# At the margins of the German energy transition:

## A multi-scalar analysis of tenant electricity in Berlin

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## Abstract

Tenant electricity is heralded as a model that could accelerate the urban energy transition in Germany. The hopes are especially high in the city-state of Berlin. In this thesis, I critically analyze why tenant electricity has not fulfilled these expectations. The analysis is based on semi-structured expert interviews and the study of selected documents. Theoretical emphasis lies on the state as the facilitator of capital's needs through the pursuit of accumulation strategies. It is complemented by a geographical approach to the political economy of energy transitions. Both perspectives are combined to serve as the theoretical groundwork for the thesis. The results reveal that tenant electricity faces multiple barriers that prevent it from realizing market penetration. These barriers are partly solvable through policy adjustments, which are subject to decision-making processes on the federal level. The analysis proceeds to show that the barriers are not only insufficient and addressed with little financial nor political commitment, but that the federal understanding of the role of tenant electricity in the German energy transition differs significantly from that/the one of the city of Berlin. Whereas the latter considers it to be an integral component in its quest for climate neutrality, the federal government sees tenant electricity as a tool to increase the public acceptance of the German energy transition. As a result, the federal government has no strong interest in tenant electricity as a core strategy to significantly increase the share of renewable energy sources. This lack of interest is rooted in the character of the German energy transition as an institutionalized strategy to guide capital towards new opportunities of accumulation. I find that tenant electricity is not compatible with this strategy.



**Key words:** Tenant electricity, Energy transition, Political economy, Energy geography, Solar power, Capital accumulation


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# 1. Introduction

Global warming urges an inevitable energy shift away from fossil fuel towards renewable sources. Hence, the inability of capital to push for the necessary change generated the need for institutionalized energy transitions facilitated by the state (Gailing & Moss 2016). Among the most prominent attempts is the German *Energiewende* (energy transition). The term was first coined in 1980 by an environmental think tank in Germany, only to be taken up again 20 years later when the Renewable Energy Act (EEG) was put in place. Since 2000 the EEG has supported the entry of renewable energy sources into the market. Especially notable is the feed-in tariff policy that supplements renewable energy produced domestically. Suddenly, it became viable for house owners to install photovoltaic[1] (PV) panels on their rooftops. As a result, the share of solar energy in the German electricity consumption rose up to 9.2% in 2020. It is thus, the second most important renewable source after wind energy (ISE 2020:6). The biggest share, 32%, of the produced solar energy derives from private households, whereas only 6.2% is generated by energy supply corporations (ISE 2021:28). Hence, small-scale PV produced on single houses rooftops became an integral part of the German energy transition. Yet, it lasted almost another 20 years until the German government was finally persuaded to address the fact that more than 57% of Germany's inhabitants are tenants, thus giving up on the potential of more than half of the population's rooftops (BSW:2017:9). In Berlin this number compounds to 85% (HTW 2018:3). Thus, a vast potential to accelerate the transition towards renewables has been untouched to date, because housing corporations that rent their properties to tenants had little economic incentives to install solar panels on their rooftops due to unfavorable economic conditions. In response, actors interested in an acceleration of the German energy transition advocated for a new model that addresses the lack of market incentives. The result is the tenant electricity act in 2017, which enabled the tenant electricity model, the first of its kind and a pioneering project tailored for the German context.

Among the largest cities in Germany, the case of Berlin stands out in its commitment to tenant electricity. Already in the 1990s, the Energy Agency Berlin [Berliner Energieagentur] has realized tenant electricity projects (BSW 2017:36, Flieger et al. 2018:29). Since then a multitude of actors emerged to explore the potential of tenant electricity. At the forefront of these is the city-state of Berlin. The center-left government has asserted Berlin’s quest for climate neutrality (HTW 2018:3). Especially remarkable is the Solarcity Masterplan that has been finalized in 2019 (Masterplan Solarcity 2020). Based on calculations on the spatial capacity of Berlin (HTW 2018), the Masterplan Solarcity released the ambitious goal of (HTW 2018:1) “covering as fast as possible a quarter of Berlin’s electricity needs through solar power”. This translates to an increase from 100 MW to 4 GW.

1 Photovoltaic (PV) and solar power are used interchangeably throughout the thesis.

Yet, the pace of the energy transition is not the only parameter at stake. The shift towards wind- and solar energy represents economic consequences for the ways in which energy is produced, consumed, and distributed. Scheer (2013:103), the political and intellectual founding father of the German energy transition, summarizes his vision of an energy transition in an equally captivating as simplifying statement: “renewable energy has two economic characteristics; it comes free of charge and is available wherever it is needed”. He implies that energy systems of the future are decentralized, local, and perhaps radically democratized. Schwartzman (1996) even argues that a solar-based economy is the necessary groundwork for realizing the communist utopia. Whether such hopes translate to reality is subject to discussion, but they are far from being unfounded. Fossil fuels are characterized through their spatial concentration. Coal beds or gas fields occur in stark concentration but are territorialized, i. e. corporations need to have territorial access to extract them. In consequence, fossil fuel production is industrial and centralized to adhere to the spatiality of its energy source (Huber & McCarthy 2017). PV, and therefore tenant electricity embodies a distinct spatiality that fosters decentralized and local production as Scheer (2013) indicated. Therefore, tenant electricity is a prime example of how a transformation of the fossil fuel economy towards renewable energies could look like. It eludes the spatial question that arises from the diffusion of renewable energy sources, that is where to build the infrastructure needed to capture wind and sun (Hornborg et al. 2019), by using rooftops rather than acres. Once again it is Scheer who praises renewable energies with the overzealous claim that “there will be no centers” (quoted in Malm 2016:374), evoking a vision of a radically distinct energy regime. Yet, the relative insignificance of tenant electricity on the energy market suggests a critical approach towards its role in the German energy transition and the underlying drivers that condition its trajectory.

# 2. Research aim, question and structure

The commitment of Berlin to achieve climate neutrality is compelling. One could ponder that the realization of the Masterplan Solarcity is only a question of time considering the utter urgency of climate change in combination with the spatial merits of using rooftops for energy production. Yet, as the statistics show this is not the case. In 2017 Berlin’s PV output was at 0.06 TWh i. e. 0.4% of the consumed energy in Berlin (HTW 2018:1). The share of tenant electricity is marginal with only 28 registered projects in Berlin (Federal Network Agency (a) 2021). This leads to an intriguing research puzzle that serves as the base for this thesis. Considering the ambitions regarding tenant electricity, why has the quantitative development of tenant electricity been this underwhelming? Taking this question as the point of departure, I argue that the necessary next step is to identify the crucial actors and how they are embedded within the logics of capitalism in order to understand the different interests at play. Throughout the first engagement with the data, it became apparent that the state has a central role in the facilitation of the German energy transition. Therefore, I focus on the role of the state on the federal as well as local level. I investigate the role of tenant electricity within the German energy transition by using the case of Berlin. In consequence, my research aim is to make sense of tenant electricity within a broader set of capitalist relations and the role of the state as their facilitator. My research question, organized through three sub-question, is the following:

**RQ:** Why is tenant electricity still at the margin of the energy transition in Berlin?

- What are current barriers?
- How are these barriers addressed and which expectations towards tenant electricity are formulated by the local and the federal state respectively?
- What are the underlying reasons for the lack of federal commitment to tenant electricity?

## 2.1 Structure of the thesis

The structure of the thesis, guided by the research questions, is as follows. First, I provide the necessary background to understand the concept of tenant electricity, as well as its embeddedness in the case. In the next step I review past literature and how it dealt with the spatial aspects of energy transitions, the role of urban energy transitions, and the concept of tenant electricity. From there I present my theoretical framework in which I elaborate on the necessary theoretical tools that enable me to answer my research question. In the following section, I elaborate on my methodology and how it serves to answer the research questions.

The analysis is divided into three sections in accordance with my questions. First, following sub-question one, I investigate the barriers to tenant electricity through the analysis of my data (section 7.1+7.2). Especially the expert interviews are a rich data source in this section. In the second section, (7.3) I analyze the response of the barriers by the federal state as well as its articulated expectations towards tenant electricity. This section has a stronger emphasis on the secondary literature. In the third section, (7.4) I stress the importance of accumulation strategies to expose the underlying reasons for the lack of federal commitment to tenant electricity. Eventually, I provide a conclusive discussion of my findings.

# 3. Background

Small-scale solar power has been one of the buzzwords of the German energy transition. Scheer (2013) praises the transition from centralized coal plants towards autonomous and highly modularized networks. To what extent, this claim for future decentralization holds true is questionable at the least. However, solar power has indeed been a flagship of the German energy transition (ISE 2021). Tenant electricity derives from the late insight that, as mentioned above, Germany is a country with many tenants. Therefore, the potential of solar power in its current state, that is small-scale solar power, can only be fully unlocked when using all of the eligible rooftops (Moser et al. 2021). Considering Germany's theoretical commitment to the Paris agreement it appears negligent to stop halfway on the path towards nationwide solar power development.

## 3.1 The concept of tenant electricity

Tenant electricity describes a business model in which PV-panels are installed on the roof of an apartment block. The distinction to other small-scale PV systems is that the electricity is not meant to be channeled into the grid, but to be consumed locally by the tenants (BMWi 2021). In a project with a contractor the tenants receive cheap electricity in comparison to the market prices, the property owner earns a ground rent for the rooftop as well as a potential increase of the estate value, and the contractor makes profit through the capture of surplus value through selling the electricity to the tenants (BSW 2017:14) The uniqueness of the model lays in the opportunity to incentivize property owners to provide their rooftops for PV installments. This is enabled through policy tools contained in the Renewable Energy Act (EEG-bill 2021). Without these policy tools, tenant electricity model would probably not exist in the same constellation. In fact, the EEG actively sets the frame for it through the nature of its funding program that compensates forthe direct consumption of the energy through tenants (Moser et al. 2021). Furthermore, and this is discussed throughout the analysis, the model serves to include civil society[2] as stakeholders in the energy transition while simultaneously fostering acceptance for renewable energies (EEG-bill 2021:3).

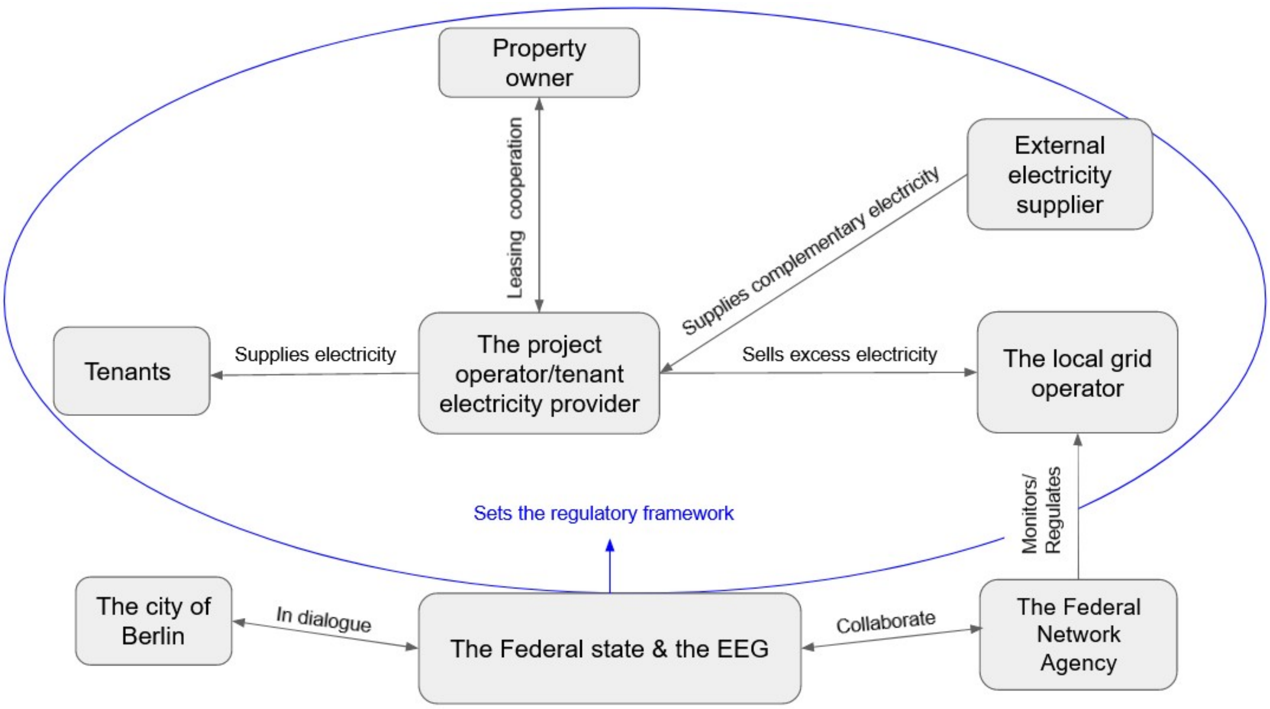
The model of tenant electricity is found in all parts of Germany, but especially in larger cities because of the relative large number of tenants (HTW 2018:17). In addition, tenant electricity is tailored for the urban context, because the irregularity of solar energy requires either costly and inefficient batteries (HTW 2018:63) or the immediate consumption of the energy. Urban spaces provide the latter in contrast to rural areas (IASS 2017:10). In consequence, cities are especially suited for tenant electricity. Berlin therefore, declared tenant electricity as an integral part of their goal to cover 25% of Berlin's electricity demand through solar power in a short amount of time (HTW 2018:1). In contrast to these ambitious goals, the achievements since the start of intense promotion of tenant electricity in 2017 are modest. In 2019 the Federal Ministry for the Economy and Energy (BMWi) published a report in which it stated that only 1% of the available funding has been used. Merely 677 tenant electricity projects were realized in the first three years (ZSW 2020:6). 28 of these are located in the state of Berlin (Federal Network Agency (a) 2021). The conclusion from the report: "The model lags far behind the expectations" (BMWi 2019:4). In 2021 the EEG received further adjustments to fix identified deficits in the changes made in 2017. Whether these are sufficient remains questionable and is addressed in the analysis.

2 Civil society refers here to the inclusion of citizens as economic actors, even though they do not hold the legal status of a firm.

## 3.2 Actors in the tenant electricity model

Tenant electricity models are complex and involve multiple actors. Fig. 1 illustrates the most important ones. At the center of the model is the operator of the installment which is also the registered as the provider of the energy that is produced by the PV-panels. Usually the operator/provider[3] is a service provider i. e. they do not own the rooftop or the grid, but they provide the service of running the project. That involves the capital investment, taking the financial risk, negotiating the contracts or the maintenance of the installment. In some cases, the provider is a municipal energy utility that is equipped with capital to make the investment. In addition, cooperatives have been active in that role. The property owner, usually a housing corporation, but possibly also a single legal person, holds a passive role. They receive a lease for the rooftop and have bureaucratic duties. The tenants share this passivity. They receive energy below the market price and have to sign a contract. Beyond that they usually have no influence on the project.

**Fig. 1: Illustrates the actor constellation of a conventional tenant electricity model (created by author)**




The external energy supplier is necessary to supply electricity when the produced energy is insufficient to cover the demand. The project operator buys the electricity from the provider and sells it then to the tenants. However, the opposite can also be the case. Installment may produce more energy than consumed. If that ahppens, the energy is sold to the local grid operator to a less favorable price for the provider. The Federal Network Agency is the German regulatory office for the electricity network. It oversees and regulates the day-to-day operation of the grid. The tariffs for the price as well as general regulations are set by the federal

3 Throughout the thesis I use interchangeably the terms provider, operator or contractor..

state. Local states, such as the city of Berlin, can provide incentives in addition to the federal state these may not overlap with existing policies though. For example the tariffs can only be adjusted on the federal level, but the city of Berlin could introduce a subsidy instrument to fund the installment of additional storage batteries, because such a funding program does not exist on the federal level.

Furthermore I refer throughout the thesis to PV that is not centered around tenants, but operated and owned by single house property owners as domestic PV.

# 4. Literature Review

In the literature review I cover three dimensions. First, I introduce recent contributions to the field of energy geography. The focus lays on the distinct spatial configurations emerging with a shift to renewable energy sources. Second, the context of the urban transitions and energy struggles. In this section, I highlight how these configurations are linked to the urban context and subject to political struggles within the former. Third, I present studies that assess the actual benefits, limitations and barriers of tenant electricity. These studies employ a solution oriented approach. In other words, they focus on solving problems of tenant electricity within the narrow field of applied policy.

