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SONNET – SOCIAL INNOVATION IN ENERGY TRANSITIONS

Co-creating a rich understanding of the diversity, processes, contributions, success and future potentials of social innovation in the energy sector

D3.2: Report on the findings on the diversity, processes and contributions of SIE-fields and their SIE-initiatives in six countries

Deep dives into social innovation in energy through investigating three SIE-fields and their SIE-initiatives in Germany

Project Coordinator: Fraunhofer ISI

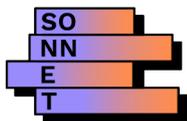
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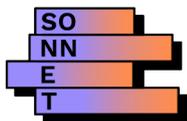
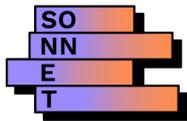
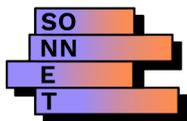


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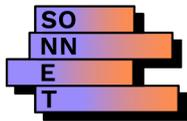


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1. BACKGROUND¹

1.1 Short introduction into the country report

SONNET (Social Innovation in Energy Transitions) brings diverse groups together to make sense of how social innovation can bring about a more sustainable energy sector in Europe. The project aims to co-create a rich understanding of the diversity, processes, contributions, successes and future potentials of social innovation in the energy sector (SIE). We define SIE as a combination of ideas, objects and/or actions that change social relations and involve new ways of doing, thinking and/or organising energy. For example, organising under cooperative principles to generate renewable energy.

As part of the WP3 case study work, we have produced 18 embedded case studies of SIE-fields across all six SONNET countries (including 36 cases of SIE-initiatives nested within them). This report outlines the case study work conducted in the UK. It contains the following sections:

Section 1 provides some reminders of the concepts and research questions. Section 2 introduces the SIE-fields investigated in the UK. Section 3 outlines the UK energy sector, in particular, the national energy system, the governance of the energy system, major energy policy changes, and social and cultural changes linked to the energy sector. Section 4 details the methodology of the UK work, including reflections on researchers' relations to the case. Section 5 contains a summary of each SIE-field studied in the UK through answering the major and minor research questions that have guided the empirical work. A list of references can be found in section 6. The three case study reports about the emergence and development of SIE-fields in the UK can be found in the appendix.

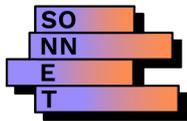
The country report builds on the previous SONNET work as outlined in deliverable 1.1, 1.2 and 3.1. It should therefore be read in combination with these deliverables. For example, the conceptual work is only briefly introduced in this report. For more detailed information, the reader should turn to D1.2 and 3.1.

1.2 A brief reminder of concepts and research questions

This section introduces three intertwined (and also distinct) empirical foci that have been investigated in WP3 (including definitions of key concepts and a visual conceptual map). The foci are: 1) emergence, development and institutionalisation of SIE and SIE-field over time, 2) SIE-field-actors and other field-actors' interactions with the 'outside' institutional environment, and 3) enabling and impeding factors for SIE-field-actors and other field-actors to conduct institutional work. The following three major research linked to these foci are:

- ✦ How do SIEs and SIE-fields emerge, develop and institutionalise over time?
- ✦ How do SIE-field-actors and other field-actors interact with the 'outside' institutional environment and thereby co-shape the SIE-field over time?
- ✦ What are the enabling and impeding factors for SIE-field-actors and other field-actors to conduct institutional work and change the 'outside' institutional environment?

¹ This section was mainly written by the WP3 lead Sabine Hielscher as it is valid across all countries studied within the SONNET project and slightly adopted to the German context.



For more detail on this work see D1.2 and D3.1.

In the following sub-sections, we introduce each of the three parts with short empirical narratives, conceptual working definitions, and a brief characterisation of the key aspects of the SIE-field that we investigate in our case studies.

1.2.1 Emergence, development and institutionalisation of SIE and SIE-field over time

Diverse SIE initiatives (and other SIE-field-actors) work on SIE and interact with other field-actors (who enable and/or impede the same SIE) within an SIE-field over time. SIE-field-actors (who work on SIE) and other field-actors (who enable and/or impede SIE) are actors within the SIE-field. These actors take one another and their activities into account and have a shared (but not necessarily consensual) understanding of an SIE and of their relationship to one another. Over time, SIE-field-actors' and other field-actors' patterns of activities can become more and more held in place, and practically taken for granted within an SIE-field. Actors can start to recognise (but not necessarily follow) shared norms, beliefs and rules.

The main focus in this part is on the emergence and development of SIE within an SIE-field as well as the development of SIE-initiatives, SIE-field-actors and other field-actors. We want to empirically identify how actors manifest around specific SIE and develop collectives (e.g. informal and formal alliances/networks/collaborations) and shared (but not necessarily consensual) narratives and activities (and associated norms, beliefs and values) over time. We are also interested in understanding what is 'socially innovative', by specifying the ideas, objects and actions these actors and collectives are working on within an SIE-field, and how these demonstrate a change in social relations and new ways of doing, organising and thinking.

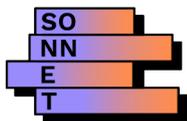
Social innovation in the energy sector (SIE) is a combination of ideas, objects and/or actions that change social relations and involve new ways of doing, thinking and/or organising energy. An example: Organising under cooperative principles to generate renewable energy.

SIE-initiative is a localised version/manifestation in time and space of a SIE. It includes SIE-field-actors, as those actors working on SIE. They can be from every sphere of society (community, market, state, third sector = SIE as multi-actor phenomena). Examples are: Ecovillage Aardehuizen and Living Lab Walldorf.

SIE-field-actors are individuals, organisations or other collectives who are part of a certain SIE-field and actively work on SIE. They can be from every sphere of society (community, market, state, third sector = SIE as multi-actor phenomena). Examples are: Cooperatives, citizen initiatives, energy companies, start-ups, local governments, intermediaries and NGOs.

Other field-actors are individuals, organisations or other collectives who are part of a certain SIE-field – these can enable and/or impede SIE. They can be from every sphere of society (community, market, state, third sector). Examples are: Local governments, national governments, professional organisations, industry actors and citizens.

A SIE-field is an arena/space that includes a specific SIE as well as SIE-field-actors working on it and other field-actors enabling and/or impeding it. In this space these actors take one another and their actions into account and have a shared (but not necessarily consensual) understanding of a SIE and of their relationship to other actors. They recognise (but not



necessarily follow) shared norms, beliefs and rules. SIE-fields are often not homogenous but are composed of actors with diverse and contradictory aims and interests. An example: The UK cooperative energy field includes SIE-initiatives and SIE-field-actors (e.g. Brighton Energy Co-op, Cooperative UK, Community Energy England, UK Government, City of Brighton), who have a shared understanding of an SIE, which exists as 'organising under cooperative principles to generate renewable energy'.

Institutionalisation is a process by which a pattern of activities comes to be regulative, normatively and cultural-cognitively held in place, and practically taken for granted within a SIE-field. The degree of institutionalisation is linked to the emergence and stability of a SIE-field.

1.2.2 SIE-field-actors and other field-actors' interactions with the 'outside' institutional environment

The SIE-field (and its actors) are nested within an 'outside' institutional environment linked to an energy system. This environment is constituted by formal and informal institutions that shape the activities of SIE-field-actors and other field-actors within the SIE-field. Although energy systems consist of a wide range of institutionalised rules, norms, and beliefs, these institutions have been object to profound changes over the past decade. These changes are due to manifold developments and can be grounded in field events and contestations, inter-field interactions, external shocks and societal trends.

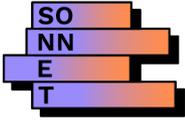
The main focus is on the interactions of SIE, SIE-field-actors and other field-actors with the 'outside' institutional environment, thereby co-shaping the SIE and its SIE-field and potentially creating institutional changes or maintaining the existing environment. We are interested in the 'outside' institutional environment that 'surrounds' and 'penetrates' the SIE-field. We want to understand how dominant institutions (regulative, normative and cultural-cognitive elements) within the 'outside' institutional environment influence the emergence and development of SIE (i.e. their social relations and patterns of doing, organising and thinking) within an SIE-field.

To understand how SIE-field-actors and other field-actors interact with the 'outside' institutional environment, we also need to identify and examine field events and contestations, inter-field interactions of SIE-fields and external shocks and societal trends. We are interested in how these events, contestations, relations, shocks and trends influence SIE-field developments and 'outside' institutional environments, as they co-shape each other over time. A particular focus is on political and policy developments.

Formal and informal institutions constitute the institutional environment. The SIE-field itself constitutes an environment (= SIE-field institutional environment) but also is nested with the larger encompassing institutional environment (= outside institutional environment). The SIE-field and its institutional environment consist of institutions and actors who interact with each other. The 'outside' institutional environment consists of institutions that can 'penetrate' (i.e. shape/ influence/ interact with) the SIE-field.

Institutional change is any change in form, quality or state in an institution or arrangement of institutional elements.

Institutions are made up of regulative, normative and cultural-cognitive elements. They are tacitly or explicitly agreed upon rules constraining or enabling activities of actors that provide stability and meaning to social life. These can be: 1) Regulative institutions: laws,



rules, standards, policies, 2) Normative institutions: norms and value systems, and 3) Cultural-cognitive institutions: shared conceptions of reality, binding expectations, common beliefs.

Field events are events, which might influence actors' relations and interactions within the SIE-field and can 'unsettle' the existing 'outside' institutional environment (but not necessarily change it). An example: A community energy advocacy group that was set up at a conference and started to talk to policy makers about their activities.

Field contestations are debates among SIE-field-actors and/ or other field-actors over SIE-field structures and processes. These contestations can 'unsettle' the existing 'outside' institutional environment (but not necessarily change it). An example: Contestations over regulatory and industrial policy linked to energy infrastructure developments.

Inter-field relations are interactions between SIE-fields (they can be nested and/ or overlapping). An example: Cooperative energy is nested within community energy in the UK.

