily be superposed by national policies and funding decisions when not counteracted by provision of resources and strong policies on the local level. Municipalities need to take policy developments on the national level

into account and pay attention and react to the observations of citizens on the local level (who in the case of the Vauban predicted the situation today as early as in 1998). Practitioners and communities can directly learn from the approach of the participative process applied in the Vauban but also, that a good project and process design alone is no guarantee for socially sustainable development if the context of the housing market is underestimated. To achieve a social mix in districts with ambitious energy targets the **municipality has to become active** to counteract the influence of the tense housing market.

Drawing upon insights from energy justice research, decision-makers urgently need to address equality and fairness in the context of low-carbon energy transitions because it has implications for the acceptance of project. If decision-makers fail to address these issues it has been observed that the public opinion is, among other factors, shaped by well-documented media reporting about cases where energy-related renovation was a mean to increase rents and crowding-out of tenants (Welz, J. & Grossmann, K., 2017). This could potentially result in social and environmental concerns being played off against each other in the public debate and thereby threaten the success of the energy transition in Germany.

In-depths descriptions, empirical evidence about cases and comparative case evaluations are still rare but urgently needed to evaluate social segregation processes within cities (Großmann et al., 2017). Further hypothesis testing is needed to evaluate how social groups are affected by urban energy projects; to examine to which extent the housing market and gentrification hinder a fair energy transition and to examine to what extent the energy transition reinforces social segregation and inequality on the local level. Furthermore, there is a need to advise decision-makers such as policy makers and municipalities how to design projects and policies that can effectively address the observed developments of energy poverty and energy-induced gentrification.

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Appendix I

Coding applied in the document analysis (with total of coded text segments in bold)

Total				447
	Procedural			0
		Decision- making		23
			Biases	Profits 18
				Other 2
		Consultation		27
			Ability to be heard	1
				Examples 42
			Institutional representation	0
				Forum Vauban 37
				Building 14
				Other 5
			Access	4
				Public 23
				Other 14
		Information		5
			Disclosure	2
				Newspaper 34
				Meeting 9
				Masterplan 8
				Newsletter 27
				Open letters 4
				Other 2
			Objectivity accuracy timeliness	1
				Quality 4
			Local knowledge	2
				Architects 6
				Working 18
				Other 5
	Distributiv			7
		Outcomes		12
			Costs	3
				Financial 23
				Externalities 6
			Benefits	5
				Financial 4
				Inhabitants 22
				Socio-structural 16
				Quality of life 12

Appendix II

Survey in German

LUND UNIVERSITY

Studie zu erneuerbaren Energien und sozialer Gerechtigkeit

Der Stadtteil Vauban erhält sowohl innerhalb von Freiburg als auch international viel Beachtung. Während das Quartier auf internationaler Ebene als idealer Vorzeigestadtteil teilweise geradezu idealisiert wird, fällt die Kritik auf lokaler Ebene bisweilen sehr harsch aus insbesondere wenn es um die Bezahlbarkeit und die soziale Durchmischung des Stadtviertels geht.

Eine Studie soll nun Klarheit bringen, denn nur wenige der über die Vauban-Bewohner getätigten Aussagen lassen sich mit Daten belegen, es scheint sich häufig um Verallgemeinerungen und persönliche Wahrnehmungen zu handeln.

Was benötigt wird, ist eine differenzierte Darstellung der Miet- und Eigentumsverhältnisse im Vauban sowie Einkommens- und Bildungsstand der Bürger.

Die Daten, die im Rahmen dieser Studie erhoben werden sind absolut anonym, werden nicht weitergegeben und dienen ausschließlich Forschungszwecken.

1. Wann sind Sie ins Vauban gezogen? _____ (Jahr)

2. Welchen Bildungsabschluss haben Sie (bitte höchsten Abschluss aller im Haushalt lebenden Personen ankreuzen)?
   - o Ohne Abschluss
   - o Hauptschulabschluss
   - o Realschulabschluss
   - o Abitur
   - o Abgeschlossene Ausbildung
   - o Geselle
   - o Meister
   - o Hochschul-/ Fachhochschulabschluss
   - o Doktortitel
   - o Professorentitel

3. Sie sind
   - o Arbeitssuchend
   - o Student
   - o Berufstätig
   - o Selbstständig
   - o Hausfrau bzw. Hausmann
   - o Pensioniert
   - o Arbeitsunfähig
   - o Sonstiges

4. Wie hoch ist das gesamte monatliche Netto - Einkommen in ihrem Haushalt (in Euro)?
   - o Unter 1000
   - o 1000-1999
   - o 2000-2999
   - o 3000-3999
   - o 4000-4999
   - o 5000-5999
   - o 6000-6999
   - o 7000-7999
   - o Über 8000

5. Sind Sie Eigentümer ihrer Wohnung?
   - o Mieter
   - o Eigentümer

6. A) Falls Sie Mieter sind: Wie viel Miete zahlen Sie für ihre Wohnung im Monat?
   Kalt:_____
   Warm:_____
   Wohnungsgröße/ gemietete Wohnfläche in m² _____

   B) Falls sie Eigentümer sind: Konnten Sie den Erwerb Ihrer Wohnung hauptsächlich über ihr Einkommen finanzieren oder haben Sie sonstiges Kapital benötigt?