## 4.1 New spatial configurations

The field of energy received increasing attention by geographers (Baka & Vaishnava 2020, Bridge et al. 2013). Its focus lies on the distinct spatialities of energy systems, and increasingly on the discrepancy between fossil energy systems and renewable ones. A basic assumption that nourishes the calls for new advances in energy geography is that subterranean organic material i. e. oil and gas can be thought of as a vast store of highly concentrated solar energy. Dukes (2003) refers to fossil fuels as “Burning Buried Sunshine”. The latter is basically a planetarian credit that is about to run out while also releasing dangerous waste products such as $CO_2$ emissions. In contrast to fossil fuels, renewable sources have not been concentrated for millions of years, but are being directly captured. Therefore, their lower productivity output per land unit requires radically distinct spatial configurations as scholars have argued (Bridge et al. 2013, McCarthy & Huber 2017, Hornborg et al. 2019, Smil 2015). The geographical implications between fossil fuels and renewable sources differ starkly. To a limited extent, the same could also be argued for different forms of renewable sources. Large remote facilities such as offshore wind require a distinct analysis in comparison to highly distributed forms of household micro generation of solar energy (Bridge et al. 2013). In short, energy systems are inherently spatial and must therefore be analyzed with consideration for their respective particularities.

If one would assume that fossil fuels are on one side of the spectrum of spatial configurations, then solar power would be diametrically opposed. Two characteristics are central. First, in contrast to fossil fuels, which is in fact, just solar energy conserved in plant matter accumulating for millions of years, solar- and wind power are not available in high densities (Dukes 2003, McCarthy & Huber 2017). Instead they are geographically diffused. This requires a distinct spatial analysis that incorporates the disparate land requirements of renewable energy (Bridge et al. 2013). Second, researchers have argued, predominantly from a materialist-Marxist perspective (Huber 2018:514, Malm 2016:372), but not exclusively (Kunze & Becker 2014:103, Scheer 2013), that renewable energies provide much less opportunities for surplus value extraction through capital. Once the infrastructure is constructed its value chains are short and its consumption is local.

Hornborg et al's (2019) study on the spatial requirements of Cuba's ambitious goal to transform the national energy production provides an excellent example of the spatial needs of solar power. They use Smil's (2015) power density framework to calculate the potential of power produced per square meter. Hornborg et al. (2019) conclude that PV-infrastructure would need to cover 4.1% of the land, to represent 18.6% of its energy consumption, but more importantly emphasize that the physical space occupied by the infrastructure does not include the space and resources used elsewhere required to produce the infrastructure in the first place. They add that "it is misleading to regard sunlight as an abundant, untapped energy resource in the absence of costly infrastructure for harnessing it, when the existence of such infrastructure in turn requires capital accumulation" (Hornborg et al. 2019:990-991). In other words, they do not only point out the massive spatial requirements of PV infrastructure, but also the space that is used and the resources that are extracted to enable the construction in the first place. The construction of technology, they argue, is not neutral but causes further exploitation of the planet. On the other hand, Huber (2018:512-513) is less skeptical. He argues that capital accumulation, through fossil capital, is in fact needed to develop renewable infrastructure, but that once such infrastructure is built, it would provide little further exposure to the exploitative logic of capitalism. Therefore, a bigger push, for example in the form of a green new deal facilitated by the state, would be needed. However, he (see Huber & McCarthy 2017) also acknowledges that such a green new deal might have to structurally address the utilization of land due to the distinct spatial configurations of renewable energy sources. This would pose an enormous challenge to any energy transition. In summary, although the two analyses differ in their stance towards technology, they agree on the massive spatial challenges posed by renewable energy sources.

## 4.2 Energy transitions in urban spaces

As a response to the spatial demands of renewable energy sources, researchers as well as politicians have emphasized the role of urban spaces. This emphasis builds upon two technological characteristics of renewable energy, and specifically solar power. First, as pointed out above, land is scarce, while simultaneously needed for a successful energy transition. Rooftops provide an abundant source of unused space with little market competition. In addition, small-scale solar panels are almost as efficient as their larger counterparts (IASS 2017:9). The second characteristic is the inherent irregularity of renewable energy and specifically solar power. PV systems produce temporally varying quantities conditioned by the weather. To account for temporal overproduction the most feasible solution appears to be the immediate consumption of the energy by channeling it to consumers. Such an approach requires a population density usually only found in urban or semi-urban areas (IASS 2017:10). In combination, these two characteristics incentivize an energy transition that is not limited to rural spaces, but embraces the urban. It is thus the urban counterpart to rural solar parks that require large amounts of land as well as transportation and storage technologies.

Basu et al. (2019) highlight the complexity of urban transitions, but also state that cities are rightfully hailed as spaces of new opportunities for energy interventions and innovations. Cheung & Oßenbrügge (2020) also emphasize the complexity of power relations and interests in urban contexts that need to be negotiated and governed. Both contributions focus on the governance and economic potentials of urban transition. Kunze & Becker (2015) put forward the concept of energy democracy that benefits from decentralization and diffusion through the urbanization of energy systems. They outline four defining aspects. First, democratization through participation in economic decision making processes, second the collectivization of property in regard to energy systems, third, the local production of surplus value that limits the outflow of capital from regions, and fourth, ecology and sufficiency aspects. They conclude that an urban energy transition holds vast potential to move further towards a form of energy democracy. Angel (2016), using a Gramscian inspired approach to the state, shows how energy democracy movements in Berlin interact with the state. He concludes that the case of Berlin was especially intriguing in its promise for a restructuring of the local energy production and distribution. However, he also adds that the movement in Berlin faced various co-optation strategies by the state. Newell (2019) affirms the two-fold potential of energy systems that ranges between structural change and green washing. Tenant electricity might be found somewhere on this spectrum.

## 4.3 Tenant electricity

Tenant electricity has been the subject of a multitude of studies. However, the majority of these appear specifically policy oriented. That is, they focus on the potential, limitations and barriers of tenant electricity within the existing mainstream policy framework. Flieger et al. (2018) for example analyze the potential of tenant electricity within Germany with specific emphasis on the use of block-chain technology. Furthermore, they see cooperatives as a potential key actor for the advancement of tenant electricity. According to their argument cooperatives would be committed to values such as democracy and solidarity, and therefore be well suited to the context of tenant electricity. Another study produced by Prognos (2017) assesses the economic viability, legal classifications, general potential and organizational forms of tenant electricity. The federal association of the solar industry (BSW:2017) released a study concerned with the varying business models which are possible to increase the efficiency and profitability of tenant electricity. It is worth mentioning that the three studies share the common ground of being funded by state institutions, whether the funding comes from the EU (BSW 2017) or from the German ministry of economic development and energy (Flieger et al. 2018, Prognos 2017).

The three studies, although varying in focus, share the assumption that tenant electricity has a vast potential that could be unlocked with the right policy tweak. However, they provide little insight into the underlying reasons why tenant electricity has not received the required political support. Moser et al. (2021) attempt to shed further light on that question. They argue that the technological and innovative potential of tenant electricity is in fact, almost fully exploited. They agree with the previous studies that the stagnating market penetration of tenant electricity is rooted in unfavorable regulations. However, Moser et al. (2021) identify the Federal Network Agency as the prime institutional obstacle. The agency would show little interest in the advancement of tenant electricity, because such decentralized forms of production increase the overall costs for grid operators as well as consumers. They conclude that the state shows little interest into decentralized and innovative solutions to climate change. Thus, tenant electricity is neglected. However, their analysis does not move beyond these empirical observations to investigate the underlying drivers. To sum up, I argue that there is a significant research gap, indicated through this literature review, to critically analyze and understand the potential role as well as limitations and barriers of tenant electricity within a state facilitated energy transition. Existing literature is mainly institutionalized and merely focuses on the policy level.

# 5. Theoretical framework

In the literature review I have pointed out that tenant electricity has received attention but to a large extent through studies commissioned by state institutions. Thus, these studies lack a critical perspective that examines the state as a crucial actor that provides the framework in which tenant electricity either grows or remains at the margin of the German energy transition. In consequence, my theoretical framework is centered around the state as well as understanding its relation to capital.

## 5.1 Geographical political economy of energy transitions

In the literature review I have indicated how geographers grapple with the spatial dimension of energy transitions. An emerging contribution to the field of energy geography is the geographical political economy of energy transitions (Bridge & Gailing 2020). The core assumption is that with the anticipated transition towards renewable energy systems new "patterns of production, employment, and accumulation have begun to emerge as a central concern of public policy (Bridge & Gailing 2020:1037). In consequence, geographic political economy highlights the spatiality of these new patterns, but also the various interests that play out through the market (Newell 2019). For example local states that attempt to create new paths for *green* capital accumulation by fostering innovation through policies (MacKinnon et al. 2019:115, Ponte 2019). These local accumulation strategies may oppose the interests of the federal state or corporate actors (Newell 2019). Fossil fuel companies for instance may face the devaluation of their assets if the state denies them further extraction. Knuth et al. (2019) refer to this as stranded assets, but also emphasize how capital finds new strategies to accumulate. The result are frictions between particular factions of capital as well as the different institutional scales.

Bridge & Gailing (2020:1040) identify three key contributions of a geographical political economy. The second one is as follows:

> "Situating the evolving spatiality of energy production and consumption within a broader account of dynamics of accumulation including, for example logics of capitalization and disinvestment associated with energy resources and infrastructures" (ibid.).

Two aspects here are crucial. First, the evolving spatialitiy of energy production which applies on the case of tenant electricity. The latter is a prime example of decentralized, and local production of energy. Second, the broader dynamics of accumulation that shape said spatiality. The important tool to highlight the interaction between these two is a multi-scalar analysis (Bridge & Gailing 2020). That is, an emphasis on the relation between small energy production, and actors operating on the national or global scale. Within the analysis geographical political economy gives me a tool to understand the contradictions between the promotion of tenant electricity on the one hand and the emergence of barriers on the other one.

## 5.2 Marxist state theory

The role of the state has been subject to heated arguments within the Marxist field, most notably the Miliband-Poulantzas debate in 1969. Miliband defended an orthodox Marxist position at that point, that proclaimed the state within capitalism to be an instrument that is used by members of the ruling class. Once the dominated classes achieve control over the state apparatus, the state would be an instrument to implement workers interests. The focus of an analysis of the state should therefore lay on the political struggle over the control of it (Das 1996). Poulantzas on the other hand attacked this instrumentalist conceptualization by arguing that the contemporary state is per se capitalist. That is, it serves the purpose of defending the interests of the dominant classes, politically (Holloway & Picciotto 1977, Walsh 2012) and economically (Altvater 1978, Hirsch 1978), and cannot be regarded as an intrinsic entity outside of capitalist relations (Das 1996, Walsh 2012).

Although this debate appeared as a rift between Marxist scholars, Das (1996) has rightfully pointed out that both sides slowly converged towards an approach that acknowledges the merits of both arguments. As a consequence, both instrumentalist and structural conceptualizations of the state should rather serve as a tool to analyze aspects of state power. For the purpose of this thesis I employ a semi-structural conceptualization of the state with an emphasis on economic structuralism. Altvater (1978), among others, claims that the state must create conditions for capitalist profit and accumulation. Nevertheless, it would be misleading to conclude that the state has the adequate knowledge and power to identify capital’s needs, and in further consequence to facilitate and realize them. Therefore, scholars (Das 1996, Jessop 1991, Morris & Padayachee 1989) have mobilized the concept of accumulation strategy to address the internal contradictions and complexities of capitalist interests.

The term accumulation strategy refers to the specific strategy employed by states to ensure that national capital has the overall conditions to accumulate further capital. It acknowledges that the state is not fully aware of capital’s needs and how to realize them. However, it does emphasize that states develop context-dependent strategies for the short- and long-term accumulation of capital. As Jessop (1991:165) puts it, “in short, the collective interests of capital are not wholly given and must be articulated in and through specific accumulation strategies which establish a contingent community of interests among particular capitals'”. These strategies are subject to individual agency and situated knowledge of actors. Examples of such are the US-American *Fordism,* the German *soziale Marktwirtschaft* (Jessop 1991), or Thatcher’s push for free markets (Edwards 2020). These examples show how regimes have responded to structures and events during periods of economic change to articulate and pursue accumulation strategies that were supposedly tailored to the needs of capital within their respective contexts. I argue that such an accumulation strategy can also be identified within the context of the institutionalized German energy transition. The latter must be seen as a response to the threat of climate change, but with the overall goal to generate new opportunities of capital accumulation.

## 5.3 Conceptualizing the German accumulation strategy

Before I delve further into the particularities of the German case I want to establish two premises of a Marxist conceptualization of accumulation. First, capital inherently seeks to expand into further markets to counter the tendency of falling profits. The latter describes the tendency of the ratio between the initial capital investment and the rate of profit to decrease over time. As a consequence capital must find new investments with higher investment-profit ratios to avoid crises (Das 2017). This leads to the second premise. In their quest of lowering production costs to increase profits, capital moves geographically. This is explained by the varying degrees of capitalist development across the globe (Das 2017, Smith 2008.). Corporations develop accumulation strategies that may differ significantly from each other. A coal plant for instance may seek the direct capture of surplus value, which is then shaped by cost cutting strategies (wages, increasing working time, or forms of organization) (Campling 2021). Another strategy may be the capture of rent through asset ownership. Examples of these include land, intellectual property or brands. A third strategy that is significant in this thesis is the appropriation of value in global value chains through lead corporations. Global value chain analyses have pointed out how market actors established lead positions in global value chains through the exploitation temporal advantages in one or more nodes of the global value chain they are part of (ibid.).

In Germany, the wages for labor are relatively high. Hence, capital can save labor costs when producing in countries with a lower degree of labor organization to withstand pressure on wages. However, costs cannot only be cut in regard to wages. The same premise counts for the means of production. Especially relevant in this analysis is land. The ground rent[4] is relatively high in Germany. Therefore, capital seeks to produce in countries with relatively low production costs (Davis et al. 2018). In short, capital has an inherent interest to lower the costs of production. Reducing ground rent and wages incentivizes industries to shift their geographical focus on production. Furthermore, the establishment of German firms as lead market actors enables them to extract value along the global value chains of the energy market. Both premises, capital's need to expand into further markets, and the geographical aspect of capitalist development that leads to distinct corporate accumulation strategies, inform and shape the accumulation strategy developed by the German state. Beyond these rather general theoretical assumptions about capital, the German case shows further particularities.

Edwards (2020) has argued that the respective accumulation strategy of the UK under Thatcher was informed by an overarching free market doctrine. Although this is, to a different degree, applicable to the German case, I argue that Germany has three characteristics that shape its particular accumulation strategy. First,

4 Ground rent refers to the pure payment to raw land made to the owner. The use value of the land, Marx terms it the *free gift of nature*, may vary in quality and quantity and impacts the physical productivity of labor (Harvey 2006 [1984]:331-335)

Germany’s economic energy landscape is dominated by few actors, which hold disproportionate influence in the political sphere in comparison to other market actors in the energy sector (Moser et al. 2021, Strunz et al. 2016). As pointed out above, accumulation strategies are at times contradictory. The state must weigh economic interests of actors. In the German context, the interests of large-scale energy producers are weighted disproportionally high due to their powerful position (Brock & Dunlap 2018). Second, Germany has a long standing economic ideology termed ordoliberalism (Bibow 2017, Ötsch et al. 2018). The latter follows the dogma of economic liberalism i. e. ensuring that the free market lives up to its assumed potential. Peculiar to ordoliberalism is the focus on a strong state to provide a stable and reliable legal framework to achieve the smooth operation of the market (Nedergaard 2020:2020). The institutionalized energy transition in Germany can be seen as the result of a strong state that guides market actors (Quitzwo & Thielges). Third, land as well as labor costs in Germany are relatively high. This has implications for the profit ratio of renewable energy, considering its land requirements. In other words, production in Germany is characterized by relatively high ground rent which increases the costs infrastructure that requires large areas of land. To summarize, the German accumulation strategy, within the particular context of the energy transition, follows the general doctrine of economic liberalism, but is informed by three further characteristics. The power concentration among few actors in the energy sector, the ordoliberal iderology emphasizing a strong state that ensures market stability and reliability, and the relatively high production costs.

Within the scope of this thesis the concept of accumulation strategies allows me to position tenant electricity within a larger context of capitalist relations. For example, the success or non-success of certain dimensions of the German energy transition is highly dependent on the willingness of the state to implement respective policies. If one assumes, and I assess this more in-depth in the first part of the analysis, that the state has the same role in the case of tenant electricity, an understanding of its accumulation strategy is crucial. Complementary to the understanding of the state and accumulation strategies is the geographic political economy, which highlights the distinct spatiality of energy systems and how these are shaped by actors on multiple geographical scales. Barriers to tenant electricity must therefore be understood as the result of conflicts of interests between actors that move in between scales as well as dynamics of accumulation.