External shocks and societal trends are, for instance, climate change, national elections, capitalism, ageing population, and economic crises that influence SIE-fields structures. Examples: Economic crises, weather disasters, and pandemics.

1.2.3 Enabling and impeding factors for SIE-field-actors and other field-actors to conduct institutional work

SIE-initiatives, other SIE-field-actors, and other field-actors perform institutional work. This means they engage in creating, maintaining and transforming institutions to be able to work on, enable and/ or impede SIE developments. Not all of the actors might be able to conduct this work (e.g. depending on skills, capacities, intentions and resources). There might be factors that can support or hinder institutional work. Some of the work conducted might have intentional or unintentional effects. Institutional changes can occur if the work and its activities appear to be more and more legitimate over time while previously institutionalised practices become eroded.

The main focus is on studying the practices of institutional work conducted by SIE-field-actors and other field-actors, in particular, aiming to understand the factors that allow (or not) for these activities to be performed. We examine why, how, when and where actors work at creating, maintaining and transforming institutions. This then enables us to build an understanding of the different forms of institutional work, types of work conducted (boundary work, strategy work, etc.), actors who are engaged (or not) in this work and enabling and impeding factors to be able to conduct this work.

Drawing attention to the practices rather than purely accomplishments of institutional work allow for an investigation of intended effects but also unintended consequences, i.e. success as well as failure, winners and losers, and acts of resistance and transformation. This then enables us to study how SIE-field-actors and other field-actors potentially contribute to institutional changes and/or maintain existing 'outside' institutional environments.

Institutional work refers to the activities of SIE-field-actors and other field-actors that aim to create, maintain and transform institutions. Examples: 1) Attempts to influence policy makers and the general public through direct lobbying, research reports, positioning papers, advertising, and the setting of technical standards and 2) Attempts to influence

informal institutions, such as values, norms, binding expectations, common beliefs, habits, and routines, among the wider public (Arenas 2017).

These foci are visualised in Figure 1 below (black = 'outside' institutional environment; blue = SIE-field and its SIE and actors; orange = change/ maintain processes).

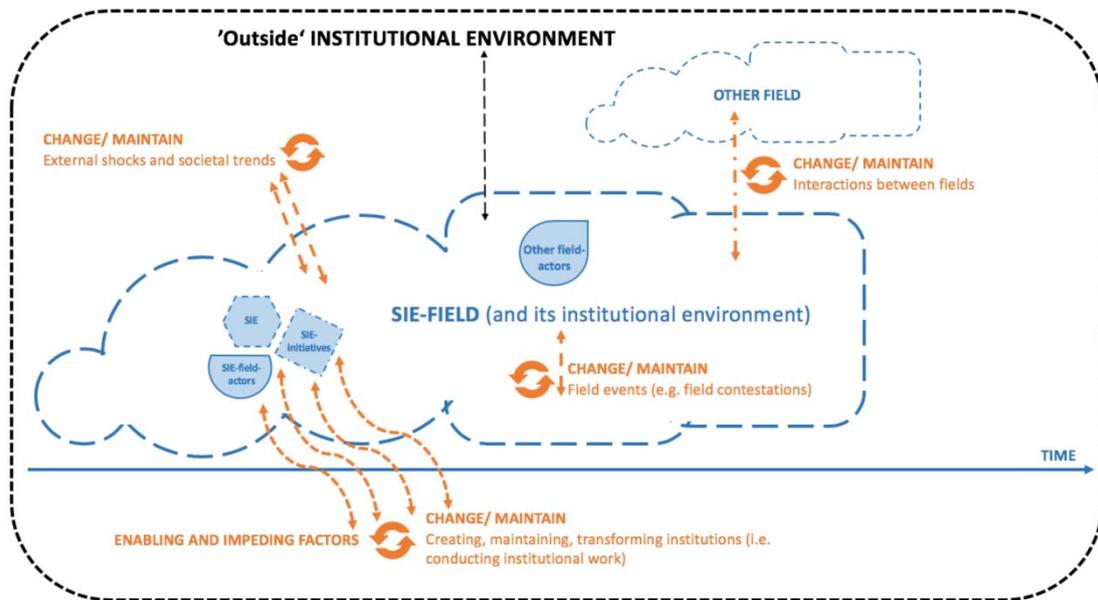


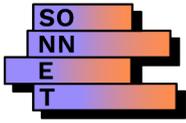
Figure 1: Summary of overall visual conceptual map

1.2.4 Emergence, development and institutionalisation of SIE and SIE-field over time

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To understand how SIE-field-actors and other field-actors interact with the 'outside' institutional environment, we also need to identify and examine field events and contestations, inter-field interactions of SIE-fields and external shocks and societal trends. We are interested in how these events, contestations, relations, shocks and trends influence SIE-field developments and 'outside' institutional environments, as they co-shape each other over time. A particular focus is on political and policy developments.

1.3 Embedded, multiple case study approach

In SONNET, we have identified eighteen clustered SIEs that together with SIE-field-actors and other field-actors make up the SIE-fields (for more detail see D1.1 and D1.2). To be able to study the SIE-fields in-depth and compare them, we have first delineated the national context as an important factor in the development and emergence of SIE and have included a diverse mix of country contexts (FR, DE, CH, PL, UK, BE/NL). We then developed a SIE-typology (see deliverable D1.1) and identified SIE clusters (see deliverable D1.2) and selected six SIE-fields for further investigation. The selection of SIE-fields was grounded in a purposive sample including the following selection criteria: 1) recognisability and prevalence of SIE-fields in each national context (i.e. SIE-fields had to be empirically recognisable in each SONNET country); 2) full coverage of interactions and manifestations that have been identified for the SIE-typology in WP1 (e.g. cooperative/doing and conflict/thinking); and 3) practical considerations including synergies with other SONNET work and building upon consortium expertise, relations in the field and interests of country teams. The following six SIE-fields have been selected in different national contexts:

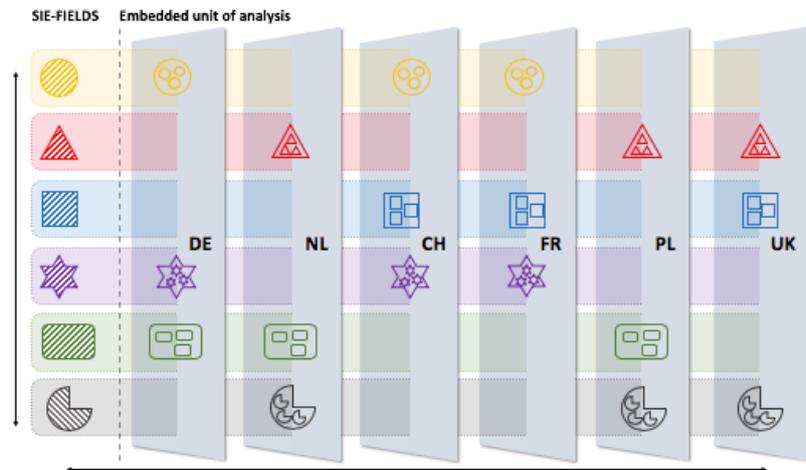


Figure 2: Illustration of SONNET's embedded, multiple case study applied, including national context

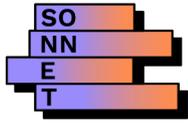
Legend:

- Circle: Cooperative organisation models for renewable energy;
- Triangle: Framings against fossil fuel energy pathways;
- Square: Local electricity exchange;
- Star: City level competition for sustainable energy;
- Rectangle: Participatory incubation and experimentation;
- Half Moon: Financial und subsidy mechanisms for renewable energy.

That is, in Germany we have produced case study reports for the following SIE-fields:

- 1) Participatory Incubation and Experimentation,
- 2) Cooperative Organisational Models for Renewable Energy and
- 3) City level competitions for sustainable energy.

See deliverable D3.1 for more information about SONNET's embedded case study approach.



2 INTRODUCTION TO SIE-FIELDS AND SIE-INITIATIVES STUDIED IN GERMANY

In the German context, we studied three SIE-fields in-depth. These SIE-fields are called 'Participatory Incubation and Experimentation', 'Cooperative Organisational Models for Renewable Energy' and 'City level competitions for Sustainable Energy'. The following section provides short descriptions of these three fields², their boundaries and relations to the country context.

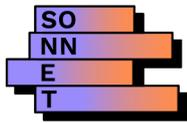
2.1.1 Participatory Incubation and Experimentation

In the SIE-field called 'Participatory Incubation and Experimentation', we studied multi-actor collaborative formats that aim to experiment with and/or test novel solutions for specific energy pathways. These formats are of socio-technical nature and provide a collective, physical space for experimentation and are often time-bound. They can involve different actors from across society such as actors from the fields of academia, civil society, economy and public authorities. Such experimentation focuses on energy topics and within SONNET is researched in Germany, Poland and the Netherlands & Flanders.

In the context of Germany, the SIE-field is closely linked to R&D policies. It especially institutionalises around the concept of *Reallabore* (real-life laboratories). The term *Reallabore* so far is used mostly in Germany and describes a hybrid form of experiments between generating and applying knowledge. The term might also be interpreted as a pendant to the German expression 'Realpolitik', emphasising that research has to be closely interlinked to the conditions of the real world. Therefore, the term has also been understood as a highly political term. In Germany, the development of these experimentation formats is based on a long history of a) participatory approaches, which especially emerged in the context of urban development and inspired transdisciplinary research approaches for sustainable development and b) technology focused research and innovation funding programmes for sustainable energy.