   - o Finanzierung basierte auf Einkommen (und evtl. damit bedientem Kredit)
   - o Finanzierung basierte auf sonstigem Kapital (wie z.B. Schenkung/ Erbschaft)
   - o Finanzierung basierte auf beidem zu gleichen Teilen

7. Kommentare (falls Sie etwas erläutern möchten):
   _____
   _____

1. When did you move tot he Vauban _____ (year)

2. What educational qualification do you have (please tick the highest qualification of the household)?
   - ○ No qualification
   - ○ Hauptschulabschluss
   - ○ Realschulabschluss
   - ○ Highschool Degree
   - ○ Completed Apprenticeship
   - ○ Journeyman
   - ○ Master craftsman
   - ○ University Degree
   - ○ Phd
   - ○ Professor

3. You are
   - ○ Job seeking
   - ○ Student
   - ○ Working
   - ○ Self-employed
   - ○ Housewife
   - ○ Retired
   - ○ Incapacitated
   - ○ Other

4. What is the mothly net income of your household (in Euro)?
   - ○ Unter 1000
   - ○ 1000-1999
   - ○ 2000-2999
   - ○ 3000-3999
   - ○ 4000-4999
   - ○ 5000-5999
   - ○ 6000-6999
   - ○ 7000-7999
   - ○ Über 8000

5. You are
   - ○ Tenant
   - ○ Owner

6. A) In case you are tenant: How much rent do you pay per month?
   Net: _____
   Including heating etc.:_____
   Appartment size/ area in m² _____

   B) In case you are owner: Could you finance your appartment mainly with your income or did you require other capital?
   - ○ Financing based on income (and possibly serviced loans)
   - ○ Financing based on other capital (e.g.donation/ inheritance)
   - ○ Financing based on both

7. Comments:
   _____
   _____

Appendix III

In German

1. Was war Ihre Rolle bei der Enstehung des Vaubans?
2. Was sehen Sie als Erfolge des Entwicklungsprozesses? (techology/ participation/ etc.?)
3. Wie würden sie das Vauban heute beschreiben? (inhabitants/ social cohesion/ technology?)
4. Wer trägt die Kosten für die Enstehung des Vaubans?
5. Wer profitierte am meisten vom Vauban Projekt?
6. Warum wurde die Zielvorgabe des durchmischten Quartiers nicht erreicht?
7. Was sind die lessons learned vom Vauban Projekt?

In English

1. Which role did you play during the development of the Vauban?
2. What do you see as the successes of the development process? (techology/ participation/ etc.?)
3. How would you describe the Vauban today? (inhabitants/ social cohesion/ technology?)
4. Who is burdened with the costs of the Vauban?`
5. Who benefited/ benefits from the Vauban?
6. Why was the goal of the socially diverse district not reached?
7. What are the lessons learned from the Vauban project?

Appendix IV

Einwilligungserklärung zur Erhebung und Verarbeitung personenbezogener Interviewdaten

Forschungsprojekt: Masterarbeit – Energy Justice
Durchführende Institution: Universität Lund, IIIEE
Interviewerin: Sophie Schwer
Interviewdatum: _____

Beschreibung des Forschungsprojekts (zutreffendes bitte ankreuzen):
( ) mündliche Erläuterung
( ) schriftliche Erläuterung

Mir wurde erklärt, dass meine Interviewaussagen für die Masterarbeit mit einem Aufnahmegerät aufgezeichnet und ggf. von Sophie Schwer
in Schriftform gebracht werden. Für die weitere wissenschaftliche Auswertung des Interviewtextes werden alle Angaben, die zu meiner Identifizierung führen könnten, verändert oder aus dem Text entfernt. Mir wird versichert, dass meine Interviewaussagen in wissenschaftlichen Veröffentlichungen nur in Ausschnitten zitiert werden. Das bedeutet, dass das gesamte Interview nicht veröffentlicht werden darf. Damit
soll erreicht werden, dass ich auch durch die Reihenfolge und Kombination meiner erzählten Ereignisse im gesamten Interview nicht für Dritte erkennbar werde.
Mir ist bewusst, dass die Teilnahme am Interview / an mehreren Interviews freiwillig ist und ich mein Einverständnis dazu jederzeit ohne Begründung und ohne Nachteile zurückziehen kann. Ebenso kann ich einer Speicherung meiner Daten jederzeit widersprechen und deren Löschung verlangen.
Ich bin damit einverstanden ein Interview oder mehrere Interviews zu geben.

( ) Ja ( ) Nein

_____
Vorname, Nachname in Druckschrift