# 6. Research design & methodology

The applied research design is of qualitative character. I use data collected from four semi-structured expert interviews as well as secondary documents published by government institutions and research institutes. In other words, the secondary sources are to be described as gray literature, which is abundant in the case of tenant electricity as well as the German energy transition at large. Therefore, I argue that a document analysis is the necessary approach for structuring and coding the abundance of material that provides the data to answer the research questions.

## 6.1 Philosophy of science

Within my thesis, I follow a critical realist approach popularized by Bhaskar (1989) and further developed by Sayer (2000). The initial premise is that a real world exists and that social science is an attempt to make sense of it. As Benton and Craib (2011:121) term it: “So, realists in the theory of knowledge are committed to the existence of a real world. Which exists and acts independently of our knowledge or beliefs about it”. Such a reality cannot be fathomed with mere empirical observations. Bhaskar (in Benton & Craib 2011:125-126) conceptualizes three layers of reality. The empirical layer of observed events, the actual flow or sequence of events that may occur in experimental conditions just as well as outside the laboratory, and the *real* world of mechanisms, powers, and relations that science ultimately attempts to discover. I argue that this stratification is especially useful for my thesis. I seek to move between these layers by starting with the empirical, that is for example the policies, and decisions enacted by political decision makers. I then navigate towards the real by trying to unveil underlying drivers for the empirical observations. It is important to note that these drivers are not structures that cause events or actions in a one-way relationship. Social structures are shaped by agency while simultaneously constraining and facilitating the latter (Jones et al. 2011:162). Yet it would be reductive to ascribe structures to single events or actions. Instead, structures must be understood as the result of relations that are (re-)produced over time (ibid.). Moreover, the analysis of structures and relations is an attempt to get a glimpse of the picture that represents reality, yet one may never comprehend it in its full magnitude.

## 6.2 Case selection

I chose the case of Berlin for two reasons. First, Berlin is a city-state. Therefore, it has the agency and decision-making power comparable to other German states. Yet, due to its size and urban character, the political agenda is especially condensed. The range of perspective does not have the same spatial range as in other states, where for instance urban interests must be weighted with rural ones. Second, Berlin has been the site of political struggles for the re-municipalization of the local grid as well as a transformative shift of the energy system (Angel et al. 2017). Although only a few demands from civil society have been implemented, it appears that the government of Berlin is politically invested in an urban energy transition (Masterplan Solarcity 2020). It is therefore a so-called most likely case (Levy 2008). In other words, it provides the best conditions for tenant electricity within the context of Germany. This reduces the number of barriers that need to be considered, while simultaneously giving adequate weight to the ones that are generally applicable, even in contexts with less conducive institutional set-ups. In consequence, this enhances the external validity of the findings (Bryman 2010:390).

Within the analysis, I use the city of Berlin as the point of departure that I return to over the course of the analysis. However, a large share of identified barriers as well as the macro-economic context of accumulation strategies takes place on the national stage. Therefore, the city-state of Berlin is the case of the thesis, but to answer my research question I have to move between different political and geographical scales; the regional, the national, and the global as emphasized by the geographical political economy of energy transitions. The national level shows to be particularly important throughout the analysis.

## 6.3 Data collection

I collected my data through expert interviews and secondary document analysis. Each interviewee holds expertise in regard to tenant electricity. Interviewee A1 holds an advisory position in the senate of Berlin. The second interviewee (B2) is an engineer in the energy sector, while also being active in the cooperative “Civilian Energy Berlin” which advocates for the democratization of the energy system in Berlin. Interviewee C3 is a spokesperson for a leading tenant electricity corporation in Germany, whereas the last interview (D4) was conducted with a consultant of the Solarcentrum Berlin. The four interviews provided me with an in-depth understanding of current barriers and opportunities of tenant electricity, and the dynamics between different actors. Bogner & Menz (2009) distinguish between three kinds of expert interviews; namely, exploratory interviews, systematizing interviews, and theory-generating interviews. I employ a combination of the first two types. While the interviews indeed gave me further direction in studying the case, I also systematically covered my prior identified research interests. In that way, the interviews are not analyzed within a vacuum, but in combination with existing material, and therefore enhance the validity of my data (Bowen 2009). The interviews for example offered rich insight into the existing barriers of tenant electricity, while also depicting perspectives on the same case from different actors.

I conducted the interviews in German, which is the native language of three of the interviewees. Each interview lasted between 25 and 35 minutes. The questions were formulated beforehand but could vary according to the context of the interviewee’s expertise. In other words, the interviews were semi-structured. Questions would change over the course of the interview or be already adjusted beforehand. I would for example ask interviewees to expand further on aspects that I was not aware of yet, while also tailoring my questions to their perspective and the flow of the interview. Nevertheless, the corpus of the prepared questionnaire remained the same. Appendix 3 presents the general interview guide and Appendix 4 an example of it adapted for the fourth interview.

The secondary literature consists of 15 sources that were thoroughly coded and processed. Most of them are published or commissioned by government institutions, studies funded by government institutions, and legal documents (table 1, appendix). In other words, they are classified as gray literature. For example, reports issued by the government that evaluate tenant electricity policies, studies calculating the spatial potential of tenant electricity, or legal documents describing the regulatory framework of the EEG. I complement this data, with smaller sources such as short press releases or government-released statistics. These sources are not long enough or lack the consistency in content to undergo a coding process.

All sources are sampled purposively, that is on the basis of their suitability for the research (Bryman 2012:645). The prime criterion for the sampling was whether tenant electricity was the topic of the document. In addition, I sampled several sources that are linked to Germany's energy transition strategy as well as sources that provide statistics and background information to the development of renewable sources. Furthermore, all coded sources are published in a four-year period between 2017-2021. This is consistent with tenant electricity that has become part of the EEG in 2017 and received a further reform in 2021.

## 6.4 Coding trajectories

In this section, I explain my coding trajectories. The full codes are found in fig.2 (appendix). Each source was systematically coded by using the software Nvivo. I performed the same procedure with the expert interviews. The approach for the coding was deductive (Bryman 2012:566). That is, I developed the codes on the basis of my research questions and in dialogue with my theoretical framework. For example, the first sub-question asks for the barriers to tenant electricity. The respective codes that are used to answer the question are straightforward. I use the codes *Spatial Limitations*, *Actor Relationships*, *Funding & EEG*, and *Prospects & Growth.* These codes reflect the multi-scalar analysis suggested by my geographical political economy framework. For instance, the actor relationships node includes the possibility of tensions due to opposing interests of actors on varying levels of scale, whereas the *spatial limitations* address the spatiality inherent to tenant electricity as well as energy transitions at large.

The second sub-question requires codes that scrutinize how the barriers are addressed. Thus, I used the codes *suggested policies,* and *current policies.* Both have the respective sub-codes *state investment, subsidies,* and *regulations*. Separating between current and suggested policies also allows me to analyze the macroeconomic context that frames the perspective of the interviewees as well as the documents. Furthermore, I designed codes to distinguish between the perception and articulated purpose of tenant electricity by the federal and the local state respectively. Once again these codes correspond with my multi-scalar analysis. Furthermore, the codes provide the basis for the analysis of the state as the facilitator of capital accumulation.

The third sub-question involves the operationalization of my theoretical concept i. e. accumulation strategies. In other words, I must determine what variables indicate the manifestation of a concept in the material world (Bryman 2012:164). This process is especially challenging because in comparison to the other codes the variables I use may only occur in limited quantity or not at all. Therefore, the coding process did not necessarily focus on how tenant electricity correlates with accumulation strategies, but rather how it contradicts them. The consequential codes were for example the *ability to cut costs*, with the sub-codes *labor* and *ground rent*. I also used codes such as the *applicability in other contexts* and the participating actors. The latter is sub-divided into multiple sub-codes corresponding to the actors. During the coding process, I then coded aspects that for example indicate an incongruity with the *ability to cut costs* through *ground rent*.

## 6.5 Limitations

Naturally to any research work, my thesis is subject to multiple limitations. In this section, I want to briefly outline the most important ones. At first, my data collection is based to a large degree on gray literature that derives from state-funded sources. Therefore, barriers, policies, and other contents are biased to a certain extent, because they are fed by institutions whose perspectives supposedly share an analogical basis. It is not an issue of integrity, but rather of diversity. I attempt to counter this tendency through my expert interviews. They provide me with additional perspectives that complement the secondary sources and vice versa.

In addition, my coding and thus analysis is rooted in a deductive approach. Before the analysis, I had already developed a potential explanation for my research puzzle. Throughout the analytical process, I was confirmed in this explanation. Nevertheless, one could claim that this happened based on an initial bias.

Moreover, the case of Berlin serves as the point of departure for this thesis. However, after conducting the expert interviews it became apparent that the case is indeed intriguing, but is not sufficient to solve the research puzzle that motivates this thesis. That is because the case of tenant electricity is to a large extent conditioned by decision-making processes on the federal level. Therefore, I employ a multi-scalar analysis, which is necessary to understand the relations between actors operating on and across different geographical and administrative scales. Such an analysis benefits from the inclusion of multiple scales but is limited in its attention to case-specific details.

# 7. Analysis

The following analysis is structured into three major sections (7.1+7.2, 7.3, and 7.4) in respect to the three sub-questions. First I argue that the economic viability of tenant electricity is dependent on the regulatory framework it is embedded in and that in consequence the federal state must be treated as the central actor of the analysis. I then lay out the key barriers that impact the profitability of tenant electricity. In the second section, I begin by analyzing the policy responses to the barriers. The focus lies on the actual volume and ambition of the respective funding program as well as on the articulation of its purpose within government documents. From there I lay out the distinct approach towards tenant electricity on the federal and local state level, and in consequence, analyze the implications that arise. In the third section, I seek to explore the underlying reasons for the lack of commitment of tenant electricity on the federal level. First, I analyze how the ordoliberal ideology of German economic policy shapes the role of the state in relation to the market, and therefore tenant electricity. On this basis, I delve further into the impact of accumulation strategies on the role of tenant electricity.

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## 7.1 The economic viability of tenant electricity

A prime obstacle to the profitability[5] of tenant electricity is its solar character. In other words, the limited concentration of energy that is found in renewable sources in contrast to fossil fuels. The profitability of the latter is significantly higher because of the availability of high concentrated energy storage that accumulated over millions of years (Dukes 2003, Malm 2016). Solar power on the other hand cannot provide such a high return on the invested capital. Tenant electricity faces its respective challenges beyond its generic character as being solar powered. Nonetheless, profits are achievable. Successful tenant electricity projects often have a return on capital that ranges between 6-7% (BSW 2017:19, HTW 2018:38), although some actors are satisfied with merely 3% (Flieger et al. 2018:150). However, such rates are not necessarily the norm. The result of the inherent competitive disadvantage of tenant electricity requires a legislative support system to generate adequate conditions for capital to capture value.

The overarching theme voiced in the expert interviews and the selected sources alike is the lackluster regulatory and economic framework that conditions the profitability of tenant electricity. Regulatory and economic framework refers to the rules and regulations that govern the business model of tenant electricity through active policies such as subsidies, or through general rules that apply in the case of tenant electricity such as laws regarding monument preservation which may complicate the installment. As interviewee *A1* claims “generally speaking PV-panels are by now comparatively simple and standardized to install. The problem is the regulatory and economic framework.” This opinion is echoed throughout the material. For instance, in a survey conducted by the Institute for Housing and the Environment in 2017, 72% of the questioned housing corporations stated that the lack of an adequate regulatory framework to generate beneficial economic conditions is crucial (Prognos 2017:21). Interviewee A1 (2021:3) adds “it is not even about profit. It is about covering the costs. Initial capital must be refinanced”. The federal tenant electricity evaluation in 2019 states that the existing funding was not sufficient to ensure the profitability of enough projects (BMWi 2019:4-5). In short, tenant electricity is dependent on state policies.

Although this dependency is not only relevant for tenant electricity, but also the small-scale solar market in Germany at large (IASS 2016:3), the rather new model of tenant electricity is especially in need of a

5 Throughout this thesis I use profitability as the relative return on invested capital.

favorable regulatory framework. The latter is decided upon on the federal level. This is evident in the analyzed material. Interviewee C3 claims that "regarding the solar development in Berlin, on the paper that is possible of course. The spaces are there. The question is, is the willingness there?" Interviewee *B2* adds "that is a federal case". *A1* concludes that "our biggest challenge was and is to advertise on the federal level, that the regulatory and economic framework conditions are improved". Crucially, A1 points out that the city of Berlin is limited in its leverage. The important regulations are decided upon on the federal level. Similar statements are found in the analyzed documents. In the evaluation of Berlin's solar potential (HTW 2018:30), it is stated that "the legal framework has a direct and as a general rule decelerating impact on the respective installed PV output, and therefore on the urban energy transition at large". With legal framework, the report refers to the legal regulations that shape the process that any tenant electricity project undergoes, beginning with the planning, and ending with the provision of solar power.

The consensus is clear. The federal state is the crucial actor to impact the profitability, and therefore the viability of tenant electricity. Notably, state policies, realized as well as suggested ones, cannot be reduced to subsidies. The policies include a range of measures. For instance (in-)direct subsidies, lifting or sharpening regulations, or possibly even state investments. To conclude, the viability of tenant electricity on the market is highly dependent on its economic profitability. The latter is determined by the regulatory and economic framework, which can be altered through state policies if other factors are not sufficient. This is the case with any industry. Currently, tenant electricity does not provide a business model that is attractive enough for large portions of capital to invest into it in the necessary quantity of installments that would meet Berlin's ambitious goals without legislative adjustments.

## 7.2 Identifying barriers

To understand the current role of tenant electricity within the energy transition in Berlin and Germany I identify and analyze barriers that prevent it from holding a key position. It is important to note that these barriers are understood and expressed through the lenses of a capitalist energy regime that is governed through market instruments such as the EEG. Therefore the barriers are to be analyzed within this context. I divide barriers that impede the economic viability of tenant electricity into three groups. First, practical barriers regarding the installment of tenant electricity. These are categorized as barriers that impact the ability to scale and standardize; second, barriers that impact the collaboration aspects indispensable to tenant electricity; third, barriers directly related to the existing subsidies and compensations.

### 7.2.1 Scaling up

In comparison to wind or solar parks tenant electricity installments are small-scale. Projects commonly range from 10 KW peak to 100 KW peak (Federal Network Agency (b) 2021). These comparatively low numbers, are the result of the generally smaller spaces, but also of the fragmentation of rooftops. The latter are relatively unique in scale, gradient, spatial coherence of available surfaces, access opportunities, and connectedness to the house. This leads to the first and most prominent barrier that lays at the very core of tenant electricity: the inability to scale and standardize the installments and therefore the production of energy.

Smallscale PV does not decrease in output efficiency as much as other energy sources (IASS 2017:9). Nonetheless, the smaller scale of installments impacts the profitability. That is because technological efficiency models are concerned with the output per square meter. The problem with smaller scale tenant electricity is that the initial investment in the infrastructure has to calculate costs that derive from the installment of the panels. These costs do not decrease in proportion to the scale. In other words, the installment costs are relatively independent of the actual size of the project (BSW 2017:17). To take an example from the agriculture industry; if a farmer needs to buy a tractor to till a field it would be more cost-efficient to have many hectares to increase the use-value of the tractor and diffuse the investment costs through a high production output. If the farmer has only one hectare, the costs would go up. The same applies to rooftops. Interviewee *B2* (2021:10) states that they "start with 10 KW and the roof is always different. That means there is nothing to scale". As a result, many providers of tenant electricity focus on the installment on especially large roofs to cope with the high installment costs (Prognos 2017:60). Nevertheless, the inherent difficulty to scale up the quantity of installed panels due to the limited size of rooftops is a crucial barrier to the profitability of tenant electricity projects.

One approach to minimize costs of PV installments is to converge them within areas of high population density. For instance, in Berlin, many buildings are structurally connected. In most cases, each of these buildings is individually linked to the urban electricity grid, which could increase the costs, because they require a cable connection through the house, and more importantly, an individual summation- or smart meter[6] that manages and documents the produced electricity (B2 2021:11). As a response, operators of tenant electricity would like to converge projects to cut costs. In other words, installments on adjacent roofs could lead to one consolidated grid connection that is channeled through the same summation- or smart meter (Prognos 2017:15). Interviewee (B2 2021:11) notes:

6 An electricity meter is a device that measures the consumption of energy. The local consumption of tenant electricity requires an advanced device that is usually a summation- or smart meter (ISE 2021:67).