SIE-initiatives in the German context often include research institutes, energy technology companies, municipalities and/or civil society actors. We studied two initiatives in more depth. One is the '*Quartier Zukunft*' in Karlsruhe, which was part of the first German lab funding line for 'Reallabore' in Baden-Württemberg in 2015. It was founded by the Institute for Technology Assessment and Systems Analysis (ITAS) that is part of the Karlsruhe Institute for Technology, and, with its embeddedness in an urban context and its open and participatory approach, represents a transdisciplinary approach. The second initiative that we studied in more depth is called *Energieavantgarde Anhalt*. This *Reallabor* was established in 2012 and aims for establishing a decentralised energy system in the region Anhalt-Bitterfeld-Wittenberg. Its multi-actor constellation includes municipalities, utilities, (energy) businesses, foundations and research institutes. It also aims for including citizens in an energy dialogue. Furthermore, this 'Reallabor' is linked to large scale national energy innovation funding. Therefore, it represents an energy technology oriented strand of development of the SIE-field.

² These descriptions have been jointly developed by the SONNET team, with discussions led and results summarized in internal documents by the work package lead Sabine Hielscher.



2.1.2 Cooperative Organisational Models for Renewable Energy

In the SIE-field called 'Cooperative Organisational Models for Renewable Energy' we investigated organisational models through which citizens jointly own means of and participate in renewable energy production. Primarily, Renewable Energy Cooperatives (RECs) aim to finance and operate renewable energy power plants but can also have other goals such as to sensitize local actors to the potential of local renewable energy and energy savings. To determine what constitutes a cooperative organisational model, we rely on the cooperative principles provided by the European federation of renewable energy cooperatives (REScoop) and by the International Cooperative Alliance (ICA) respectively. These principles include i) concern for community, ii) voluntary and open membership, iii) democratic governance of the undertaking, and iv) autonomy and independence.

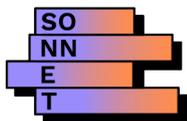
In Germany cooperative organisational models who adhere to the cooperative principles can be distinguished from other organisations by their legal form. The main attributes of member orientation, the identity principle and the democratic principle have been guaranteed by the German Cooperative Law (GenG) since 1889 (in GenG §1-§172). Those principles assure that cooperatives pursue the interests of their members through three means: (1) a communal business, (2) a combination of two opposing roles, e.g., the landlord and the renter, and (3) voting rights, where every member of the cooperative has one vote independent of the amount of his/her share (Klagge et al., 2016). Those principles are fundamental characteristics of energy cooperatives and play an important role for the selection of the cooperative model. Furthermore, since the registration in the German cooperative register is mandatory for all cooperatives (§10 §11 GenG) it is ensured that all energy cooperatives are comprehensively registered.

For the German case we investigated different regional and national operating SIE-field members. In addition to that we selected two different SIE-initiatives for more in-depth examination. As a first initiative we chose a middle-sized cooperative, namely the initiative *Solix Energie* with 120 members and several regional activities. In contrast, as second SIE-initiative we selected a very big cooperative, namely *Elektrizitätswerke Schönau (EWS)* which has a supra-regional activity scope, various business fields and around 9,000 members nationwide. Besides its function as a cooperative EWS is a key actor for the field of energy cooperatives, amongst others e.g. through its supporting measures for single cooperatives, its function as a role-model and its various cooperation with other actors in the field.

2.1.3 City Level Competitions for Sustainable Energy

In the SIE-field called 'City level Competitions for Sustainable Energy' we studied energy competitions that happen at the city level. In these competition formats participants pursue activities or measures contributing to energy behaviour changes within the city and/ or changes within the city administration to better address energy issues. Competitions involve elements of participants ranking themselves and/ or gaining or winning something at the end of the competition (including games voluntary comparisons, rankings, benchmarking, etc.).

In the case of Germany, the SIE-field is closely embedded in existing institutional structures. Due to the federal political system, cities play an active role in developing formats to engage different actors. Competitions take place both within cities and between cities. Competitions within cities often have a more playful character and target behaviour changes of citizens. They are part of cities' attempts to develop more attractive formats to reach out to citizens, schools, administrative units and motivate participants to increase their awareness for energy related



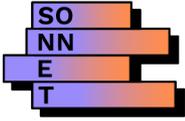
issues. Competitions between cities often focus on specific indicators and benchmarks to rank cities achievements in specific energy transition pathways.

We investigated two SIE-initiatives in more depth. As example of competition formats taking place within cities, we investigated a *Climathon* competition in the particular context of the city of Mannheim. In a one-day event, a Climathon aims for developing (technical) solutions for solving pre-defined local problems (challenges) in the context of climate change. The competition is part of a broader European initiative. It is however carried out by a local associate in close cooperation with the local city administration. Concerning competition formats between cities, we exemplary studied the German sustainability award (Deutscher Nachhaltigkeitspreis), which honours pioneers of sustainability in Germany and aims for motivating key players exchange best-practice examples for urban sustainability transition pathways.

The following table provides an overview over the definition of the SIE-fields, their key boundaries and characteristics in the German context.

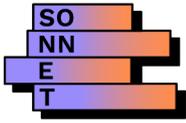
Table 1: Overview SIE-field, SIE and SIE-initiative examined in Germany

Name of SIE-field	Description of SIE-field & its boundaries	SIE definition linked to SIE-field	SIE-initiatives investigated	Cross-country comparison
Participatory Incubation and Experimentation	Multi-actor collaborative formats that aim to experiment with socio-technical solutions for specific energy pathways; often time-bound character with a physical space for experimentation	Closely linked to R&D policies, actors involved: researchers, energy companies, municipalities, civil society actors; concept of 'Reallabore' as pendant to 'Realpolitik'	Quartier Zukunft – Karlsruhe Reallabor Energieavangarde Anhalt	Netherlands & Poland
Cooperative Organisational Models for Renewable Energy	Organisational models through which citizens jointly own means of and participate in renewable energy production and which adhere to the cooperative principles provided by the European federation of renewable energy cooperatives and by the International Cooperative Alliance	Determined by the legal form of an organisation. Main attributes of member orientation, the identity principle and the democratic principle are guaranteed by the German Cooperative Law (GenG)	Solix Energie Elektrizitätswerke Schönau (EWS)	France & Switzerland
City level Competitions for Sustainable Energy)	Energy competitions that happen at the city; activities contributing to energy behaviour changes within the city and/ or the city administration to better address	Closely embedded in federal administrative structures. Competitions take place on within cities (often targeting	Deutscher Nachhaltigkeitspreis (competition for municipalities) Climathon Mannheim (organized on the city level, targeting	France & Switzerland



	energy issues; involves elements of ranking, gaining or winning	behaviour changes of citizens) and within cities (often with a focus on specific indicators and benchmarks).	the involvement of citizens)	
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The structure of this report is as follows. Section 2 (this section) summarizes the key insights derived from the three case studies in Germany. Section 3 describes the national context of Germany's energy system and major historical energy policy changes. Section 4 outlines and reflects on the methodology and the empirical basis of the three cases under study. Section 5 then reflects on the key research questions for each of case studies. The case study reports can be found in the Appendix of this document.



3 BRIEF INTRODUCTION TO THE GERMAN ENERGY SECTOR RELEVANT FOR SIE FIELDS STUDIED

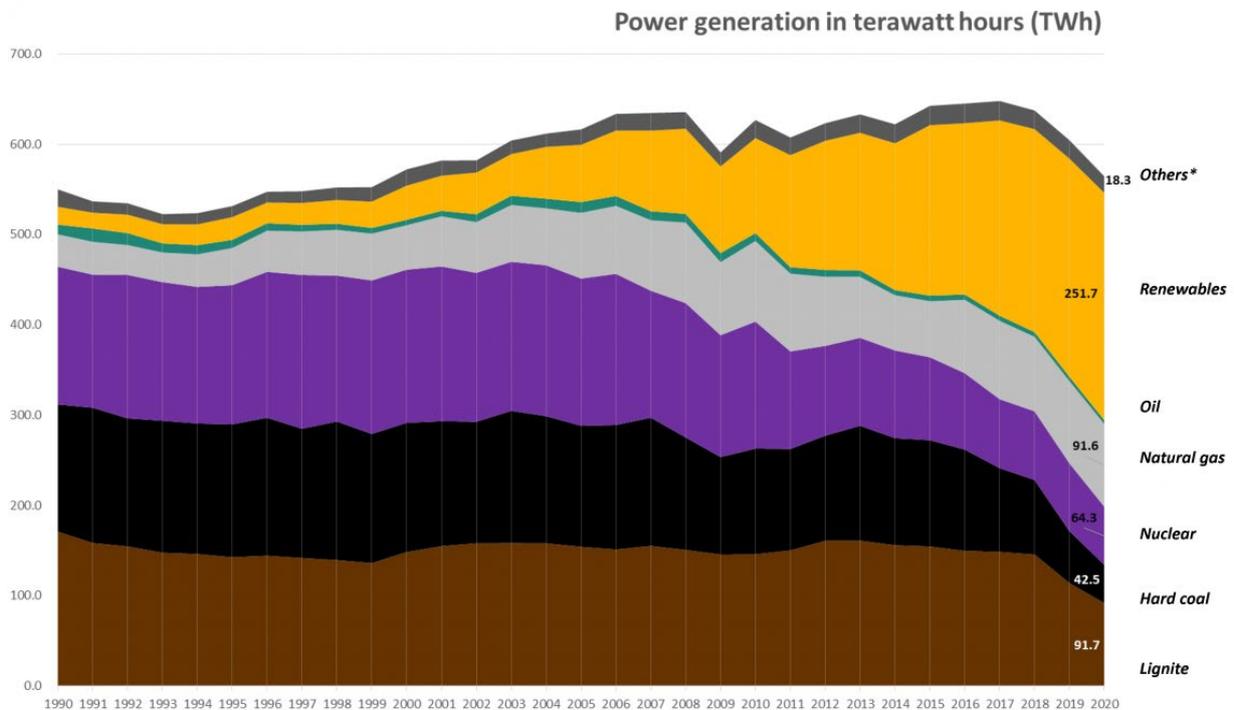
This section briefly outlines Germany's energy sector, in particular, the national energy system, the governance of the energy system, major energy policy changes, and social and cultural changes linked to the energy sector. Rather than providing an in-depth outline, the purpose of this section is to highlight key aspects and changes that are relevant for the three SIE fields investigated in this report. Thereby, this section provides a context for reading the three case study reports (see appendix).