> “Five stairways, a pretty flat roof, together maybe 100 rent units. I could cover the whole roof there and connect the 100 housing units to tenant electricity. Does not work, because the thing has five stairways and probably also five grid connections. That means five times the cable goes into the house. With that I can only do five tenant electricity installments and therefore, the costs increase enormously because I have to set-up a respective summation meter package for every individual grid connection”

To avoid this situation one could converge the respective housing units through a cable connection through the basement, which must be requested from the local grid operator. Interviewee B2 (2021:11) adds that “this would cost so and so many thousand euros. That we have to do this is a matter of regulation”. They refer to the fact that energy produced by tenant electricity panels cannot be channeled through the public grid unless it is being sold directly to the local grid operator (Federal Network Agency 2020:9). Hence, it is costly for operators of tenant electricity projects because they cannot use the local grid to converge installments on adjacent rooftops. In addition to the federal government, the Federal Network Agency is regulating the access to the grid and is therefore partly responsible for the interdiction of tenant electricity to temporarily use the local grid.

To sum up, the initial investment costs are especially high for tenant electricity because the costs cannot be diffused through scaling up the installment as would be the case in large solar parks. Interestingly this leads to a cost-efficiency calculation that has to weigh the benefits of low ground rent that is provided through the tenant electricity model with the inability to scale the installments causing further costs. However, possibilities exist to mitigate the spatial limitations of rooftops. Operators could converge installations of separate rooftop units on structurally connected houses. However, such an approach is blocked through regulations that do not allow the use of the public grid. This exemplifies how the existing spatialities of a centralized and uniform energy regime is challenged through tenant electricity because the distribution system is not set-up for the flexible and local context of tenant electricity.

### 7.2.2 Standardizing

Another barrier, directly related to the ability to scale up the installment, is the inability to standardize. As pointed out above, the rooftops are unique in many facets. Any potential project requires an in-depth evaluation regarding the profitability (B2 2021:9). In this planning process, multiple aspects could increase the costs. First, buildings suitable for tenant electricity are significantly higher than detached houses in semi-urban or rural neighborhoods. Therefore, the costs for an installment are dependent on the house to have easy access to the roof through staircases. If that is not the case the construction of scaffolding causes further costs (A1 2021:7, HTW 2018:43). Returning to the ability to scale, the relative costs for scaffolding are also dependent on the number of panels that are realized on the roof. Making the initial investment into scaffolding on a small roof is seldom profitable (B 2021:10). Additional costs may occur depending on the gradient of the roof (A1021:2). It is the uniqueness of roofs that impedes the ability to standardize. Interviewee B2 (2021:10) for example mentions that they would only consider flat roofs: “anything else is currently economically not feasible”. Considering the uniqueness of rooftops the case of Berlin is especially complex. The proportion of older buildings with less suitable roofs is high in Berlin. This is evident in the high number of houses that are under monument protection law. About 46 000 of all scrutinized roofs in the (HTW 2018:30) solar potential study of Berlin are considered monuments. The relative output potential of these buildings is even disproportionately bigger than their non-monument counterparts and amounts to ca. 30% of the calculated solar potential (ibid.). Each project requires scrutiny and coordination to navigate through the specifics of the building and the respective legislation.

The relatively high density of old houses leads to an additional issue. Housing units differ in their electrical set-up. Commonly the connection to the grid is in the basement. Thus, the panels need to be connected to the grid through the entirety of the building. The cost intensity is then dependent on the architectural set-ups (B2 2021:12). Houses with elevators for instance lower the costs because they provide a suitable space to connect the panels to the grid. Is that not the case, costs may increase (ibid.). Furthermore, tenant electricity models are usually required to have a specific energy meter, either a summation- or a smart meter, that documents the energy going into the grid (Prognos 2017:28). This is necessary because tenant electricity covers in most cases only a share of the energy, but not all of it. The meter controls how much energy is going in and out. Its installation is already costly, but in addition, it requires an available space to install it. This creates another criterion that might tip the scale and make a project insufficiently profitable. Interviewee B2 (2021:9) summarizes the complicacy:

> “My day-to-day business is to decline projects because they are not economically viable. That has many reasons. (...). What does the connection situation look like? How high is the accumulated consumption in the house? Yes, that could work. Then we go out and take a look at the roof. How is the gradient of the roof? How is the structural design? Yes, that could also work. How does the basement look? Do I have space for the energy meter? Yes, that could just about work. How is it with the wiring? Does it even go once through the house. Yes, that could just about work. How is it with the owners? Oh, a homeowner association with 25 rent units or with 30 or with 50. Are they all on the same page? Yes, maybe. What is the situation with the inhabitants? Will they participate eventually?”

A similar concern is found in the tenant electricity evaluation of the German Parliament. It is noted that any statements prior to the thorough individual evaluation regarding the profitability of projects are impossible due to the multitude of factors that impact the latter (Prognos 2017:5). To sum up, the costs of tenant electricity installations are dependent on the spatial set-up of the roof as well as the inner house. Costs need to be calculated accordingly. In consequence projects are difficult to standardize. The planning and facilitation of tenant electricity projects does not only cause immense costs before the actual realization of projects, but also decreases the certainty for actors to receive adequate returns on their invested capital. Projects are not always identified as unprofitable from the start. Instead, they require a meticulous evaluation that may flatline the project at any point. It is anticipated that the corporations that strategically improve their procedures and invest into lean and efficient procedures will finally prevail on the market (BSW, 2017:11).

### 7.2.3 Complex actor relationships

Tenant electricity is dependent on collaboration between a heterogeneous range of actors. The BMWi (2017:36) lists the following actors in regard to tenant electricity: the tenants, the property owner and lessor, the operator of the PV-panels, the external and complementary electricity supplier of the inhabitants, and the local grid operator. All parties involved may differ in interest, awareness, and agency (D4 2021:24). Therefore, the realization of a project requires comprehensive planning processes.

In a survey (ZSW 2019:16+44) the administrative work load arising from the documentation and managing of the produced energy is voiced as the second biggest barrier by tenant electricity operators. Moser et al. (2021) add that the Energy Industry Act (EnWG) causes many administrative expenses that impede the profitability. Interviewee A1 (2021:3) notes that the current legal framework complicates collaborations between actors due to the administrative barriers, while Interviewee D4 (2021:24) adds that “it is simply not worth the effort” for actors to participate in projects that suggest marginal profit rates, but also enormous administratively expenses in form of labor. In addition, interviewee C3 (2021:23) asserts that many potential business partner are not even aware of the benefits they may receive through tenant electricity. In particular, housing corporations, which are an integral component of tenant electricity, lack the necessary awareness. Other participants refuse collaboration because they deem tenant electricity to be against their interests. For example local grid operator that lose customers to tenant electricity (Moser et al. 2021).

The Federal Network Agency appears to be especially skeptical towards. This point of view has been evaluated to be a key reason for the stagnating development of tenant electricity by Moser et al. (2021). They claim that experts agree that a diffusion of energy is currently not wanted by the Federal Network Agency (Moser et al. 2021). This is at least partly reflected in the interviews. C3 (2021:21) for example states in reference to the Federal Network Agency that “there is surely overall the biggest skepticism”. They elaborate that it is about their “own hegemony over the electricity supply” (ibid.). That is, the Federal Network Agency has an interest to maintain a centralized grid run by regional grid operators. Interviewee D4 (2021:26) adds that if tenant electricity projects channel electricity through the public grid they face especially high grid fees. The reason behind the skepticism of the Federal Network Agency is anchored in a cost efficiency ratio. A key merit of tenant electricity is that it is directly consumed where it is produced. In consequence, operators are exempt from fees for the usage of the grid, whereas consumers receive electricity prices that are exempt from electricity taxes (Moser et al. 2021). Considering that the public grid is tax-supported the result is the increase of costs for everybody that does not consume locally. This is reflected in rising electricity prices. In other words, the Federal Network Agency has an inherent interest to stabilize the price for the usage of the public grid. If It does not, the prices for electricity rise for consumers, which puts political pressure on the Federal Network Agency as well as the federal government. Tenant electricity poses a threat to this interest. The result of this threat is that tenant electricity may not be channeled through the public grid, which impedes the potential to scale, because every installment needs an individual connection with the grid and a respective meter instrument.

### 7.2.4 Trade tax and housing corporations

A central barrier that has been highlighted by three of the interviewees (A1 2021:3, C3 2021:17, D4 2021:24) as well as in the analyzed documents (Prognos 2017:21, HTW 2018:25) is the loss of tax benefits for housing corporations. To elaborate, housing corporations can apply for the so-called *Erweiterte Gewerbesteuerkürzung* according to § 9 Nr. 1 Satz 2 GewStG (Prognos 2017:24) which translates to an advanced trade tax reduction. Essentially this leads to the cutting of trade tax for housing corporations. The purpose of this law is to exempt housing companies from paying taxes based on the administration and utilization of their own housing property. The generation and commercialization of energy through PV-panels is not covered in this law. Therefore, housing companies lose their tax exemption when producing tenant electricity (Prognos 2017:34, ZSW 2020:16). This is termed tax infection. In consequence, many housing corporations shy away from tenant electricity projects, because they cannot make profits with the PV-panels without losing money due to the shortfall of their tax exemption (C3 2021:17). Therefore, actors create complex supply chain models in which a contractor, not the housing corporation, serves as the supplier of the energy. The contractor is then the energy provider while leasing the rooftop space from the property owner i. e. usually housing corporations..

Once again it is the Federal Network Agency that voices skepticism towards such models, claiming they are not valid to receive tenant electricity supplements[7] (Federal Network Agency 2020). This understanding has not been shared by legislators, but has created insecurity among tenant electricity operators and housing corporations (Prognos 2017:19). It was only in the EEG reform in 2021 that the federal government confirmed the legal validity of contractor models. Yet, even with this validation, housing corporations still have low incentives for an involvement. Interviewee B2 (2021:14) for example claims that they were offered a tenant electricity project with a roof lease of 500 euros per month. This is comparable with the rent retrieved off a small housing unit. In other words, the housing company receives marginal profits through leasing the roof. Adjusting the advanced trade tax [*Erweiterte Gewerbesteuerkürzung]* could create further

7 The tenant electricity supplement is a funding tool to guarantee stable prices for locally produced and consumed energy (further explained in the coming chapter).

incentives for housing companies to take initiative and participate as an active partner on the market (A1 2021:3).

The barrier of entry for housing corprations is evident when assessing the participating actors in the current tenant electricity market. Among the ca. 30 providers that moved into the market are many housing cooperatives and municipal facilities (Flieger et al. 2020). In BSW (2017:11) it is pointed out that “the first solar tenant electricity projects were realized by engaged idealists from the cooperative context and local solar initiatives'”. Interviewee A1 (2021:4) explains that cooperatives play indeed an integral role for tenant electricity, but are not in the majority. It is expected that once the regulative economic framework is favorable, providers that are capable of strategically increasing their efficiency and lean production procedures will assert themselves on the market (BSW 2017:11). Interviewee C3 (2021:23) affirms this expectation. They add that it is especially important that housing corporations to actively participate in the market, which could be achieved through the aforementioned reform of the trade tax. They continue to point out, that housing corporations are often unaware of the merits of tenant electricity. Therefore, it is necessary to do lobby work and convince actors from the housing market that tenant electricity has indeed economic potential (ibid.).

In summary, tenant electricity is hampered due to its complex actor relationships, that are partly rooted in the lack of awareness (housing corporations), general conflicts of interests (Federal Network Agency) and in the lack of economic incentives for all participants. The unusual set-up that is required for tenant electricity contrasts conventional energy industries. Housing corporations are a key actor that is not sufficiently incentivized to participate in the market. They shy away from apparently low prospects and additional costs arising due to coordination and governance of projects. Their inclusion requires first and foremost a reform of existing tax regulations. Yet, also elaborate lobby work to inform and network appears necessary. In addition the Federal Network Agency is an important actor that meets tenant electricity with skepticism. Such skepticism exemplifies the tensions between the interests of actors operating on distinct geographical and political scales with respective strategies and interests.

### 7.2.5 Direct and indirect funding

The federal government uses the EEG as a prime tool to direct the energy transition. It entails most importantly the tenant electricity supplement [*Mieterstromzuschlag*], and furthermore the guarantee of feed-in tariffs. These instruments are argued to be most important for the economic viability of tenant electricity, because they are adjustable, whereas barriers such as the difficulty to scale the installments are inherent. It is pointed out that “besides the technological and structural constraints the indexing of the potential [of tenant electricity] is therefore, especially dependent on the regulatory economic framework" (HTW 2018:36). I distinguish the latter in two forms of state policy: direct and indirect funding through the state.

### 7.2.6 Tenant electricity supplement

Direct and indirect funding through the state are the predominant tools used in the case of tenant electricity. Central in this context are the feed-in tariffs. The latter, falling under the category of direct funding, describes a policy mechanism that provides long-term security for producers by guaranteeing a price for the feed-in of their energy into the public grid. In other words, the federal state guarantees that locally produced energy is bought to a price above the rate on the free market. Typically this price is dependent on the production costs per unit of energy that is generated by the respective technology. That means that the respective grid operator pays a fixed price for the fed-in electricity. Over a 20 year period that price slowly regresses (Federal Network Agency (b) 2021). Although it is the grid operator that pays any potential discrepancy between the feed-in tariff and the actual market price, the costs are eventually reallocated [EEG-Umlage] to all grid users, apart from a large share of the industrial sector (BAFA 2018), by increasing the overall electricity prices (Federal Network Agency (a) 2020). Tenant electricity receives feed-in tariffs, but crucially these are significantly lower in comparison to conventional domestic PV production (Federal Network Agency (b) 2021, Moser et al. 2021). Although one might argue this still represents an additional incentive in contrast to non-funded energy sources, it is in fact an attempt to stop tenant electricity projects from feeding into the public grid, because the policy aims to prioritize direct consumption by tenants over feeding the electricity into the grid (Federal network Agency (a) 2021). In turn, tenant electricity receives an almost identical tool that is specifically designed for this context; the tenant electricity supplement [Mieterstromzuschlag]. It is the result of the tenant electricity act in 2017. The underlying reasoning is that tenant electricity should include tenants in the energy transition (B2 2021:8+15 2021). In consequence, produced electricity should be consumed within the house. Thus, the tenant electricity supplement funds each KWh that is directly consumed within the same immediate vicinity of its installment location. Although tenant electricity is directly funded, whether it feeds into the public grid and receives feed-in tariffs, or is directly consumed, it is questionable whether the current funding can guarantee the profitability of tenant electricity models (Prognos 2017:22, ZSW 2019:30).

A frequent argument is that operators of tenant electricity models are disadvantaged in comparison to non-tenant focused small-scale PV of domestic consumers, because they have to pay the full EEG-reallocation costs for the energy they deliver to the tenants (Lange 2020). Reallocation costs are compensations for the grid operators who pay renewable energy providers the feed-in tariff instead of the market price. These are financed through a reallocation of the costs onto all other electricity consumers (Federal Network Agency (c) 2021). For example the price for electricity from the public grid increases by a certain percentage dependent on the amount of electricity that enters the market through feed-in tariffs (Federal Network Agency 2020). Exempt from the reallocation costs are industries that are especially energy intensive and belong to certain sectors. For example the steel industry, the aluminum industry, or the petroleum processing sector (BAFA 2018). Additionally, domestic energy consumers only pay 40% of the reallocation costs (Lange 2020). In contrast, tenant electricity operators pay the full costs. This is supposedly balanced through the tenant electricity supplement. However, this led to a peculiar situation in which the additional costs for the use of the grid were 6.4 cents per KWh through the EEG-reallocation, whereas the tenant electricity supplement merely generated 2.2-3.8 cents per KWh (Federal Association for Consumers 2019). In other words, tenant electricity is severely disadvantaged in this aspect, comparing it with other domestic PV production. The inefficiency was especially exposed when in 2020 the tenant electricity supplement fell under zero cent per KWh, because they were coupled to the feed-in tariffs. To elaborate, tenant electricity supplements were always supposed to be eight cents below the feed-in tariffs (Lange 2020). Considering the falling feed-in tariffs the tenant electricity supplement became irrelevant. Interviewee C3 (2021:19) comments: “Naturally, that is an insane economic barrier”.

### 7.2.7 EEG-reallocation costs

Besides direct funding, indirect funding represents a higher financial contribution to the economic viability of tenant electricity (BMWi 2019:9). The main factor is the exemption from grid fees. The latter apply through the usage of the public grid. Just as citizens are required to pay taxes for common infrastructure, energy producers need to pay fees for the use of the public grid. The disadvantage of tenant electricity’s exemption is that even small amounts of solar power cannot be channeled through the public grid unless it is sold to the grid operator. As mentioned above this hinders the converging of installments, and therefore the cutting of costs through scaling up. Another option to increase the indirect funding is to cut down the costs for the reallocation of the feed-in tariff (Prognos 2017:18-19). The bottom line to both forms, indirect and direct funding, is that they are currently not enough to ensure the profitability of tenant electricity. The tenant electricity supplement is not even enough to compensate for the costs deriving from the EEG-reallocation of increasing grid costs.

The key takeaway of the first section of the analysis is that tenant electricity faces many barriers, but that several of these barriers are either solvable or can be mitigated through the right policy tools. In addition, the barriers are the result of changing patterns of production and partial resistance against these. The Federal Network Agency for example is skeptical towards the autonomous and highly modularized networks that are necessary for tenant electricity. Thus, they are reluctant to collaborate at best. Moreover, the barriers to tenant electricity also characterize its strength and weaknesses, and therefore provide a first picture of its compatibility with strategies of accumulation.

## 7.3 Policies for tenant electricity

In the previous section I have outlined the central barriers to tenant electricity. For example the spatial limitations of rooftops are inherent to tenant electricity and cannot be completely resolved. Installments will never be able to reach the same scaling as rural solar parks. However, as I have argued, there are tools to mitigate this weakness. Other barriers are solvable through simple policy tools and legislative adjustments. In the following section I therefore analyze how the barriers are and have been addressed through policies, but also the expectations, and distinct strategies that tenant electricity is approached with. I begin with an assessment of the policy reforms in 2021, to then continue laying out the expectations and ambitions that are implied by the policies. In the third part of the section I analyze the distinct perspectives of the city of Berlin and the federal state and how they impact their respective commitment to tenant electricity.

### 7.3.1 The 2021 reform

In 2021, four years after its reform in 2017, the EEG received further adjustments, partly targeting tenant electricity. The Ministry for Economic Affairs and Energy (BMWi 2021) claims that tenant electricity is now significantly more attractive. Some of the adjustments address existing barriers. Most notably the tenant electricity supplement was increased and is now independent of the feed-in tariffs (ibid.). In contrast to 2020, when the supplement fell to zero cent per KWh, it is now at 3.79 cents per KWh for installations up to 10 KW. If the latter exceeds 10KW the funding shrinks to 3.52 cents per KWh, and to 2.37 cents if it exceeds 40 KW (Federal Network Agency (b) 2021). Such a graduation clearly benefits the construction of small-scale installments, providing them additional incentives in consideration of their higher relative installment costs. The staggering of the supplement in relation to the scale of the installment is directly linked to another policy adjustment. If installments on structurally connected roofs have the same operator they are not anymore accounted as one installment. Therefore, operators can scale up installments on structurally connected roofs, but still receive beneficial supplements (BMWi 2021). However, this does not apply for installments that are linked through cables and use the same access to the grid. Hence, it is still not possible to cut costs by converging the grid connections of multiple installments.

In addition, the EEG reform enables that the produced energy that is consumed by tenants does not have to come from the very same roof. Interviewee C3 (2021:19) illustrates this with a simple example: “We had sometimes the situation, that garage gates that stand next to an apartment block could be covered with PV, but the electricity was not allowed to be sold within the house”. The new formulation dictates now that the electricity must be consumed within the same quarters, not in the very same house. This enhances the ability to scale up the production. However, the public grid must still not be used which poses challenges for connecting installments on different rooftops (BMWi (a) 2021).

Additional measures include an adjustment of the trade tax [Gewerbesteuer]. In March 2021 the federal government coalition of the SPD and the CDU came together to negotiate a reform of the trade tax that enables housing corporations to earn up to 10% of their income through the sale of renewable energy (Handelsblatt 2021). In consequence, housing corporations would not be in danger of losing their tax exemption when earning money from renewable energy such as tenant electricity. However, this is still an ongoing process. Furthermore, the federal government officially confirmed the validity of supply-chain models with a contractor. This generates security for actors such as housing corporations (BMWi (a) 2021).

In summary, the federal government has indeed partly addressed some of the multiple barriers. The increase of the tenant electricity supplement is vital for the profitability of projects. Furthermore, the regulative tweaks on the converging of installments are important to cut down costs for operators. Nevertheless, the policy response lacks the necessary commitment. The reform of the EEG merely tweaks existing policies into slight adjustments, rather than structurally shifting the strategy.

### 7.3.2 The policies: Ambition and volume

The report of the BMWi (2019:4) states that it “shows overall that the expansion of tenant electricity projects with a total of around 14 MW is well below expectations'”. This evaluation raises the question of what the actual expectations were. In particular because the federal government has merely changed details in the 2021 EEG reform two years after the statement above.

A general indication of the imagined magnitude of tenant electricity by the federal government is found when looking at the financial volume of the EEG in regard to tenant electricity as well as the quantitative cap that limits the outflow of supplements. The direct funding through the tenant electricity supplement policy amounted to 30 000 euro in the years 2017 and 2018 combined (BMWi 2019:5). In comparison, the overall potential calculated by the government funded Prognos (2017:89-90) study assesses an additional 14 TWh of produced solar energy if tenant electricity reaches a best case scenario. This would be a 36% increase to the overall solar power produced in 2015. The study then calculates the costs if the potential tenant electricity would be hypothetically realized within the year 2016. They conclude that the financial volume would amount to 1.25 billions euro when considering the 2017 designed tenant electricity supplement and feed-in tariffs. In addition, another 0.53 billion euros would arise for municipalities and grid operators. The costs would be significantly lower than with conventional PV supplement programs that are mainly financed through feed-in tariffs (ibid.). The overall investments into renewable energies in 2017 were at 15.8 billion euros of which 1.7 billion euros were invested into PV. This data includes the private sector (ZSW 2020:32). Therefore, providing 1.25 billions in funding appears feasible at first glance, even though, as is evident in hindsight, the policy measures designed in 2017 were not sufficient to ensure the profitability of tenant electricity.

The insufficiency of the unambitious programs development does not come by surprise. The yearly goals for PV installments between 2014-2016 were at 0.0025 TWh. These goals were not achieved because the feed-in tariffs were too low (BSW 2017:9). This is documented in a significant decrease in PV installments between 2012-2017. Investments into PV decreased from 12 billion to 1.7 billion Euros in merely five years (ZSW 2020:32). The significance of the tenant electricity supplement is additionally illustrated by the high number of launched tenant electricity projects in the first term of 2019, because in the beginning of the year a reduction of the supplement was announced. (BMWi 2019:8).

The yearly cap for the tenant electricity supplement is set at 500 MW (BMWi 2019:7). That converts to 0.0005 TWh, thus representing only a fraction of the potential, even within a moderate scenario that assumes a gradual development over several years (Prognos 2017:91). It shows that the intent behind the policy tool is not the development of an otherwise unprofitable industry, but rather a kick-start for actors to grow and be able to penetrate the market on their own. The purpose of the policy is therefore rather to provide a market entry for corporations focusing on tenant electricity (ZSW 2020:7). This is achieved once the corporations have developed lean and efficient procedures (BSW 2017:11). The state serves as a facilitator to shepherd the industry into new markets. However, it shows little interest in sustaining its policy efforts to enable infrastructure development beyond the initial market entry, even in the wake of climate change. The low cap of 500 MW shows this reluctance of changing the pre-existing path of cautious long-term intervention into the market.

### 7.3.3 The purpose of tenant electricity: Frictions between the local and the federal state

The analysis reveals frictions representing different understandings of the needs of capital. Most central is the rift between the city of Berlin and the federal government when it comes to the commitment to tenant electricity. Interviewee A1 (2021:5) comments “we have demanded multiple times from the federal government that we expect more. Also recently. So far this is not satisfying”. The other interviewees affirm as well that the interest in tenant electricity on the federal level is restrained. On the question whether the conditions for tenant electricity will improve in near future interviewee B2 states: “That is federal for now, and they are far away to think about these things” (B2 2021:19). Interviewee C3 adds that “the Union [CDU] is not an immense friend of PV, but does not put itself in the way either”.

The official goal of Berlin is clearly formulated: covering a fourth of the city’s electricity consumption through solar energy (Masterplan Solarcity 2020). To achieve this, the city of Berlin has developed institutional support to consult potential projects (ibid.). Furthermore, the city is currently investigating further tools to incentivize tenant electricity. For instance the introduction of a financial support program for the meter technology (C3 2021:20, D4 2021:27). The challenge is that the local government cannot fund aspects of tenant electricity that are already targeted through policies on the federal level. In consequence, the city of Berlin has limited possibilities to improve the profitability of tenant electricity (B2 2021:12, HTW 2018:52). One approach is to address policy changes through the German Bundesrat, the upper house of parliament. Since 2018 the state of Berlin has put forward multiple motions to change the existing legal framework. Partly in collaboration with other states such as Thuringia, the Rhineland-Palatinate or North Rhine-Westphalia (Masterplan Solarcity 2020:31). In the summer 2020 the conference of all ministers of the economy in Germany explicitly requested the federal government to improve the current regulatory framework for tenant electricity (Minister Conference 2020). Their demands show a clear distinction in strategy between the federal and the regional state governments.

Additionally to the parliamentarian work, the city of Berlin has equipped the recently founded municipal energy facility with capital to invest into tenant electricity projects (A1 2021:6). Yet, the agency gained is tied to the amount of capital, which does not appear enough for a large-scale investment. Currently, the portfolio includes only a handful of projects (Municipal Energy Utility Berlin 2021). The approach is nonetheless significantly different to the EEG. It allows state institutions to invest into infrastructure rather than waiting for market actors to do so. Additionally, the senate of Berlin will pass a law that forces the installment of solar panels on newly constructed buildings if the investment is economically viable (D4 2021:27). Despite the limited scope of these measures, it does represent an approach beyond economic liberalism. In contrast, to the ordoliberal ideology of the federal government, the City of Berlin seems to consider large structural investments. For example state investments in the form of a green new deal. In the case of Berlin, the HTW (2018:50) study points out that the GDP of Berlin was at 135 billion euros per year in 2017. Unlocking the maximum solar potential of the city would require an investment volume of 7.5 billion euros. This would only be a fraction of the GDP. The returns on the invested capital could range between 3-9 % (ibid.). Moreover, the goal of covering one quarter of Berlin’s energy consumption through solar power faces urgency. The HTW (2018:49) study elaborates that reaching the full potential of solar power in Berlin within 30 years would require a realization of 30 projects every day. In comparison, only 28 projects have been installed in Berlin since 2017 (Federal Network Agency (a) 2021). The study continues arguing that:

> “The funding measures may only avail when the whole city society is addressed and prompted to use solar energy. Climate partnerships with single companies are a start, but ultimately no scalable tool. A public campaign is required that appeals to the different target audiences” (HTW 2018:48).

Such strategies are far from being realized, but show that a climate Keynesian (Malm 2018:185-186) approach, in short an increasing role of the state as an investor into renewable energy sources, is to a small extent reflected in the formulated strategy of the city of Berlin, and more so in the HTW (2018) study that was published in collaboration with the city. Interviewee B2 rightfully asks “if we want to produce solar energy in Berlin than we have to do this through tenant electricity. How else should that work?”.

### 7.3.4 Participation over production

The city of Berlin frames tenant electricity as a necessary path to achieve climate neutrality. In other words, tenant electricity is a means to produce enough energy to dismiss fossil fuels. The federal approach differs significantly in its formulation. In the EEG, the federal government states that “tenant electricity is an important component for the acceptance of the energy transition, because it also enables a participation of the tenants” (EEG bill 2021:3). The governmental tenant electricity report (BMWi 2019:3) even claims that the tenant electricity supplement, and thus a viable tenant electricity program, was established to “increase the acceptance of the energy transition, anchor it further in the population and to engage more actors”. Following these statements, one must conclude that participation and an increasing acceptance of the population is the central purpose of tenant electricity. Yet, when deconstructing the actor constellations of tenant electricity it remains questionable in what aspect it increases the participation in any conceivable way. Tenants indeed benefit from lower electricity prices, but framing this as a form of democratic participation is a stretch. The only influence tenants have is their purchasing power. They may decide not to buy electricity from the panels on their roof, but that is where their agency ends. Interviewee B2 (2021:15) explains that the “people have the possibility to participate through the contract they sign that can be terminated monthly and that is it”. Interviewee D4 (2021:28) remarkably adds: “Tenant electricity is also conceptualized as an opportunity for tenants to participate in the energy transition. In practice, it is not possible for tenants to make such a decision, because there is no right for tenants to say: I claim PV”. Nevertheless, it would be negligent to dismiss the framing of participation as a simple misunderstanding.

It appears that the argument for an increased participation is indeed based on the fiction that purchasing power equals participation. Domestic PV nourishes off the idea that civilians act as small capitalists in the name of the environment. They make investments with a return on capital that is not attractive for actors on the free markets (D4 2021:27). Therefore, they take a position as market participants but on the ground of so-called ethical investments. Saving costs through the tenant electricity model is significantly less relevant for tenants than the green character of the produced energy (Schäfer 2019:89). Tenants do not usually have the capital assets for such a decision. Their agency is reasoned to lie in their role as consumers that participate through the choice of living in houses with green electricity (D4 2021:27). The tenant electricity supplement reinforces the role of the tenant as a consumer, because the model itself incentivizes the direct consumption over the feeding into the local grid (Federal Network Agency (b) 2021). This suggests that a successful energy transition is not only dependent on the state, but on the willingness of individuals to take the right decisions. Considering the centrality of participation and acceptance for the federal perspective exemplifies the lack of commitment to tenant electricity as a significant productive source of renewable energies in Germany. Following this logic tenant electricity rather has an ideological function for the federal state than a meaningful expansion of production.

To summarize the second section of the analysis, the assessment of the articulated expectations and intents in contrast to the realized measures, shows internal contradictions, but also hint towards the ordoliberal perspective of the federal state. The tenant electricity supplement in combination with other existing barriers does not seem sufficient to expect a market push for tenant electricity. In addition, the low volume cap and the focus on a problematic form of participation suggest that the underlying driver of the development is not rooted in the idea to expand the production of renewable energy. In fact, the federal perspective clearly suggests an ideological function of tenant electricity i. e. to use participation narratives as a tool to appeal to certain parts of the population. In stark contrast, it appears that the city of Berlin positions tenant electricity as an integral component of their path towards climate neutrality. Their suggested measures reflect a distinct approach that considers a stronger role of the local state to provide the necessary impulses. Once again this distinction between local and federal actors strategies shows how the tensions play out in the political economy of the German energy transition.

## 7.4 Accumulation strategies

The previous section has shown that the federal government does not block tenant electricity, but simultaneously shows little interest in tenant electricity as a significant contribution to the replacement of fossil fuels. Instead it rather ascribes an ideological function to tenant electricity. Following this logic, i. e. the barriers are not addressed with the sufficient commitment, because the purpose of tenant electricity is not a significant expansion of its quantitative production output, raises the question why this is the case. It would be simplifying to dismiss the federal state as ignorant towards climate change. Instead, turning to the concept of accumulation strategy provides a helpful tool to explain the inactivity of the German government. The German accumulation strategy is characterized, as presented in the theoretical framework, by high domestic production costs, few, but powerful actors in the energy sector, and its ordoliberal ideology.

### 7.4.1 Tenant electricity and economic (ordo-)liberalism

I argue that the reluctance of the German government to push for a stronger supplement, if not acting as an investor itself, reflects its ordoliberal ideology. The latter describes the German version of economic liberalism. *Ordoliberal* derives from the German term *Ordnungspolitik* which translates to order policy. The underlying reasoning is that the key aspect of a successful market economy is the establishment of a strong legal and institutional framework to ensure free and fully realized competition (Nedergaard 2020). The German state acknowledges that competitive markets are not achieved through laissez-faire liberalism, but through an active state that politically constructs the frameworks for markets to function accordingly (ibid.). Malm (2016:384) gives the following summary:

> "The [the] odd German ideology known as ordoliberalism – a putative third way between neoliberalism and keynesianism, not retreating from nor intervening in the market but actively midwifing its innately benevolent forces – it champions feed-in tariffs as the panacea of the transition: guarantee producers a revenue when they feed renewable electricity onto the grid and they will do it"

Ordoliberalism highlights stability as a key characteristic for a successful market economy. It is emphasized how the EEG has been copied by countries all over the world because of the stability of its market support (IASS 2016:11). Actors can not only rely on receiving the necessary support they need, according to the argument, but they can also rely on the market to be stable enough to plan ahead (ibid.). From an ordoliberal perspective it is crucial to shepherd the interests of capital, but the state must stay neutral in its role as a facilitator (Nedergaard 2020). Over-funding certain sectors or businesses would damage the trust in the state as a non-committed actor. In consequence other participants of the market would lose their trust in the state. In hindsight the German government for example reduced its funding of PV in 2012, stating that the market became dependent on it. They drew the conclusion that PV was over-funded in the period until 2012. As a result, the development of PV in Germany received a significant setback (ZSW 2020:32).