3.1 Description of national energy system & governance of energy system

While energy systems in many countries were undergoing major transformation processes during the past years, the case of Germany's energy transition (*Energiewende*) has received particular attention due to the scope and speed of this process (Agora Energiewende 2015, p. 1). Compared to 1990, Germany's energy system started to transform from a centralized, coal and nuclear focused system into a more flexible and decentral system with an increasing amount of renewable energy production and renewable energy consumption.

Gross power production in Germany 1990 - 2020, by source.

Data: BDEW 2020, data preliminary.



* Without power generation from pumped storage.

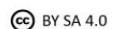
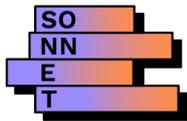


Figure 3: power production in Germany 1990-2020 (Source: Clean energy wire, data: BDEW 2020)



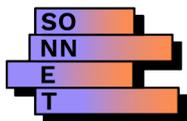
Historically, the German energy system has been heavily based on coal. From the late 19th century on, large industrial acclamations formed in coal intensive areas such as the Rhine-Ruhr region (von Hirschhausen 2018, p. 20). Through the 20th century, coal and lignite remained the most important sources for energy production in a strongly centralized national energy system. “After the war, one of the founding principles on which the European Community was built was the idea that a cartelized energy and heavy industry would maintain jobs and supply security” (von Hirschhausen 2018, p. 24). From the 1950s and 1960s onwards, nuclear technologies extended the sources of energy production.

The German energy transition has to be understood as a long-term societal and political process that has its roots in the anti-nuclear movements during the 1970s (Kemfert et al. 2018). According to Kemfert et al. (2018), “the Energiewende is a long-term project, and it is a political and societal revolution as much as it is a technological revolution” (Kemfert et al. 2018, p. 380).

With regard of transformative innovation to address grand challenges, Geels (2020), distinguishes three different phases of this transition in the German electricity sector: First, after the 1970s oil crisis R&D programmes supported niche innovations for alternative ways of energy production, such as solar PV and wind turbines. A feed-in-law for renewable energies made these developments economically feasible. As outlined by Meister et al. (2020), the liberalisation of the German electricity market in 1998 was an important step as it allowed for a greater diversity of energy providers and enabled small-scale actors such as energy cooperatives to enter the market (Meister et al. 2020, p. 7). In a second transition phase, influenced by the nuclear phase-out decision in 2000, renewable energy technologies were further pushed and quickly diffused through guaranteed payments for renewable electricity. During this phase “solar PV became an industrial success story” (Geels 2020, p.16). In a third transition phase, renewable energy technologies further diffused due to declining technology prices. However, in the course of this phase, renewable energies also experienced difficulties and economic problems such as concurrence from Chinese technology providers or the increase of the surcharges for renewable energies born by German electricity consumers apart from exempted energy-intensive industries (Geels 2020, pp. 13–18).

In this long-term process, the years 2010 and 2011 mark a milestone for Germany's energy transition. Some scholars even distinguish this particular phase of development and describe it e.g. as ‘Merkel's Energiewende’ (Paul 2018), which is however embedded in a larger process. With the German 'Energy Concept' and the nuclear phase out decision after the Fukushima nuclear catastrophe the German 'Energiewende' approached an “integrated policy framework” (Agora Energiewende 2015, p. 5). First, the Energy Concept in 2010 highlighted the role of renewable energies and included ambitious targets e.g. to reduce energy consumption by 50% until 2050 compared to 1990 (BMW i 2010, p. 5). However, from a critical perspective and regarding the nuclear phase out process, it has been argued that the Energy Concept from 2010 came with a side agreement that guaranteed nuclear power plant utilities to “maintain their economic benefits from the lifetime extension even after a subsequent change of government” (von Hirschhausen 2018). More drastic changes then only took place in 2011 after the Fukushima nuclear catastrophe, when the German Law on Nuclear Energy was amended and then included the law on the closure of nuclear power plants.

The objectives of energy policy are declared to target the combat of climate change, avoid nuclear risks, improve energy security, and guarantee competitiveness and growth (Agora Energiewende 2015, p. 5). More precisely, the German federal government declared to want to reduce greenhouse gases by 80–95% by 2050, to shut down nuclear power plants by 2022, to



increase the share of renewable energy production to 80% by 2050 and furthermore to increase energy efficiency (von Hirschhausen 2018, pp. 39–41).

Table 2: Main objectives of the energiewende (von Hirschhausen 2018, p. 40)

	Reduction of nuclear energy	Share of renewable energy		Reduction GHG-emissions	Reduction of energy demand			
		Gross final energy	Electricity production		Primary energy	Domestic heat	Final energy transport	Electricity demand
2015	–47%							
2017	–56%							
2019	–60%							
2020		18%	35%	–40%	–20%	–20%	–10%	–10%
2021	–80%		40–45%					
2022	–100%							
2025								
2030		30%	50%	–55%				
2035			55–60%					
2040		45%	65%	–70%				
2050		60%	80%	–80% to 95%	–50%	–80%	–40%	–25%
Base	2010	–	–	1990	2008	2008	2005	2008

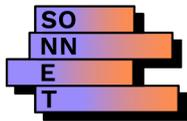
Source: Energy Concept 2050 (BReg 2010), 13th Amendment of the Law on Nuclear Energy (Atomgesetz, AtG)

3.2 Understandings of ‘social innovations’ in the energy sector

As outlined in the first part of this report, social innovation in energy (SIE) are understood within SONNET as a combination of ideas, objects and/or actions that change social relations and involve new ways of doing, thinking and/or organising energy.

Grassroots movements and claims for citizen’s participation in energy related topics have a tradition in Germany, with the German energy transition being rooted in strong anti-nuclear movements during the 1970s. According to Quitzow et al. (2016) the broad public discourse on renewable energies that emerged in the 1970s and 1980s set the foundation for Germany’s energy policy today. Political and technological developments would therefore be “founded upon locally rooted, community-driven, and ecologically inspired political activism” (Quitzow et al. 2016, p. 3). Germany’s *Energiewende* is especially known for its feed-in tariffs, which – according to some scholars in social science research on energy transitions – have been interpreted as a means to strengthen energy democracy and public participation in the *Energiewende* (Leiren and Reimer 2018). Feed-in-tariffs for renewable energies have especially encouraged energy cooperatives and citizen energy (both can be associated with social innovation in energy), to play an important part in Germany’s energy transition process (Agora Energiewende 2015, p. 13). Furthermore, due to the strongly decentralised structures in the federal political system in Germany, local governments play an active role in developing (local) sustainable energy pathways (Deutsche Energie-Agentur GmbH 2019), often in cooperation with civil society groups or energy cooperatives (Meister et al. 2020).

However, the concept of social innovation in some cases starts to be recognized by policy makers and to be furthermore explicitly mentioned as part of political strategies. One example is the High-Tech Strategy of the German Federal Government, Germany’s overall research and innovation strategy. The latest strategy paper, the High-Tech Strategy 2025, defines innovation as



both socially and technically. Social innovation would thereby include “new social practices and organizational models” that provide sustainable solutions for societal challenges (BMBF 2018, p. 11). According to this policy strategy, social innovations are also supported by Germany’s energy research program (BMBF 2018, p. 23), e.g. by supporting real world laboratories for experimenting and testing new energy pathways in collaborative multi-actor settings. In parallel to an understanding of social innovation that is based more on grassroots movements, in the German context, social innovation might be seen as becoming increasingly part of the political agenda. From a critical perspective, scholars from social sciences might, however, argue that the adopted concept of social innovation brings about an entrepreneurial understanding of social innovation (Schubert 2019).

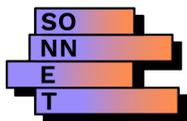
Terms and examples that are used to describe some social innovations in energy in Germany, among others, are: energy cooperatives (Energiegenossenschaften), citizen energy (Bürgerenergie), prosumers, sharing options in the mobility and transport sector (e.g. car sharing) but also research formats such as real world laboratories for energy research (Reallabore), or dialogue formats and round tables that encourage exchange between different types of actors (e.g. Energiedialoge).

3.3 Major historical energy policy changes

The German ‘*Energiewende*’ has to be understood as a political manoeuvre that changed the dominant pattern in German energy policy and was shaped by “a rich policy mix” (Rogge and Schleich 2018, p. 1642). According to Kemfert et al. (2018), “one observes a pattern in German energy policy in which the corporate sector sets targets and roadmaps, and public energy policy is reduced to following suit. The *Energiewende* broke this pattern” which in turn had major implications for the four large incumbent utilities.

One can summarize the developments that led to these changes starting from the liberalisation of the German energy market in 1998. According to Meister et al. (2020), this was an important step towards a greater diversity of energy providers and thus enabled small-scale actors such as energy cooperatives to enter the market (Meister et al. 2020, p. 7). Throughout the 1990s, especially after the 1992 UN conference on Environment and Development in Rio de Janeiro, Germany developed climate policies (von Hirschhausen et al. 2018, p. 30) and encouraged innovations in the field of renewable energy technologies (Geels 2020, p. 14). In the early 2000s, the Coalition of Social Democrats and the Green Party introduced major changes in energy policies (Agora *Energiewende* 2015, p. 11): the first nuclear phase out-decision (law passed in 2002) and the Renewable Energy Sources Act (EEG) in 2000 were important milestones. The EEG introduced feed-in-tariffs that were specified for different renewable energy technologies and guaranteed for a period of 20 years (BGBl 2000 I 13 S. 305-309). This opened possibilities for citizen energy and energy cooperatives by guaranteeing stable investment conditions (Leiren and Reimer 2018).

However, several regular and later also ad-hoc amendments of the EEG during the following years (in 2009, 2012, 2014 and 2017) changed this legal situation and especially challenged the situation for energy cooperatives and citizen energy. These amendments of the EEG included for example the introduction of a growth corridor that allowed to control the development of renewable energy production and the experimentation and later switch to an auction model for renewable energies. According to Leiren and Reimer (2018) two parallel developments influenced this change: First, pressures from the European Commission to adopt more competition-oriented approaches. Second, changes within the national government (Leiren and Reimer 2018). While



the first feed-in-tariffs were introduced by a coalition between Social Democrats (SPD) and the Green Party (Bündnis 90/Die Grünen), the more competitive approach was especially favoured by the later elected coalition government between the Christian Democratic Union / Christian Social Union (CDU/CSU) and the Liberal Party (FDP). In 2013, under a "grand coalition" between CDU and SPD, the responsibility for energy was transferred from the environmental ministry to the Ministry of Economics (then called Economics and Energy) which further contributed to this policy change (Leiren and Reimer 2018).

Table 3: Overview of German Government coalitions from 1998 until today (April 2021)

Years	Coalition	Chancellor
1998 - 2002	SPD + Bündnis 90/Die Grünen	Gerhard Schröder
2002 - 2005	SPD + Bündnis 90/Die Grünen	Gerhard Schröder
2005 - 2009	CDU/CSU + SPD	Angela Merkel
2009 - 2013	CDU/CSU + FDP	Angela Merkel
2013 - 2018	CDU/CSU + SPD	Angela Merkel
2018 - today	CDU/CSU + SPD	Angela Merkel

The years 2010 and 2011 - during Merkel's coalition government between CDU/CSU and FDP - marked an important milestone in the German *Energiewende* towards a more integrated framework. The German Energy Concept from 2010 translated climate targets that were set on the European level into a national program and aimed for a reduction of greenhouse gas emissions by 80–95% (compared to 1990) by 2050 (BMW_i 2010). However, it was criticized for justifying the future use of coal and guaranteeing nuclear power plants an average extension of 12 years lifetime (von Hirschhausen 2018, pp. 34–35). This changed with the nuclear phase-out decision in 2011, as reaction to the nuclear catastrophe in Fukushima, which represented a turnaround of government towards a reconfirmed nuclear phase out by 2022. While initially seven of the oldest nuclear power plants were immediately shut down (Agora *Energiewende* 2015, p. 12), a little bit later an Amendment of the Law on Nuclear Energy regulated the shut down of the rest of Germany's nuclear power plants by 2022 (BGBl 2011 I 43 S. 1704-1705).

Another important milestone for social innovation in the German energy transition occurred in 2018, when a new energy research programme funded by the German Federal Government was launched. For the first time, it mentioned the term social innovation and its' role for Germany's energy transition (BMW_i 2018a, p. 68). This especially refers to the role of research to explore social needs and consequences in transdisciplinary real world contexts. The strategy paper and funding programme 'Reallabore der Energiewende' (real world laboratories of the energy transition) of the Federal Ministry for Economic Affairs and Energy (BMW_i) further elaborates this approach, especially focusing on digital innovation and its role for technological and societal change (BMW_i 2019).

The table below provides a selective overview of key policies that shaped the German energy system over the past two decades.

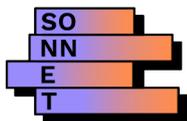
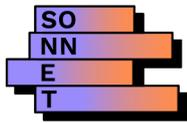


Table 4: overview of key policies that shaped the German energy system over the past two decades

Year	Short description of policy	Relevance for SIE-field	Source
1998	Liberalisation of the German electricity market	Liberalisation of the German electricity market in 1998 when Germany complied with the regulations of the 1996 EU directive about the liberalisation of the electricity market.	(EU DIR 96/92/EG Brussels 1996; BGBl 1998 I 23 S. 730-736)
2000	Renewable Energy Sources Act (EEG):	Introduction of technology-specific feed-in-tariffs guaranteed for 20 years; enabled citizen energy and energy cooperative business models	BGBl 2000 I 13 S. 305-309
2002	First nuclear phase-out law (negotiated agreement for nuclear phase out by 2022)		BGBl 2002 I 26 S. 1352-1359
2010	Energy Concept of the German government (for an environmentally friendly, reliable and affordable energy supply)	Turing point for more integrated energy policies	BMWi 2010
2011	Second nuclear phase out law (roughly reinstating the earlier nuclear phase-out decision of 2002)	Post-Fukushima all-party consensus to close all German nuclear power plants by December 2022	BGBl 2011 I 43 S. 1704-1705
2014	Amendment of Renewable Energy Source Act (EEG 2.0)	decreasing feed-in tariffs, introduction of a breathing lid (until the amendment 2014 optional), direct marketing of renewable energy as a pilot for the auction model (to be tested for free field solar PV)	BGBl 2014 I 33 S. 1066-1147
2018	Launch of 7th energy research programme	Includes a funding strategy for ‚Reallabore‘	BMWi 2018b
2019	Climate action law	Germany's first climate law makes emissions reductions legally binding	BGBl 2019 I 48 S. 2513-2521



3.4 Key cultural and social developments

As the *Energiewende* is understood as a political as well as a societal process, cultural and societal trends play an important role in this development. With its long tradition of socio-ecological awareness rooted in the anti-nuclear movements since the 1970s, the German *Energiewende* can generally draw on relatively high social acceptance rates. Especially renewable energies are popular and contribute to (Local Energy Consulting 2020, pp. 8–9). This however differs among renewable energy technologies: a survey by Agora Energiewende in 2020 found that wind energy is supported by 51% percent of the society while the acceptance rate of solar systems in roof-tops is much higher and lies around 81% percent (Local Energy Consulting 2020, pp. 9).

With the start of the Fridays for Future movement in 2018, an important societal shift started to get visible, which further increased the support of *Energiewende* as well as the involvement of bottom-up participation by civil society actors across different societal spheres and stakeholder groups (see 'scientists for future', 'farmers for future' etc). For the year 2019, the yearly report by Agora Energiewende about the development of the German energy transition for the first time describes 'climate protection and energy transition' as the number one political topic before other topics such as migration or education (Agora Energiewende 2020).

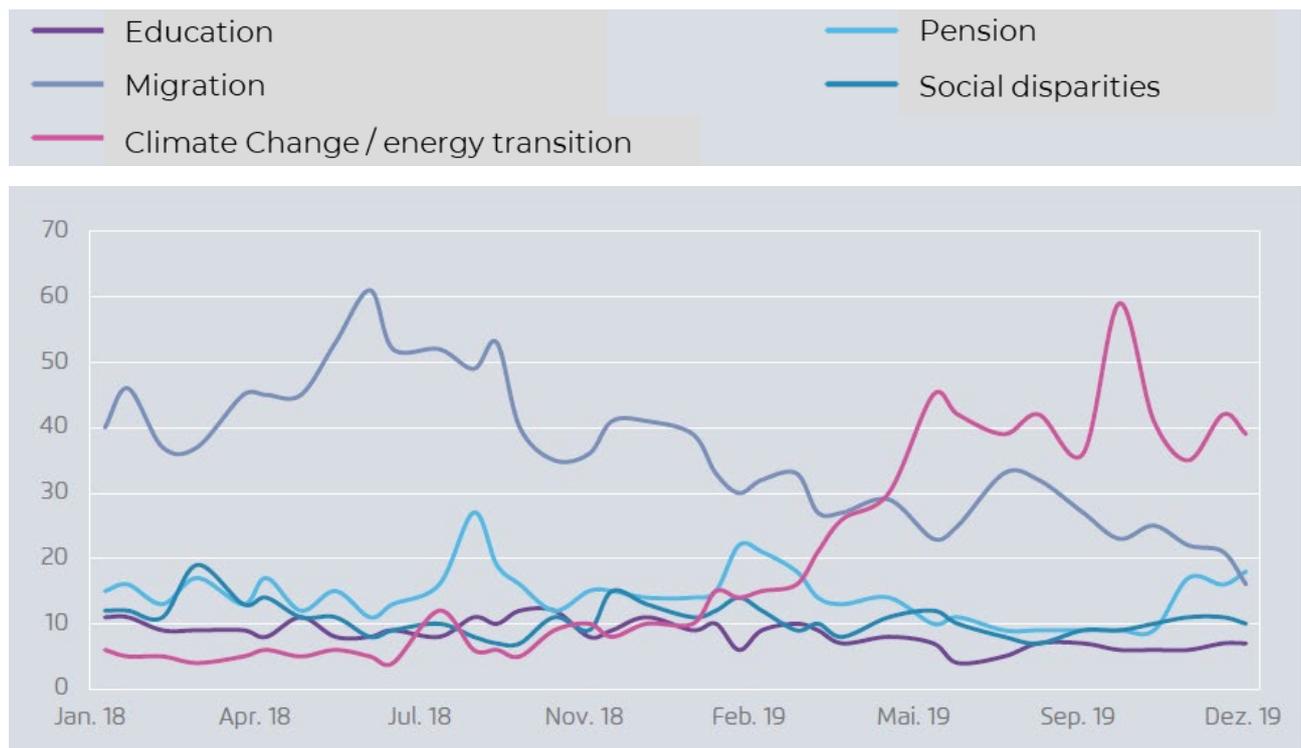
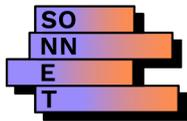


Figure 4: Top 5 political problems in Germany 2018-2019 according to 'Politbarometer'; Source: (Agora Energiewende 2020, p. 65)



4 METHODOLOGY

4.1 Researcher's relations to the case studies

The researchers who conducted the German case studies have different social science backgrounds and previously to SONNET only partly worked on topics related to social innovation and/or energy transitions, and none of them has been active in any of the three SIE fields. Several senior researchers at Fraunhofer IS who have previously conducted research on the transformation of the German energy system and especially the role of innovation in this process supported the research through a range of means, including supervising the research, providing advice, acting as door-openers, suggesting relevant literature and/or contacts to interviewees. In addition, city and academic partners involved in SONNET who work on similar topics provided helpful insights into the SIE-fields.