As discussed in the second section of the analysis the German funding system in regard to tenant electricity is cautious. The yearly cap of 500 MW on the funding of tenant electricity through supplements shows the continuous dialogue between the policy and the dynamics on the market. Once the market is kick-started, tenant electricity projects should not receive further funding. This would in turn provide a free competition between the existing actors that entered the market. Following this logic other market actors could be discriminated against if the federal state would continue to finance tenant electricity. Therefore, the federal state uses funding as a stable and reliable, but simultaneously cautious investment.

In 2010 the former Minister of Economic affairs Wolfgang Schäuble commented provocatively that there seem to be “two different approaches to economic policy-making on each side of the Atlantic. While US policymakers like to focus on short-term corrective measures, we take the longer view” (quoted in Financial Times 2010). However, Germany has not always abided by that. In fact, the 2008/9 crisis is a prime example of a crisis that needed a short-term macroeconomic investment by the state to fix the capitalist crisis (Bülow 2017). This resulted in a massive aid package to save market actors that were deemed crucial for the German economy. Following Jessop (1991:165) the formation of accumulation strategies is necessarily a weighing of different needs of capital. In the 2008/9 crisis the state chooses the interests of particular frictions of capital over the interests of others. Such decisions are not uncommon (Das 1996, Morris & Padayachee 1989). For instance, it appears to be in the inherent interest of capital to solve climate change to sustain the future of capitalism. Simultaneously, other frictions of capital are vehemently against some of the most needed measures such as stepping away from coal (Carton 2017, Malm 2016). It is the state who may take an active role in identifying and in consequence safeguarding the needs of capital. The economic crisis of 2008 is arguably an example of such an evaluation (Ehrig & Staroske 2014). In the case of tenant electricity a corrective measure by the state could be a crucial investment to contribute to the German climate goals or in the case of Berlin to the goal of climate neutrality. However, the inevitable crisis of climate change does not cause a similar reaction to protect the needs of capital.

This weighing of capital’s interest is partly explained by the market hegemony of only few actors in the German energy sector. As past studies have shown these hold positions of strong influence in the German political economy (Brock & Dunlap 2018, Oels & Buschmann 2019). Interviewee B2 (2021:22) adds the case of tenant electricity is not comparable with the German energy sector at large where few actors have practically divided the market among themselves for a long period of time. In short, the German energy sector is an arena of few influential actors and many small ones such as corporations investing in tenant electricity. The large companies are not necessarily even opposed to models such as tenant electricity. Nevertheless, they are not interested in a state that interferes into a sector in which they still hold lead positions.

I argue that this cautiousness towards a more proactive strategy that negates the interests of particular frictions of capital to protect its long-term needs is rooted in the ordoliberal character of the German accumulation strategy. The climate crisis does not appear to pose an adequate enough threat to capital for the German government to move away from their ordoliberal roots in the particular case of tenant electricity. This does not reflect an objective assessment of capital’s needs, but a subjective articulation by a multitude of actors at a particular point of time.

### 7.4.2 Exporting the German energy transition

Germany's ordoliberal ideology is a key principle of Germany's accumulation strategy and therefore provides the necessary explanation for the reservation of the federal state. However, I have pointed out in the theoretical framework, that the German accumulation strategy must be analyzed in regard to the German energy transition. If one understands the German accumulation strategy in combination with the German energy transition the deduction is that Germany has an inherent interest in solving climate change because the latter impedes the long-term accumulation of capital. In consequence, the German energy transition is institutionalized (Gailing & Moss 2016). To elaborate, the German energy transition has provided state incentives through the EEG, but also through other tools to encourage investments from market actors into renewable energy that would have not happened otherwise. The important point is thus, that the institutionalized energy transition is not a mere means to prevent climate change, but aims to provide new opportunities to accumulate if only approached with the adequate strategy. This is exemplified in an excerpt of the speech that Siegmar Mosdorf, the former parliamentarian state secretary for economic affairs and energy, gives at the introduction of the EEG in 2000:

> "To realize the future perspective of bringing our country back on the passing lane, to modernize and to push forward the development of renewable energies on the electricity market must be flanked through the adequate measures. The goal must be to increase the economic viability of renewable energies, thus, a long-term and self-carrying market for these technologies develops. In regard to renewable technologies, we can observe significant progress. Therefore, we see a great competitive opportunity, also with an eye on the world market, because Germany must also hold in this field a leading position" (German Parliament 2000:8428)

The institutionalization of the German energy transition is not only evident in their funding programs such as the EEG, but also in their active guidance of the market. This guidance includes for instance government-funded Research and Development (R&D) programs such as the "Innovations for Energy Transition". The sevenths of its kind it provides a volume of 6,8 billion euros for the time frame between 2018-2022 (ZSW 2020:7). Furthermore, throughout the 2000s the federal state showed strong commitment to the development of PV technology (Carvalho et al. 2017). Another example are the energy partnerships that are promoted by the German government. In their report on energy partnerships (BMWi (a) 2019) the German ministry for Economic Affairs and Energy highlights the cooperations between Germany and countries across the world as important chances for the economy. In a report on the global significance of the German energy transition two key points are identified. First, the German energy transition generates lead market effects for the German economy, while its success would encourage other countries to invest in renewable energies (IASS 2020:11). Second, the German government is deeply invested to promote energy transitions beyond its own borders and in cooperation with other countries. The report later explicitly states that bilateral co-operations are a means to export the German energy transition (IASS 2016:30). The German Corporation for International Cooperation [GIZ] explains that the "German private sector involvement is also an integral part of the partnerships. The promotion of forward-looking energy concepts and private-sector innovation is thus strengthened worldwide" (GIZ 2021). These examples show that the federal state does in fact, guide market actors towards new opportunities of accumulation. This does not happen through state investment into infrastructure nor corrective measures in times of crisis but through steady facilitation of bilateral cooperation and R&D investments (Carvalho et al. 2017, Quitzwo & Thielges 2020). Quitzow & Thielges (2020) refer to Germany's role as a soft power that attracts other countries to the German energy transition, and therefore leads to cooperation in the private sector. The bottom line is that the focus of the institutionalized German energy transition lies on the global market. In consequence, the question is whether tenant electricity is compatible with this strategy. In the following section, I illustrate three characteristics of tenant electricity that are exemplifying of its incompatibility with the strategies of capital accumulation that are central to the German energy transition. Two of these characteristics derive from the analysis of the barriers.

### 7.4.3 Tenant electricity's incompatibility

First, tenant electricity is especially context dependent. It is particularly adapted to Germany's character as a tenant nation. The latter is conditioned by a legislative framework that supports the rights of tenants comparatively better than other European countries (Davies et al. 2017). Hence, tenant electricity has a significantly lower spatial potential in other European markets, not to mention the global market, which leads to a lower attractiveness of tenant electricity beyond the German context. Furthermore, the complex actor relationships require a robust institutional framework, by corporations as well as state institutions, to navigate through the multitude of stakeholder interests. Due to the unconventional model the respective state may have to adjust existing rules about taxes, supply-chain constellations, and the utilization of the public grid as I have pointed out in the first section of the analysis. Germany has a strong institutional framework to do so, but it may not be attractive in other contexts. Once again this hampers the attractiveness of tenant electricity in other contexts. To briefly summarize, tenant electricity shows less applicability outside of the German context. Therefore, it is decreases in interest for the German energy transition that institutionalizes an accumulation strategy focused on the expansion into new markets.

Second, an emerging accumulation strategy is, driven by the increasing need for infrastructure for renewable energy sources, characterized by what researchers have called a global land rush to sustain low-carbon transitions (Scheidel & Sorman 2012, also see Huber & McCarthy 2017, Newell & Mulvaney 2013). The underlying driver is the low ground rent in economies in the majority world[8]. Acquiring land often leads to implications that are referred to as dispossession. Ambitious solar plans in Morocco (Rignall 2015) or Algeria (Zahraoui et al. 2021) stand out as opportunities for the global solar industry to penetrate new markets. The focus on large-scale projects and international cooperation exemplifies the need of capital to

8 Refers to the Global South.

expand to markets that are more vulnerable to land grabbing and labor exploitation (Mc Carthy 2015, Stock & Birkenholtz 2021). The spatial availability, but diffusion of renewable energy sources increases the production costs through an increase of ground rent. Tenant electricity reduces these costs because rooftop spaces have little value on the free market (B2 2021:14). However, in countries that are at different stages of their capitalist development, the production costs are less conditioned by the cost of land (Harvey 2014:150, Scheidel & Sorman 2012). It is the other way around, capital moves geographically to exploit low ground rent. As Das (2017:513) puts it “the less developed regions, with their low wages and unemployment, attract capital from the developed ones”. Low ground rent is a major factor that attracts capital (Smith 2008). Hence, cutting land costs is much less important in markets other than the German, and to a lesser degree, the European one. Tenant electricity contradicts this trend because it is exactly tailored for the context of an urbanized country such as Germany.

The third example is the limited technological capacity of tenant electricity. A corporate accumulation strategy is the investment into R&D to eventually capture rent through intellectual property (Campling 2021). As argued by Malm (2016:369) the technology for capturing, converting, and storing the energy of fuel is the crucial aspect in consideration of the exchange-value on the market. Therefore, one needs to analyze the value chain of the built infrastructure of tenant electricity, i. e. the said technology, to understand the positioning of tenant electricity within it. The technological aspect of tenant electricity appears rather simple at first glance. Solar panels have been part of the institutionalized German energy transition for more than 20 years now. Not surprisingly technology has not been named as a barrier by a single source. Interviewee B2 (2021:10) an energy engineer, claims:

> “Spoken differently, we do absolute low-tech. For 20 years we do standard. We screw modules on the roof, pull the cables into the basement, connect them to the grid, and done! Maybe a special electricity meter, but this is by no means rocket science”.

Moser et al. (2021) affirm the statement but importantly point out that in the last 20 years solar technology has made significant technological and administrative advancements, but that the innovative and technological capacity of tenant electricity is exhausted by now. This is especially evident in the patenting of PV technologies. The number of German-based corporations that have filed at least one patent per year in the PV industry has decreased by 78% between 2011-2014 (Carvalho et al. 2017:21). The only country that continued to grow in terms of innovation was China. This does not mean that Germany’s solar economy has not profited. Firms received investments as well as buy-outs for their technological expertise and patents (Carvalho et al. 2017). Nonetheless, the result is that the production of PV modules almost completely shifted to China and neighboring countries. 80% of the produced panels are from Asia (ISE 2021:26). The production costs in China decreased massively. Interestingly though the Chinese firms have not committed to the same push in patents as their European and US-American counterparts. That is because their corporate accumulation strategies rely to a large extent on the ability to cut costs, for example through lowering wages (Carvalho et al. 2017), not on the rent captured through asset ownership i. e. intellectual property. In short, the investments of the German economy into solar panel innovation and production have decreased in the 2010s (ibid.). Instead Chinese companies dominate the PV market (ISE 2021:24.). Their innovation focus lies on technology to decrease production costs. The consequence for tenant electricity is that it benefits from the continuously decreasing costs of PV-panels, but is not part of a flourishing industry that seeks to accumulate capital through innovation, and hence intellectual property. Instead, the innovation potential is largely exhausted. In consequence, tenant electricity holds little promise for future value extraction through intellectual property.

To conclude the third section, the reluctance of the German state can be explained through the analysis of its ordoliberal ideology that emphasizes stability as a key condition for long-term capital accumulation. However, the facilitation of other strategies such as the bi-literal cooperations initiated by Germany, or the facilitation and support of R&D programs shows that the federal state is willed to commit to supporting certain frictions of capital under the umbrella of long-term accumulation strategies. The German energy transition can be understood as such, while it is simultaneously intended to solve climate change which poses a threat to capital accumulation. The lack of commitment towards tenant electricity must therefore not only be understood as the result of Germany's ordoliberal ideology but also of the incompatibility of tenant electricity with strategies to accumulate capital that are part of the German energy transition. This incompatibility is evident in three aspects. First, tenant electricity is tailored to the German context and may be limited in its applicability beyond the German market. Second, the crucial merit of tenant electricity is its ability to cut the otherwise high ground costs of the German context. Such an advantage decreases in value when applied in other countries. Especially considering that much of the international pursuit for land to build energy infrastructure is caused by low ground rents in the first place. Third, I have argued that tenant electricity has an exhausted technological potential. Current innovations are focused on the cutting of production costs, not on downstream activities, i. e. the operation of the installments.

# 8. Conclusive discussion

The point of departure of my analysis is the first sub-question w*hat are current barriers?*. The first, and most inherent one is the spatial context of urban rooftops that impedes the ability to scale installments, and therefore the ability to cut costs. Additionally, the fragmentation and uniqueness of each space complicate any attempts to standardize installing and planning processes. Both barriers are difficult to address through policies. The radically different relation to the use of space, i. e. its character as small-scale, fragmented and urban in contrast to fossil fuels, is exemplifying the spatial conflicts that characterize a transition from fossil fuels towards renewable energy sources. The second category of barriers is the complex actor relationships. Due to the recent character of tenant electricity, it is still subject to constraining regulations that prevent sufficient market incentives for all participants. The third barrier is the lackluster funding program. The tenant electricity supplement has been at times hitting zero cents per kWh. Although this was fixed in the 2021 adjustments of the EEG it remains questionable if it delivers the necessary incentive for a market push. To conclude, the analyzed material made clear that tenant electricity is limited in its profitability due to a number of barriers which are, and this is the crucial takeaway for the development of the argument in this thesis, to a large extend solvable through policies.

This leads to the second sub-question: *How are these barriers addressed and which expectations towards tenant electricity are formulated?* The premise developed through the first sub-question is that the barriers can be addressed through adjustments in the EEG and other policy tools. Most promising are an increase of the tenant electricity supplement, favorable regulations for the converging of installments, the reform of the advanced trade tax reduction, and perhaps even the possibility to use the public grid. Furthermore, the 2021 reform has already adjusted multiple barriers. For example, the tenant electricity supplement has been marginally increased and stabilized Furthermore, it is possible now for installments to be on adjacent roofs of the same quarters. However, looking at the cap of 500 MW and the still rather low supplement brings up the question of the purpose of tenant electricity. I argue in the analysis that the federal state, in opposition to the city of Berlin, has little interest in tenant electricity as an integral part of their strategy to decarbonize. This is evident in the low commitment to funding policies, and the fact that it took the government 17 years after the EEG to induce a framework tailored for Germany's characteristic as a tenant nation. Further evidence for this comportment, is found in the framing of tenant electricity by the federal state. Its goal is rather to generate acceptance through a problematic conceptualization of participation. Therefore, the answer to the second sub-question is that the barriers are not addressed sufficiently because the purpose of tenant electricity is not the expansion of production. In fact, its purpose is ideological.

The third sub-question is *what are the underlying reasons for the lack of federal commitment to tenant electricity?* The answer to this question is conditioned by a multitude of reasons that are to a large extent, but not exclusively explained by its accumulation strategy in regard to the German energy transition. First, the ordoliberal ideology that serves as the macroeconomic basis for much of Germany's policies suggests stability as a prime principle to serve the goal of market competition. I argue that according to the underlying logic of ordoliberalism, it would be an infringement of the role of the state as a neutral referee to fund tenant electricity to an extent that it changes the energy market composition. However, the specific context of the German energy transition is crucial. The latter is an institutionalized strategy to solve climate change, while simultaneously guiding German market actors towards new opportunities of accumulation. Based on this conceptualization, the question must not only be why tenant electricity receives little federal commitment now, but also why it took such a long time for the state to develop an adequate framework. The reason lies in the character of the accumulation strategies put forward by the German energy transition.

The German energy transition facilitates a transition that is driven by the need of capital to expand into new markets. Tenant electricity does not provide a clear path towards the accumulation of capital. It is tailored for the German context of high ground rent, and a robust set of institutions. Its benefit of bypassing the scarcity of land through the utilization of rooftops is especially relevant for the German context, less in other countries that are either less urbanized or have fewer tenants and can unlock the spatial of rooftops for conventional small-scale PV. Furthermore, the technological and innovative capacity of tenant electricity is largely exhausted at this point. It shows comparatively little potential for R&D investments. Considering these characteristics of tenant electricity the answer to sub-questions three is two-fold. First, the current reluctance of the German state is rooted in its ordoliberal ideology that rejects erratic market interference. Second, tenant electricity's prime purpose does not lie in the expansion of renewable energy production, because it is not compatible with the German energy transition that is informed by the need to expand towards new markets. The form of this expansion may be the institutionalized cooperation with other countries and in consequence the involvement of the private sector. Another form is the capture of value through assets such as intellectual property. Tenant electricity corresponds to neither of these.

In conclusion, the answer to my research question is that tenant electricity is at the margin of the energy transition in Berlin because the latter is strongly conditioned by the broader German energy transition. The latter upholds an ordoliberal market doctrine that is not only aligned to a stable and slow transition that protects the assets of actors in the energy sector but more importantly to the prospect of expanding into new markets. Tenant electricity may have the capacity to be a significant contribution to the decarbonization of the German industry, but its inherent barriers such as the inability to scale and standardize show too little prospect for capital accumulation which leads to its current role at the margin of tenant electricity.

The respective strategy of the city of Berlin is more ambitious and views tenant electricity as an important component of their energy transition. However, within the context of the EEG, the city-state has little agency. A potential way out of this dilemma would be the equipment of municipal facilities with enough capital to ensure that Berlin reaches its ambitious solar goals. Yet, this appears to be an unlikely prospect and would require a significant change of direction from the city of Berlin, despite its distinct trajectory in comparison to the federal state. Urban movements in the past have shown potential in challenging the privatization of the energy regime. In fact, Berlin is right now in the process of re-municipalizing its energy grid. Additionally, the municipal energy facility was founded in 2014 as a result of urban struggles against the privatization of energy. Although facets of this struggle have been co-opted and the more radical demands of the movement are far from realized (Angel 2016, Becker et al. 2019), it provides hope for local struggles to-gain control over state capital, which could then be used to make necessary infrastructure investments. Therefore, local struggles to re-seize control over the local state may be a key strategy to navigate the waters of an impending climate catastrophe, because the federal energy transition is merely half-committed to solving climate change, while the other half seeks to exploit new opportunities for capital accumulation.

# List of references

## Books and journal articles


Altvater, E., 1978. Some problems of state interventionism. In John Holloway and Sol Picciotto, eds., *State and Capital: A Marxist Debate*. Edward Arnold, pp.40-42.

Angel, J., 2016. Towards an Energy Politics In-Against-and-Beyond the State: Berlin's Struggle for Energy Democracy. *Antipode*, 49(3), pp.557-576.

Baka, J., and Vaishnava, S., 2020. The evolving borderland of energy geographies. *Geography Compass*, 14(7).

Basu, S., Wehnert, T. and Topp, K., 2019. A complexity approach to defining urban energy systems. *Cities 95*.

Becker, S, Angel, J., and Naumann, M. 2019. Energy democracy as the right to the city: Urban energy struggles in Berlin and London. *Environment and Planning A: Economy and Space,* 52(6), pp. 1093–1111.

Benton, T. and Craib, I., 2011. *Philosophy of social science*. Houndsmill, Basingstoke, Hampshire: Palgrave Macmillan.

Bhaskar, R., 1989. *Reclaiming Reality: A critical introduction to contemporary philosophy*. London: Verso.

Bibow, J., 2017. How Germany's Anti-Keynesianism Has Brought Europe to Its knees. *SSRN Electronic Journal.*

Bogner, A. and Menz, W., 2009. *The theory-generating expert interview: Epistemological interest, forms of knowledge, interaction*. Palgrave Macmillan.

Bowen, G., 2009. Document analysis as a qualitative research method. *Qualitative Research Journal*, 9. pp. 27-40-

Bridge, G., Bouzarovski, S., Bradshaw, M. and Eyre, N., 2013. Geographies of energy transition: Space, place and the low-carbon economy. *Energy Policy*, 53, pp.331-340.

Bridge, G. and Gailing, L., 2020. New energy spaces: Towards a geographical political economy of energy transition. *EPA Economy and Space*,52(6), pp.1037-1050.

Brock, A. and Dunlap, A., 2018. Normalising corporate counterinsurgency: Engineering consent, managing resistance and greening destruction around the Hambach coal mine and beyond. *Political Geography*, 62, pp.33-47.

Bryman, A., 2012. *Social research methods*. Oxford: Oxford University Press.

Buschmann, P. and Oels, A., 2019. The overlooked role of discourse in breaking carbon lock-in: The case of the German energy transition. *Wiley Interdisciplinary Reviews: Climate Change*, 10(3), pp. e574.

Campling, L., 2021. The corporation and resource geography. In Himley, Havice, and Valdivai eds The Routledge Handbook of Critical Resource Geography, forthcoming.

Carton, W., 2016. Dancing to the rhythms of the fossil fuel landscape: Landscape inertia and the temporal limits to market-based climate policy. *Antipode,* 49(1), pp.43-61.

Carvalho, M., Dechezleprêtre, A. & Glachant, M., 2017. Understanding the dynamics of global value chains for solar photovoltaic technologies. *WIPO Economic Research: Working Papers 40*, World Intellectual Property Organization - Economics and Statistics Division.

Cheung, T. T. T., and Oßenbrügge, J., 2020. Governing urban energy transitions and climate change: Actions, relations and local dependencies in Germany. *Energy Research and Social Science, 69*, pp. 1-9.

Das, R. J., 1996. State theories:: A critical analysis, *Science and Society,* 60(1), pp. 27-57.

Das, R., 2017. David Harvey's theory of uneven geographical development: A Marxist critique. *Capital & Class*, 41(3), pp.511-536.

Davies, B., Snelling, C., Turner, E. and Marquardt, S., 2017. Lessons from Germany: Tenant power in the rental market. IPPR, Last accessed the 14th of August 2021 on. http://www.ippr.org/publications/lessons-from-germany-tenant-power-in-the-rental-mark.

Davis, D., Kaplinsky, R., and Morris, M., 2018. Rents, power and governance in global value chains.. *Journal of World-Systems Research*, *24*(1), pp.43-71.

Dukes, J.S., 2003. Burning buried sunshine: Human consumption of ancient solar energy. *Climatic Change* 61, pp. 31–44.

Edwards, G., 2020. The state of the north sea: Thatcherism and the fossil economy. Lund University, LUP Lund student papers, Last accessed the 11 th of August 2021 on https://lup.lub.lu.se/luur/download?func=downloadFile&recordOId=9010105&fileOId=9020364

Ehrig, D. and Staroske, E., 2014. Lessons to be drawn from the world financial crisis. Marx, Keynes, or Minsky? Who tells us the real story?. *International Business and Global Economy*, 33, pp. 637–650.

Gailing, L., and Moss, T., 2016. *Conceptualizing Germany's energy transiton, institutions, materiality, power, space*. Palgrave Macmillan, London.

Hirsch, J., 1978. The state apparatus and social reproduction: Elements of a theory of the bourgeois state. In Holloway and Picciotto, eds., *State and capital: A Marxist debate*, Edward Arnold, pp.57-107.

Holloway, J. and Picciotto, S., 1977. Capital, crisis and the state. *Capital & Class*, 1(2), pp.76-101.

Hornborg, A., Cederlöf, G. and Roos, A., 2019. Has Cuba exposed the myth of "free" solar power? Energy, space, and justice. *Environment and Planning E: Nature and Space*, 2(4), pp.989-1008.

Huber, M. and McCarthy, J., 2017. Beyond the subterranean energy regime? Fuel, land use and the production of space. *Transactions of the Institute of British Geographers*, 42(4), pp.655-668.

Knuth, S., Potts, S., and Goldstein, J. E., 2019.In value's shadow: Devaluation as accumulation frontier. *EPA Economy and Space*, 51(2), pp.461-466.

Kunze, C. and Becker, S., 2014. Energy democracy in Europe: A survey and outlook, *Rosa Luxemburg Foundation*, Brussels office.

Jessop B., 1991. Accumulation strategies, state forms and hegemonic projects. In Clarke S. (eds) *The state debate. Capital and class*. Palgrave Macmillan, London, pp. 157-182.

Jones, P., Bradbury, L. and Le Boutillier, S., 2011. Introducing social theory. Second Edition. Cambridge; Medford, MA: Polity Press..

Levy, J. S., 2008. Case studies: Types, designs and logics of interference. *Conflict Management and Peace Science*, 25(1), pp. 1-18.

MacKinnon D, Dawley S, Pike A, et al. 2019. Rethinking path creation: A geographical political economy approach. *Economic Geography*, 95(2), pp. 113–135.

Malm, A., 2016. *Fossil Capital*. London: Verso.

McCarthy, J., 2015. A socioecological fix to capitalist crisis and climate change? The possibilities and limits of renewable energy. *Environment and Planning*, A 47(12), pp. 2485–2502.

Morris, M. and Padayachee, V., 1989. Hegemonic projects, accumulation strategies and state reform policy in South Africa. *Labour, Capital and Society,* 22(1), pp. 65-109.

Moser, R., Xia-Bauer, C., Thema, J. and Vondung, F., 2021. Solar Prosumers in the German energy transition: A multi-level perspective analysis of the German 'Mieterstrom' model. *Energies*, 14(4), pp.1188.

Municipal Energy Utility Berlin, 2021. Mieterstrom: Sonneenergie nach Hause bringen. Berliner Stadtwerke, Last accessed the13th of August 2021 on https://berlinerstadtwerke.de/mieterstrom/.

Nedergaard, P. 2020. The ordoliberalisation of the European Union?, *Journal of European Integration*, 42(2), pp. 213-230.

Newell, P., 2019. Trasformismo or transformation? The global political economy of energy transitions. *Review of International Political Economy*, 26(1), pp.25-48.

Newell, P., and Mulvaney, D., 2013. The political economy of the "just transition". *Geographical Journal*, 179(2), pp. 132–140.

Ötsch, W., Pühringer, S., and Hirte, K., 2018, *Netzwerke des Marktes: Ordoliberalismus als politische ökonumie*. Springer.

Ponte, S. 2019. Green capital accumulation: Business and sustainability management in a world of global value chains. *New Political Economy*, 25(1), pp.72-84.

Quitzow, R. and Thielges, S., 2020. The German energy transition as soft power, *Review of International Political Economy*, pp. 1-26.

Rignall, K., 2015. Solar power, state power, and the politics of energy transition in pre-Saharan Morocco. *Environment and Planning A: Economy and Space*, 48(3), pp.540-557.

Sayer, A.. 2000. *Realism and social science*. Sage

Scheer, H., 2013. *The energy imperative*. Hoboken: Taylor and Francis.

Scheidel, A., and Sorman, A., 2012. Energy transitions and the global land rush: Ultimate drivers and persistent consequences. *Global Environmental Change*, 22(3), pp. 588–595.

Schäfer, M., 2019. Akzeptanzstudie "Mieterstrom aus Mietersicht": Eine Untersuchung verschiedener Mieterstromprojekte in NRW. Wuppertal Institut.

Schwartzman D., 1996. Solar communism. *Science & Society*. 60(3), pp. 307–331.

Smil V. 2015. *Power density: A key to understanding energy sources and uses*. Cambridge: MIT Press.

Smith, N., 2008. *Uneven development*. Athens: University of Georgia Press.

Stock, R. and Birkenholtz, T., 2019. The sun and the scythe: Energy dispossessions and the agrarian question of labor in solar parks. *The Journal of Peasant Studies, 48(5), 984-1007.*

Strunz, S., Gawel, E. and Lehmann, P., 2016. The political economy of renewable energy policies in Germany and the EU. *Utilities Policy*, 42, pp.33-41.

Walsh, C., 2012. Nicos Poulantzas and the capitalist state. International Socialist Group, Last accessed on the 11th of August 2021 on https://www.internationalsocialist.org.uk/index.php/2012/08/nicos-poulantzas-and-the-capitalist-state/

Zahraoui, Y., Basir Khan, M. R., Al Hamrouni, I., Mekhilef, S. and Ahmed, M., 2021. Current status, scenario, and prospective of renewable energy in Algeria: A review. *Energies*, 14(9), 2354.

## Grey literature

BAFA, 2018. Ergebnisse zur Begrenzung der EEG-Umlage in 2018. Bundesamt für Wirtschaft und Ausfuhrkontrolle, Last accessed the 15th of August 2021 on https://www.bafa.de/SharedDocs/Downloads/DE/Energie/bar_pm_20171221_anlage.html

BMWi, 2021. Mieterstrom: Energiewende im eigenen Haus. Ministerium für Wirtschaft und Energie. Last accessed the 11th of August 2021 on https://www.erneuerbare-energien.de/EE/Navigation/DE/Recht-Politik/Mieterstrom/mieterstrom.html

BMWi (a), 2021. Was ist eigentlich Mieterstrom?. Bundesministerium für Wirtschaft und Energie, Last accessed the 11th of August 2021 on https://www.bmwi-energiewende.de /EWD/Redaktion/Newsletter/2021/01/Meldung/direkt- erklaert.html

BMWi, 2019. Mieterstrombericht nach § 99 Erneuerbare-Energien- Gesetz 2017. Bundesministerium für Wirtschaft und Energie, Last accessed the 11th of August 2021 on https://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/Berichte/mieterstrombericht-eeg-2017.pdf?__blob=publicationFile&v=9

BMWi (a), 2019. Energy partnerships and energy dialogue: Annual report. Ministerium für Wirtschaft und Energie. Last accessed the 11th of August 2021 on https://www.bmwi.de/Redaktion/EN/Publikationen/Energie/annualreport-energy-partnerships-2019.pdf?__blob=publicationFile&v=3

BSW, 2017. Geschäftsmodelle mit PV-Mieterstrom. Bundesverband Solarwirtschaft, Last accessed the 11th of August 2021 on http://www.pv-financing.eu/wp-content/uploads/2016/11/D4.1_Germany.pdf

EEG bill, 2021. Entwurf eines Gesetzes zur Änderung des Erneuerbaren-Energien-Gesetzes und weiterer energierechtlicher Vorschriften. Ministerium für Wirtschaft und Energie, Last accessed on 11th of August 2021 on https://www.bmwi.de/Redaktion/DE/Downloads/G/gesetzentwurf-aenderung-erneuerbare-energien-gesetzes-und-weiterer-energierechtlicher-vorschriften.pdf__blob=publicationFile

Federal Association of Consumers, 2020. Das Mieterstromgesetz trägt Trauer zu seinem dreijährigen Bestehen. Verbraucherzentrale Bundesverband, Last accessed the 11th of August 2021 on https://www.vzbv.de/sites/default/files/downloads/2020/07/15/2020_07_24_mieterstrom_verbaende.pdf

Federal Network Agency (a), 2021. EEG-Registrierdaten und -Fördersätze. Bundesnetzagentur, Last accessed the 11th of August 2021 on https://www.bundesnetzagentur.de/DE/Sachgebiete/ElektrizitaetundGas/Unternehmen_Institutionen ErneuerbareEnergien/ZahlenDatenInformationen/EEG_Registerdaten /EEG_Registerdaten_node.html

Federal Network Agency (b), 2021. Mieterstromzuschlag. Bundesnetzagentur, Last accessed the 11th of August 2021 on https://www.bundesnetzagentur.de/DE/Sachgebiete/ElektrizitaetundGas/Unternehmen_Institutionen/ErneuerbareEnergien/EEGAufsicht/Mieterstrom/Mieterstrom_node.html

Federal Network Agendy (c), 2021. EEG-Umlage, Bundesnetzagentur. Last accessed the 11th of August 2021 on https://www.bundesnetzagentur.de/SharedDocs/A_Z/E/EEG_Umlage.html

Federal Network Agency, 2020. Monitoringbericht. Bundesnetzagentur. Last accessed the 11th of August 2021 on https://www.bundesnetzagentur.de/SharedDocs/Mediathek/Berichte/2020/Monitoringbericht_Energie2020.pdf?__blob=publicationFile&v=8

Federal Network Agency (a), 2020. Hinweis zum Mieterstromzuschlag als eine Sonderform der EEG-Förderung: Version 1.1. Bundesnetzagentur. Last accessed the 11th of August 2021 on https://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Sachgebiete/Energie/Unternehmen_Institutionen/ErneuerbareEnergien/Mieterstrom/Hinweis_Mieterstrom.pdf?__blob=publication File&v=6

Financial Times, 2010. Maligned Germany is right to cut spending. Financial Times, Last accessed 11th of August 2021 on https://www.ft.com/content/216daeba-7f0c-11df-84a3-00144feabdc0

Flieger, B., Schachtschneider, U., Wolter, H., Lautermann, C., Aretz, A., Gährs, S. and Broekmans, J., 2018. Zukunftsfeld Mieterstrommodelle: Potentiale von Mieterstrom in Deutschland mit einem Fokus auf Bürgerenergie. Forschungsprojekt BuergEn. Carl von Ossietzky Universität Oldenburg.