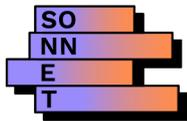
The interviewees were approached in a step-by-step process, following a snowballing approach. In two of the case studies, we started with one or two explorative interviews that allowed to identify further relevant interviewees. In the third case study, the selection for the first interviewees was made after a desktop research and in the following based on the interviewee's description of relevant actors for the field. We furthermore asked the interviewees after every interview about further possible contacts. To gain a diversity of experiences and narratives, we chose interviewees with different backgrounds, motivations and roles related to the SIE-fields under study. We approached the interviewees with an introductory email in which we outlined what SONNET is and informed potential interviewees of our informed consent procedures. Together with the email we sent a link to the SONNET website giving more background information on the project. At the beginning of the interviews, we explained that interviewees would be able to respond to the case study report and gain access to it once it was completed. Some of the interviewees provided feedback on the reports.

Due to COVID-19 all of the interactions with the interviewees happened via telephone and/ or video conferencing. While this physical distance has influenced our research approach, overall the personal interviews went smoothly and were informative despite the virtual or phone setting. All participants were extremely collaborative and we are grateful to their time in answering our questions. Most of the engagements with research participants were based on 1 - 1.5 hours interviews; in addition, in some instances interviewees provided additional information and/ or feedback on timelines, reports, etc. via email.

4.2 Short description of methods

SONNET makes use of an embedded case study approach, aiming to describe SIE-fields using diverse units of analysis. The main unit of analysis is the SIE-field, whereas the subunits of analysis are made up of SIE-initiatives and SIE-field-actors (who work on SIE) and other field-actors (who intentionally and/ or unintentionally enable and/ or impede SIEs within a SIE-field) and SIE. The context refers to the 'outside' institutional environment linked to the SIE-field (wider socio-political, social-economic and socio-cultural context), seeing that SIE-fields are nested within a larger encompassing context.

We have drawn on the innovation history approach to co-construct the emergence and development of a SIE-field (including a SIE/ SIE-initiatives/ SIE-field-actors/ other field-actors). Case study researchers (through the document review and conducting interviews) and SIE-field-



actors and other field-actors (through granting interviews) have co-created this history. In addition, we have taken inspiration from the critical turning points approach to examine critical instances/ processes where SIE-field-actors and other field-actors have conducted institutional work to create, maintain and/ or transform institutions.

We have gathered data through analysing documents, conducting in-depth interviews and carrying out (online) participant observation³ across the three embedded case studies in Germany. These three methods are being used to enable data enrichment and triangulation. The fieldwork was carried out between May 2020 and February 2021. The three methods are detailed in more depth within the following three sections.

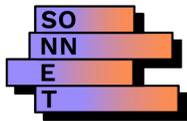
4.2.1 Document review

The review of documents was a starting point for the case study work and further accompanied the work on other methods. All three case studies made use of grey literature, policy documents, scientific literature and (SIE-initiatives) websites. An overview of primary and secondary sources is given in the methodology section and in the reference lists within each case study report.

In the case study on the SIE-field referred to as 'Participatory Incubation and Experimentation', we started with conducting a search on Google scholar, with several search terms (e.g. living lab + energy + Germany), yielding a variety of journal articles with focus on different multi-actor collaborative formats. In particular, some of the articles provided an overview of existing participatory formats related to energy or more broadly to sustainability. We selected the examples related to the German context. Furthermore, a special issue in 'GAiA – ecological perspectives for science and society' under the title 'Labs in the real world' provided a good overview and allowed to identify further articles, websites and related actors in a snowball approach. We took this as a starting point to look at several actors, groups and organisations' websites with their own reports, statements, newspaper articles, etc. As the SIE-field is closely related to R&D innovation policies, one important type of document we looked into were policy documents that e.g. outline different funding lines for transdisciplinary research in multi-actor collaborative formats. Additionally, we looked at websites (e.g. of SIE initiatives), policy documents and other reports mentioned by interviewees.

In the case of 'Cooperative Organisational Models for Renewable Energy' we started with a document review based on results for the relevant keywords of the search engines Google scholar and Scopus. This served as a starting point to get a first overview of the main developments, particularly concerning the policy changes relevant for the field. Due to the multiplicity of results we focused on the most recent literature about the SIE-field under study. The scientific documents mainly revealed numerical developments of energy cooperatives, addressed issues concerning energy cooperatives in general or a specific form of energy cooperatives regarding a specific topic. They gave a good overview of the main developments relevant for energy cooperatives but did not extensively address emerging and changing actor constellations within the field and beyond. To gain deeper insight into that, additional websites were consulted based on search engine results for relevant keywords. In particular the website of the national association "Energiewende Jetzt e.V." served as a starting point to get an overview of relevant SIE-field actors for energy cooperatives. Starting from that and from recommendations of the

³ The situation due to COVID-19 made it impossible to conduct face-to-face participant observation. In some cases it was possible to join online meetings or follow online discussions as an alternative to the participant observations.



interview partners the websites of relevant SIE-field actors were investigated and relevant primary sources (press releases, statements, publications etc.) examined. Thus, the sampling of documents and websites was based on a mix of journal articles, websites of initiatives, websites of SIE-field actors, press releases, SIE-field related guidelines and reports.

For the case study on 'City level competitions for sustainable energy', we conducted a Google search with several search terms (e.g. searching for different kinds of competitions, searching for energy related Apps on the city level) to gain an overview over existing formats and the actors involved. We furthermore conducted a search on Google scholar to gain an overview over existing scientific literature. The variety of articles that emerged in many cases was not directly linked to the SIE under study but rather described e.g. the role of cities or city-networks in transitions more generally or the role of apps for energy savings and ways of programming them. There seems to be still a lack of scientific literature that links competition formats to the topic of energy on the city level. As part of the case study work, we also looked at several actors, groups and organisations' websites. Some of them have produced their own reports, statements, newspaper articles, etc. We chose to analyse the documents that helped us to deepen our understanding of key events and activities mentioned by the interviewees. Instead of providing an overview over broader developments in this SIE-field, these websites mostly documented and promoted single events, which we summarized in our report. The sampling of the documents and websites was furthermore expanded by additional projects and people mentioned by our interviewees.

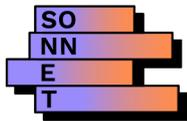
4.2.2 In-depth interviews

The three main research questions and minor ones outlined in the methodological guidelines guided the design of an English interview guide for the in-depth interviews across all SONNET case studies and country context (see: Hielscher et al. 2020). This interview guide was translated into German and used in conducting interviews for all three German case studies. However, before conducting the interviews the document review was conducted but also continued alongside the in-depth interviews.

Most interviews consisted of 1-2 hours sessions and were conducted by one of the ISI researchers. Interviewees were selected based on their role in and their relationship with the SIE-field, as well as in response to referrals from interviewees. Overall, the interviews differed slightly due to the different role, position and background of the interviewees in relation to the SIE-field. These differences resulted from the duration of the interview, the amount of time spent on each of themes in the topic guide, as well as the character and degree of spontaneous open questions that arose during the interview. Some of the interviewees might have had specific foci and thus only the relevant themes in the topic guide were covered.

During the research process a detailed list of key events making up the historical narratives of each SIE field was developed. The list of events was sometimes discussed as part of the interviews and/ or events were added and/ or more details were provided (a detailed list of events can be found in the appendix of each case study report).

In the case of the SIE-field 'Participatory Incubation and Experimentation' we conducted 8 in-depth interviews. Also for this case study, colleagues from Fraunhofer ISI, partners in the SONNET project and members of the advisory board helped to gain access to relevant interviewees. With two colleagues from ISI we could conduct explorative interviews (these were also analysed as part of the overall 8 interviews). Further interviewees could be identified through these conversations and colleagues in some cases worked as gatekeepers to get in contact with relevant interviewees.



Other interviewees, especially the members of SIE-initiatives, were approached based on the results of the document review. We spoke to a number of field actors related to transdisciplinary research, policy making initiatives or managing agencies on the national and European level and members of SIE-initiatives operating on the regional and national level in Germany. Especially the interviews with SIE-field-actors helped to gain a good overview of the emergence and development of the SIE-field over time.

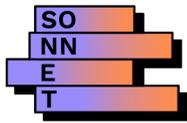
With reference to the case study 'Cooperative Organisational Models for Renewable Energy' 8 in-depth interviews were conducted in total. The initial desktop research served as a starting point to get a first overview of the field and relevant actors for the field of energy cooperatives. The sampling strategy was based on initial research insights and in the following snowball sampling. More precisely, interviewee selection was based on the aim to include regional as well as national SIE-field actors and to obtain an overview of field developments. As a result, we spoke to board members of different regional networks for energy cooperatives, a board member of a national operating association for citizen energy, a board member of a cooperative electricity supplier and two SIE-initiatives. The interviews with the different SIE-field actors were particularly insightful for overall field developments while the interviews with the SIE-initiatives contributed to the deeper insights into small-scale developments.

With reference to the case study on 'City level competitions for sustainable energy', 8 in-depth interviews were conducted. Colleagues from Fraunhofer ISI, partners in the SONNET project and members of SONNET's advisory board supported the search to gain interviewees for the fieldwork, i.e. they worked as gatekeepers; in two instances they agreed to be interviewed themselves given their close relation to the field. The sampling strategy was therefore based on convenience and snowball sampling. We spoke to people involved in organising different kinds of competition formats taking place on the city level which were e.g. members of city networks, local city administrations or national organisations. Most of the interviews focused on the development of a particular competition activity and for many interviewees it seemed difficult to share deeper insights into broader developments on the national level. In total, however, these distinct descriptions helped to conclude about the overall emergence and development of the SIE-field over time.