German Parliament, 2000. Deutscher Bundestag: Stenographischer Bericht. Deutscher Bundestag. Last accessed the 13th of August 2021 on https://dserver.bundestag.de/btp/14/14091.pdf

GIZ, 2021. Biliteral Energy Partnerships. Deutsche Gesellschaft für Internationale Zusammenarbeit, Last accessed the 13th of August 2021 on https://www.giz.de/en/worldwide/53180.html

Handelsblatt, 2021. Fondsstandortgesetz soll Verbesserungen bei der erweiterten Kürzung für Grundbesitz bringen. Last accessed the 14th of August 2021 on https://blog.handelsblatt.com/steuerboard/2021/05/21/fondsstandortgesetz-soll-verbesserungen-bei-der-erweiterten-kuerzung-fuer-grundbesitz-bringen/

HTW, 2018. Das Berliner Solarpotenzial: Kurzstudie zur Verteilung des solaren Dachflächenpotenzials im Berliner Gebäudebestand. Hochschule für Technik und Wirtschaft, Last accessed the 11th of August 2021 on https://pvspeicher.htw-berlin.de/wp-content/uploads/HTW-Berlin-2018-Das-Berliner-Solarpotenzial.pdf

ISE, 2021. Aktuelle Fakten zur Photovoltaik in Deutschland. Fraunhofer Institut, Last accessed the 11th of August 2021 on https://www.ise.fraunhofer.de/content/dam/ise/de/documents/publications/studies/aktuelle-fakten-zur-photovoltaik-in-deutschland.pdf

IASS, 2016. The German energy transition in international perspective. Institute for Advanced Sustainabiliry Studies (IASS), Last accesed the 11th of August 2021 on https://www.iass-potsdam.de/sites/default/files/files/iass_study_thegermanenergytransition_ininternationalperspective_en.pdf

IASS (2017). Integration von Photovoltaikanlagen in die Deutschen Niederspannungsnetze. *Institute for Advanced Sustainability Studies*, Potsdam 2017, Institute for Advanced Sustainability Studies, Last accessed on the 11st of August 2021 on: https://www.iass-potsdam.de/sites/default/files/files/wp_17-03_integration_photovoltaik_deutsche_niederspannungsnetze.pdf

Lange, S., 2020. Mieterstrom: Power to the people!, Mein PV-Anwalt, Last accessed the 11th of August 2021 on https://mein-pv-anwalt.de/mieterstrom-power-to-the-people/

Masterplan Solarcity, 2020. Monitoringbericht 2020. Stadt Berlin, Last accessed the 11th of August 2021 on file:///C:/Users/Julte/AppData/Local/Temp/masterplan_solarcity_2020_monitoringbericht_satz_final.pdf

Minister Conference, 2020. Beschlusssammlung der Wirtschaftsministerkonferenz am 25. Juni 2020. Bundesrat, Last accessed the 11th of August 2021 on https://www.wirtschaftsministerkonferenz.de/WMK/DE/termine/Sitzungen/20-06-25-WMK/20-06-25-beschluesse.pdf?__blob=publicationFile&v=2

Prognos, 2017. Mieterstrom: Rechtliche Einordnung, Organisationsformen, Potenziale und Wirtschaftlichkeit von Mieterstrommodellen. Bundeswirtschaftsministerium für Wirtschaft und Energie. Last accessed the 11th of August 2021 on https://www.bmwi.de/Redaktion/DE/Publikationen/Studien/schlussbericht-mieterstrom.html

ZSW, 2019. Vorbereitung und Begleitung bei der Erstellung eines Erfahrungsberichtes gemäß §97 - neuerbare-Energien-Gesetz Teilvorhaben II c: Solare Strahlungsenergie Teilbericht Mieterstrom. Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg. Last accessed the 11th of August 2021 on https://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/Berichte/vorbereitung-begleitung-erfahrungsbericht-gemaess-paragraph-97-eeg.pdf;jsessionid=20F4DCC9F1CA7C10466498F5D731B57D?__blob=publicationFile&v=4

ZSW, 2020. Erneuerbare Energien in Zahlen: Nationale und Internationale Entwicklung im Jahr 2019. Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg, Last accessed the 11th of August 2021 on https://www.bmwi.de/Redaktion/DE/Publikationen/Energie/erneuerbare-energien-in-zahlen-2019.pdf?__blob=publicationFile&v=6.

## Expert-interviews

A1, 2021. Interview with a person holding an advisory position in the senate of Berlin. Conducted by Jelte Burfeind.

B2, 2021. Interview with an engineer in the energy sector and board member of the cooperative "Civilian Energy Berlin". Conducted by Jelte Burfeind.

C3, 2021, Interview with a spokesperson of a leading tenant electricity company in Germany and Berlin. Conducted by Jelte Burfeind.

D4, 2021. Interview with a consultant of the Solarcentrum Berlin. Conducted by Jelte Burfeind.

# Appendix

## Appendix 1

**Table 1:** A list of all analyzed documents.

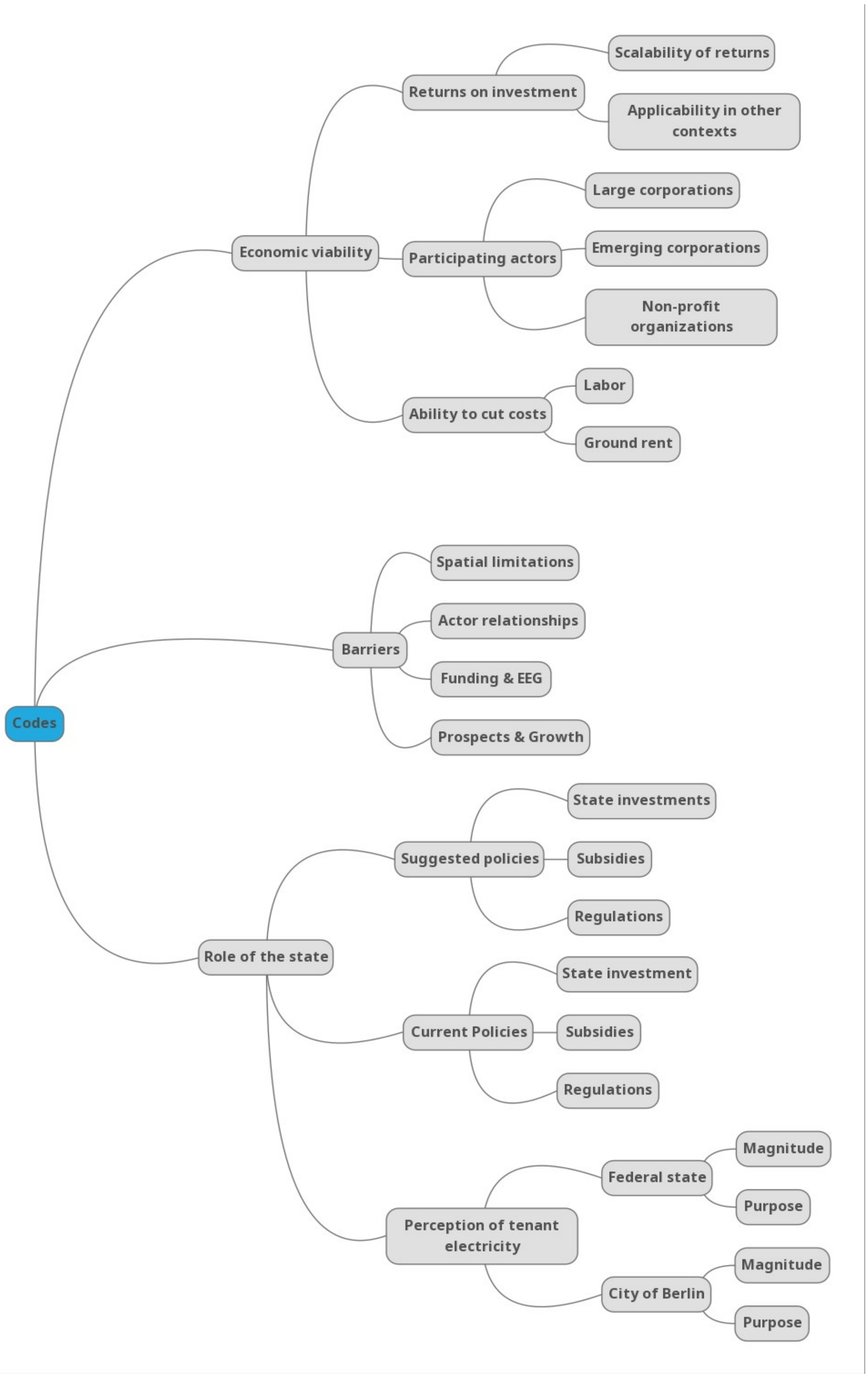
| Type of Document | Document title | Content description | Publisher & funding institutions | Reference tag |
|---|---|---|---|---|
| Report | Aktuelle Fakten zur Photovoltaik in Deutschland | • Summarizing information and statistics regarding PV in Germany | Fraunhofer Institute (ISE) | ISE 2021 |
| Protocol | Beschluss-Sammlung der Wirtschaftsministerkonferenz am 25. Juni 2020 | • Meeting of ministers of the economy | Upper house of the German parliament [Bundesrat] | Minister Conference 2020 |
| Study | Das Berliner Solarpotenzial: Kurzstudie zur Verteilung des solaren Dachflächenpotenzials im Berliner Gebäudebestand. | • Assessing the available rooftop space for PV in Berlin | College for technology and economy Berlin<br><br>Received funding from the EU and the City | HTW 2018 |

| | | | | |
|---|---|---|---|---|
| | | | Berlin | |
| Report | Erneuerbare Energien in Zahlen | • Processing of statistics about renewable energy sources in Germany and international | Center for Solar Power and Hydrogen Studies, Baden Württemberg<br><br>Commissioned by the Federal Ministry Economic Affairs and Energy (BMWi) | ZSW 2020 |
| Report | Energy partnerships and energy dialogue: Annual report | • Presenting and reporting on multiple bi-literal energy cooperations | Federal Ministry Economic Affairs and Energy (BMWi) | BMWi (a) 2019 |
| Report | Geschäftsmodelle mit Mieterstrom | • Evaluation of tenant electricity,<br>• barriers, policies, and potential | Federal Association for Solar Economy (BSW)<br><br>Received funding from the EU | BSW 2017 |
| Policy | Hinweis zum Mieterstromzuschlag als eine Sonderform der EEG-Förderung | • Explaining the policy: tenant electricity allowance | Federal Network Agency | Federal Network Agency (a) 2020 |
| Legal document | Gesetzesentwurf der Bundesregierung | • Suggested changes in the Renewable Energy Act (EEG) | Federal Government | EEG-bill 2021 |
| Report | Masterplan Solarcity: Monitoringbericht | • Evaluation of the development of solar power in Berlin<br>• Focus on government initiatives | Berlin: Senate Administration for Economic Affairs, Energy, and Businesses | Masterplan Solarcity 2020 |
| Report | Mieterstrombericht nach § 99 Erneuerbare Energien Gesetz | • Evaluation of tenant | Federal Ministry Economic Affairs and | BMWi 2019 |

| | | | | |
|---|---|---|---|---|
| | 2017 | electricity,<br>• barriers, policies, and potential | Energy (BMWi) | |
| Report | Mieterstrom:<br>Rechtliche Einordnung, Organisationsformen, Potenziale und Wirtschaftlichkeit von Mieterstrommodellen (MSM) | • Evaluation of tenant electricity,<br>• barriers, policies, and potential | Prognos AG, BH&W<br><br>Commissioned by the Federal Ministry for the Economy and Energy (BMWi) | Prognos 2017 |
| Report | Monitoringbericht | • Monitors the grid operation and capacity | Federal Network Agency | Federal Network Agency 2020 |
| Report | The German Energy Transition in International Perspective | • Evaluating the international importance of the German energy transition | Institute for Advanced Sustainability Studies (IASS) | IASS 2016 |
| Report | Vorbereitung und Begleitung bei der Erstellung eines Erfahrungsberichts gemäß § 97 Erneuerbare-Energien-Gesetz: Teilbericht Mieterstrom | • Overall report on the interaction between the EEG and tenant electricity | Center for Solar Power and Hydrogen Studies, Baden Württemberg<br><br>Commissioned by  the Federal Ministry ofEconomic Affairs and Energy (BMWi) | ZSW 2019 |
| Study | Zukunftsfeld Mieterstrommodelle: Potentiale von Mieterstrom in Deutschland mit einem Fokus auf Bürgerenergie. | • Evaluation of the potential of tenant electricity with emphasis on cooperatives and block-chain technology | Institute for ecological and economic research (IÖW)<br><br>Received funding from the Federal Ministry for Education and Research | Flieger et al. 2018 |

## Appendix 2

**Fig. 2:** Shows the codes used for the analysis of the selected documents and expert-interviews.



## Appendix 3

### Interview guide

**Interview duration**: 25-35 min.
**Medium**: Zoom
**Language:** German
**Format:** Semi-structured interviews

**Overall themes of the interviews**

The themes are marked **boldly**, whereas the various sub-questions are marked in *italic*. Questions I intended to ask the interviewees are not italic. Furthermore, the questions would differ slightly according to the context of the interview.

**Role of the State**

- *What is the role of the local state?*
    - How does the city of Berlin approach tenant electricity? Is tenant electricity supported sufficiently?
    - What are funding- and support strategies of the state?
        - Ar these strategies efficient?
- *How do strategies between the local and the federal state differ?*
    - Is there a discrepancy between the city of Berlin and the federal state in the evaluation of tenant electricity?

**Economic viability of tenant electricity**

- *What are current barriers?*
    - Where do you still see barriers or constrains for tenant electricity in Berlin?
- *What is its magnitude/ambition of tenant electricity?*
    - What is the role of tenant electricity within the context of the energy transition in Berlin? Is the role an integral one or rather complementary?
- *What are the revenue strategies corporations pursue?*
    - What are the prospects for corporations that participate in tenant electricity? What are the growth models for corporations? Is it possible to scale revenues in the long-term?
- *Who are the relevant actors?*
    - Who are the most relevant actors? What are their incentives?
    - How does the corporate landscape look in the tenant electricity sector? Do the actors reduce their activities to tenant electricity, or does it rather complement other business branches?
- *What is the difference between large scale energy production and tenant electricity models*?

- Do models such as tenant electricity change the structures of the energy sector? Is tenant exclusively interesting for niche corporations?
- What are the implications for distribution and consumption infrastructure? Are the grid structures adapted accordingly

**Berlin as a site of urban struggles for the democratization of energy production**

- *Does tenant electricity have implications for the democratization of energy production?*
    - Do you think that tenant electricity democratizes the production of energy?
        - If yes, what features of tenant electricity are important for that?
- *Does the local state foster the democratization of energy production?*
    - Is your impression that the local state is interested in the decentralization and democratization of energy production?

## Appendix 4

### Specific Interview preparation → Example of interview 4

**Interview with a consultant of the Solarzentrum in Berlin**

- Greeting
- Informing about
    - the recording
    - the length of the interview
    - the format
- Asking to start the interview (unless questions arise)

- **1. set of questions**
    - Do you want to give a short introduction which role tenant electricity has in berlin from your perspective? What is the status quo? What are recent developments? Where does it lead?
    - How do you evaluate the potential of tenant electricity?
        - Is it possible to reach the ambitious goals of the city of Berlin n that are expressed in the Masterplan Solarcity through tenant electricity as it is right now?

- **2. set of questions**
    - What are current barriers and constrains?
    - What could the city of Berlin do to remove these barriers? Which other actors need to act?

        - It appears that there is a discrepancy between the commitment of the federal government and the city of Berlin. Do you have an explanation for that?

- **3. set of questions**
    - Who are the current actors that invest into tenant electricity? Is the composition of actors going to change any time soon?
    - One aspect of tenant electricity is that the costs for all other grid consumers increase because tenant electricity is exempt from these costs. Is this a relevant argument to consider in your day-to-day operation?
        - How do the Federal Network Agency and the federal government relate to this?
    - Is the concept of tenant electricity also applicable in other contexts outside of Germany? If not, why could that be?

- **4. set of questions**
    - In debates around the Energy Table Berlin in 2013 demands for a democratization of the energy production and distribution in Berlin were made. How do you see the role of tenant electricity in this context?