During the interviews, the interviewees were told that the interview data would be treated confidentially and that they would be quoted anonymously in the case study report. Except of one interview, all interviews were recorded with consent by the interviewees and transcribed making use of the NVivo transcription service. The quality of the transcriptions varied, and parts of the interviews were therefore re-transcribed manually. These transcriptions were used as a basis for coding in NVivo. After having written a full version of the case study reports, we checked with every interviewee how they would like to be referred to (organisations name or anonymously), how we could use their direct quotes and whether there is anything they would like to share after having read the report. When interviews were hold in German, we translated the quoted sentences to English.

4.2.3 Participant observation

Due to COVID-19, it was not possible to conduct face-to-face participant observation. We joined several online events that took part, depending on whether relevant meetings took place ('Participatory Incubation and Experimentation': three meetings; 'Cooperative Organisational Models for Renewable Energy': one meeting, 'City level competitions for sustainable energy': no



meetings). The events varied, i.e. were organised by different types of actors, had a local or international reach and related to several purposes (e.g. academic seminars and experience sharing between local initiatives). See full list of events in each case study report.

4.3 Description of analysis

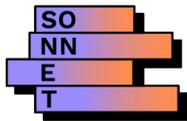
Once we collected the data, we analysed it before writing up the three case study reports. This has not been a linear, but rather iterative process where we went back and forth between collecting data, writing up parts of the report, going back to our data, and possibly holding another interview. However, this differed slightly across case studies. More precisely, for the case study on ‘Participatory Incubation and Experimentation’ we analysed the interviews in a sequential process parallel to the process of conducting further interviews; whereas for the case studies on ‘City level competitions for sustainable energy’ and on ‘Cooperative Organisational Models for Renewable Energy’ the interviews were analysed after conducting all interviews.

We used the NVivo transcription tool to transcribe all of the interview material. Some of the transcriptions have been of a rather poor quality, which meant that for some interviews we re-transcribed parts of the interview material manually. A list of codes (and their descriptions) was developed by the SPRU and DRIFT team and shared with the SONNET team (e.g. SIE-field contestations, maintain institutions, and SIE-field-actor’s activities). For the case studies ‘City level competitions for sustainable energy’ and ‘Participatory Incubation and Experimentation’ the interview data was coded in the qualitative software tool NVivo, for the case study ‘Cooperative Organisational Models for Renewable Energy’ the coding was done without the software. Other material such as research articles and other documents were partly summarized and used alongside interview data to prepare interviews and triangulate interview data.

The historical narrative in the case study report was written up based on all data sources, i.e. by analyzing the coded material and summaries. For each report, several time phases were inductively identified to structure the historical narrative. In addition, the boundaries of the SIE-field and answers to the three research questions were formulated. An internal review of the case studies was carried out within the ISI team, by our city partners (i.e. city of Mannheim) and a SONNET researcher.

4.4 Reflections on overall methodology

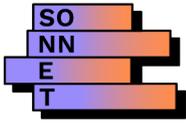
The research on the SIE-fields was designed in accordance with the methodological guidelines developed in the SONNET project (see: Hielscher et al. 2020) and guided by three overarching research questions associated with the underlying conceptual framework (see: Wittmayer et al. 2020). In reporting back on our research, we used the SONNET case-study report template. We kept all the (sub)sections and headings of this template and aimed to fill it in coherently. There is however some variety in terms of where and how issues were discussed and interpreted, depending on the empirical material and the researcher writing up the report. In total, three researchers worked on writing up the case study reports: Maria Stadler led and wrote the first drafts of the case studies ‘City level competitions for sustainable energy’ and ‘Participatory ‘Incubation and Experimentation’ while Jasmin Heidary led and wrote the first draft of the case study ‘Cooperative Organisational Models for Renewable Energy’, while Karoline Rogge supervised and coordinated the case study work for Germany, providing guidance, feedback and editorial support for all three case studies. In addition, two further senior researchers at Fraunhofer ISI provided feedback and comments.



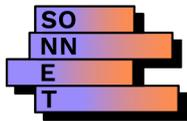
In the case of the SIE-field referred to as 'Participatory 'Incubation and Experimentation', a good starting point for getting an overview of the emergence and development of the SIE-field over time was to contact researchers who were engaged in research activities with close relation to the SIE-field. Especially, interviewing researchers with long experience in energy related research activities allowed to gain a first overview of the SIE-field and deciding whom to contact for further in-depth interviews. The document analysis revealed that this particular SIE is increasingly researched in different research fields such as sustainability transitions research, urban development, innovation studies, energy research and policy studies. Taking into account the time constraints of this study (as with all other case studies 1.5 person months), we had to focus on identifying overall changes and their interrelations. Due to the resource restrictions, it was not possible to research all debates in the different research fields mentioned in-depth. National funding programmes and policies therefore served as the baseline for identifying changes, which were then traced back to the actors, their engagement and aims. A timeline was developed in the process of conducting the research and served during the last three interviews as a starting point for discussing the SIE-field-development. This allowed to integrate feedback from the interviewees and add further details. Overall, especially the sequential process of conducting the fieldwork helped to react to different findings e.g. by adjusting interview questions and gain a good overview of the emergence and the development of the SIE-field over time.

The SIE field of 'Cooperative Organisational Models for Renewable Energy' is another well researched social innovation. Building on this previous work showcasing the heterogeneity of the field and due to the time constraints outlined above (1.5 person months) in this case study we focus on the conditions for energy cooperatives engaged in the electricity sector and less on cooperatives involved in activities related to the heat sector. In addition, while the case study reveals several inner SIE-field developments during the last 20 years, we foreground the current challenges for the field in our interviews, and less so the previously well researched past challenges. Furthermore, it must be noted that only interviewees in favour of a more decentralized energy transition and citizen energy in general have been interviewed. That is, additional insights from an opposing point of view are only reflected when they came up in the document analysis. Thus, the focus of the study at hand is the perspective of energy cooperative supporters and results might look different if also interviewing actors with opposing views. Interviews have been done sequentially, which allowed for the integration of feedback and the adjustment of interview questions during the process. Nonetheless, during the process of writing up the report, it became clear, that further interviews with more specific questions would enhance the insights of the report. Another remark concerns the interview conduction. The process revealed that some parts of the interview guidelines sometimes had to be adapted to reach a common denominator with the interviewee. Finally, interview insights were further complemented by participatory observation of one field event.

We consider the case study on 'City level competitions for sustainable energy' as pilot study as we conducted it first and incorporated lessons learned into our further research (e.g. adjusting the questionnaire or taking a draft timeline along to interviews). For this pilot study and in acknowledging that the field has a very heterogeneous character in Germany, we focused on two different kinds of competition formats and differentiated between competitions taking place between cities and competitions within cities. Due to the different actors involved in these competition formats, both of them could have also been studied as separate fields. What linked these formats was, however, the strong role of municipalities as central actors organising these competitions and/or taking part in them. A larger amount of interviews with different municipalities would have provided deeper insights in the different roles that municipalities may



take in organising or participating in energy related competition formats. The focus of the historical account is based on (and partly limited by) the people that we were able to interview, the number of documents and websites we could examine and the time we had to conduct the research (1.5 person months). The people interviewed often provided insights in individual competition formats, their emergence and development over time and less so on the whole SIE field. We therefore reconstructed the emergence of the overall SIE-field over time by aggregating the insights gained from different interviewees and additional information from document reviews.



5 SUMMARY OF EACH CASE STUDY REPORT: THREE SIE-FIELDS AND THEIR SIE-INITIATIVES IN GERMANY

5.1 Introduction

This section provides a summary of each case study report. The summaries are structured around answering the major and minor research questions (as outlined in D3.1) and are based on the three empirical foci (as outlined in section 1) that have guided the empirical work and conceptual and methodological work outlined in D1.1, D1.2 and D3.1. The foci are: 1) Emergence, development and institutionalisation of SIE and SIE-field over time, 2) SIE-field-actors and other field-actors' interactions with the 'outside' institutional environment, and 3) Enabling and impeding factors for SIE-field-actors and other field-actors to conduct institutional work. The structure of answering the major and minor research questions has been chosen to ease the cross-case comparison across the 18 SONNET case studies that will be presented in D3.3 (i.e. it will be possible to compare each answer across the 18 case studies, providing a starting point for the analysis).

For a reader, who is not part of the SONNET project team, these summaries might be too dense (i.e. moving between empirical and conceptual reflections) and therefore difficult to follow. A better starting point to understand the SIE-fields might be the case study reports that provide an empirical narrative of the historical development of the SIE-fields. The full research reports of the three SIE-fields and their SIE-initiatives studied in Germany can be found in appendix of the document.

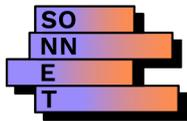
5.2 Case study 1: Participatory Incubation and Experimentation in Germany

5.2.1 How have the SIE and SIE-field emerged, developed and institutionalised over time?

What are the relevant SIE-field-actors and other field-actors within the SIE-field and what are their roles within the SIE-field? How have these changed over time?

The SIE-field 'Participatory Incubation and Experimentation' is defined as multi-actor, collaborative formats that aim to experiment with and/or try out novel energy solutions in specific local settings. According to this definition, actors from different societal spheres are participating in shaping these formats. This means in the context of this analysis that multiple **SIE-field-actors** (actors who work on SIE) with different **roles** can be identified.

In the German context, multi-actor collaborative formats have been referred to as e.g. labs, living labs, urban labs, regulatory sandboxes, showcases or 'Reallabore' (real-life laboratories). Depending on the format, the actors involved as well as their roles differ. However, in most of these formats, **researchers** play an important role for developing, testing and experimenting with new energy pathways. In terms of the SIE-actors shaping participatory multi-actor formats, we observed two different strands of development in the German context.



A first strand of formats is inspired by socio-ecological and transdisciplinary research approaches. These formats have a broader participatory approach. They can be developed by **researchers**, **local governments** and/or **civil society actors**, mostly on the local level. Local governments might play a role in facilitating the establishment of participatory spaces and settings on the local level. Examples for these kinds of formats are e.g. referred to as urban labs. For these urban labs one example in Germany is the 'Quartier Zukunft' in Karlsruhe which is a project that started in 2011 and was developed by the Institute for Technology Assessment and Systems Analysis (ITAS), at the Karlsruhe Institute of Technology. Its participatory approach aims to involve local citizens, (local) private business and local authorities.

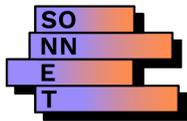
In contrast, more technological and economic oriented formats target **energy companies** and **technology developers**, while users are often integrated as **'testers'**. This second strand of development is closely linked to national or federal R&D politics. Therefore, (federal) **governments** play a central role in defining, financing and promoting these multi-actor collaborative formats. Prominent examples are the BaWü-Labs, funded and developed by the federal state of Baden-Württemberg, or the national strategy "Reallabore der Energiewende" (translated as 'real world laboratories' or 'regulatory sandboxes' for the energy transition) by the German Federal Ministry of Economic Affairs and Energy (BMWi).

Some of the formats are linked and further developed by **network organisations**. The two most important examples in Germany are 1) the network of sustainability oriented real world laboratories (Reallabore der Nachhaltigkeit), founded by the Karlsruhe Institute of Technology (KIT), Leuphana University Lüneburg and Wuppertal Institute and 2) the network "Reallabore", established by the Federal Ministry for Economic Affairs and Energy (BMWi). While the first one targets a broader societal approach and aims to include civil society actors, the latter rather targets technological and economic orientated innovations. Over the past years in Germany, multi-actor collaborative formats have been pushed increasingly by national and regional R&D funding lines. The role of **policy makers** in shaping participatory multi-actor collaboration formats has therefore increased and these formats started to institutionalize around the term 'Reallabor' (see section 5.1.3.3).

What are relevant activities, aims/ goals and narratives that have been developed and manifested by SIE-field-actors and/ or other field-actors within the SIE-field over time?

The SIE-field 'Participatory Incubation and Experimentation' is characterised by SIE-field-actors i.e. actors from different societal spheres getting involved in diverse multi-actor collaborative formats. The major goal of these formats is to experiment with, develop and/or test novel energy solutions in specific local contexts. Depending on the format and the actors involved, the overall goals, aims and narratives can, however, differ.

The **aims** and **goals** of the SIE-field-actors in developing multi-actor participatory formats can range from quite explicit goals in project-like settings (e.g. to develop digital solutions that support the energy transition in the project SINTEG) to broader societal aims (e.g. to develop a local culture of sustainability in the project 'Quartier Zukunft' in Karlsruhe). More technological and economic oriented formats of the first strand are often more on the side of developing and testing specific solutions and formulate explicit targets and conditions. The infrastructural settings thereby play an important role. In broader participatory and transdisciplinary formats of the second strand inspired by socio-ecological research traditions, the goals might be broader



and target society rather than specific energy solutions. These formats also tend to follow a broader experimental approach.

For some SIE-field-actors the initial **aim** was to develop solutions that are approved by 'users' as well as in broader societal discourses. Especially in the case of more technological oriented formats, one important experience was the failure of smart meter implementation in Germany due to strong societal protests and concerns around data protection. As a result, the perspective of different actors, e.g. users, is nowadays to be integrated in the development process early on.

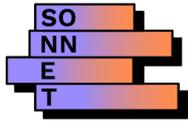
Several interviewees mentioned that the development of multi-actor collaborative formats is part of the current 'Zeitgeist' or describe these formats as 'sexy' or 'trendy'. According to this 'trendiness', the formats developed over time and started to institutionalize as research approach and political principle (participatory society). Multi-actor collaborative formats are often referred to as 'labs', e.g. as living labs, urban labs or real world laboratories with the lab metaphor offering a strong **narrative** and framing energy research formats as innovative themselves. The message is that the conditions can be controlled in laboratory settings but that research takes place directly in real world settings and therefore does not have to be transferred to real world contexts afterwards. This, however, might mainly express a political interest while the methodological approaches can largely differ between lab types. Here, the strong metaphor turns into a 'label' that stands for an innovative approach but at the same time also distracts from more clearly describing the exact processes that stand behind the label.

Concerning the concrete **activities** carried out by SIE-field actors, these actors carry out energy related (research) projects, developing, testing and experimenting with solutions for energy related projects. The multi-actor formats often require a large amount of communicative work to reach different actors involved. This is why work in these settings is often described by interviews as extremely time-intensive. Furthermore, SIE-field-actors conduct networking activities, e.g. by establishing network organisations, presenting their research approaches on conferences or to policy makers.

What types of interactions/ relations exist between SIE-field-actors and/ or other field-actors? What types of informal and formal alliances, networks, collaborations have existed (and possibly still do)?

In what follows we focus our answer on the **relations** between SIE-field-actors and other field-actors as well as on the **power relations** shaping the SIE-field under study. This includes a reflection on the role of **informal** and **formal** relations and networks.

In the case of multi-actor collaborative formats in Germany, these formats can be described as settings that provide partly formalized structures for collaboration. The ambition of these activities is to establish relations between actors that would otherwise not work together on energy related issues and provide time and space for building up these relationships. The formats are **formalized** in terms of often having clear temporal and spatial boundaries and responsibilities. They are **informal** in terms of allowing for personal interactions and exchanges to develop through these settings. One major problem described by interviewees is that the short-term project-like settings often do not allow to establish long-term relationships between participants. This, however, was argued would be necessary for developing a setting that actually allows for including different voices in the process.



Most of the SIE-field-actors describe the building of relationships as a crucial aspect of their work, but at the same time as extremely time intensive and difficult task. This concerns both relations between participants in experimentation settings as well as relations to other SIE-field actors such as funding authorities, local municipalities or other stakeholders. Especially in the case of resource intensive labs, e.g. experimenting with novel energy technologies, **alliances** have to be found in order to share infrastructures as well as expenses. Due to this time-intensive process of negotiating interests, it is however seen as important to carefully consider who should be involved at which point of the process. Especially the involvement of actors from the 'bureaucratic systems' (e.g. policy makers working in public administration) are described by interviewees as a barrier for the flexibility of the innovation process. Networks between different SIE-field actors are established to share best-practice experiences, with one example of a successful network being the network sustainability oriented real world laboratories (Reallabore der Nachhaltigkeit), founded by the Institute for Technology Assessment and Systems Analysis (ITAS) that is part of the Karlsruhe Institute for Technology (KIT), the Faculty of Sustainability at Leuphana University Lüneburg, Wuppertal Institute and Ecological Research Network (Ecornet). However, other networks failed due to the lack of time of participants to participate in meetings and networking events, an example being a German network for Living Labs. Interviewees also reported that they do not get involved in networks due to time restrictions and the feeling that they might not benefit enough from getting engaged in these activities.

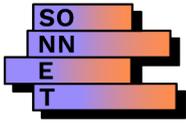
Besides these time constrains, interviewees do see crucial aspects of **power** relations that are shaping the SIE-field in the actors' abilities to form alliances, develop communicative strategies and negotiate between different interests (power with). This refers to more **informal** structures between SIE-field actors and other field-actors. However, **formalized** structures, especially funding schemes, can be extremely powerful in shaping relations between actors.

How can the interactions/ relations between SIE-field-actors and/ or other field-actors be characterised (e.g., cooperation, exchange, competition and conflict)? How have they changed over time?

Within SONNET, the SIE-field 'Participatory Incubation and Experimentation' has been linked to an SIE that is based on social interactions (and changes to social relations) that aim to bring about changes in the energy system that are often based on '**cooperation**' (rather than conflict, exchange and competition) and make use of novel ways of **organising** cooperation. Cooperation between actors of different societal spheres in project-like settings is therefore at the core of the multi-actor formats that we observed in the SIE-field under study.

However, depending on the actors involved and the formats in which interaction takes place, cooperation can take quite different **forms** and be linked to different **roles** of the actors involved. On the one hand, there are rather open formats that aim for co-creating knowledge in transdisciplinary research settings. Cooperation in these settings involves the acknowledgement of different types of knowledge. Also the role of participants in these settings can therefore be rather open and further develop over time. As a consequence, however, the goal of the cooperation might not be that clearly defined. On the other hand, cooperation in rather economic and technological oriented projects might be less open, but pre-shaped by roles and interests of participants as well as project developers.

Regarding the cooperation between **SIE-field-actors** and **other field-actors**, several interviewees pointed out that cooperation can be a time-intensive task that requires good communicative



strategies. Cooperation, according to one interviewee, therefore includes a relational and communicative form of **power** to convince others for certain standpoint. In this sense, cooperation always involves conflictual aspects, even if there might not be formal contestations.

What is 'socially innovative' about the SIE (including SIE-initiatives and/ or SIE-field-actors)? How and to what extent do which ideas, objects and/or actions demonstrate a change in social relations and new ways of doing, thinking and/or organising energy?

In SONNET, we define SIE as 'a combination of ideas, objects and/ or actions that change social relations and involve new ways of doing, thinking and/ or organising energy'. In the SONNET typology, the SIE type called 'Participatory Incubation and Experimentation' has been categorised as **changing social relations** through **cooperation** and involving new ways of **organising** energy. A main characteristic of this type is that activities focus on organising experimentation and incubation of ideas and/ or technology (as object) through multi-actor constellations, including different actors across society like researchers, policy makers, private companies or citizens. Insofar, changing social relations is at the core of these formats as they explicitly aim for changing innovation processes by integrating different stakeholders in research and innovation settings.

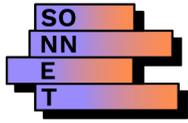
In the German context, the socially innovative aspects refer to several different aspects. First, there are **new actors** involved in these formats such as citizens, civil society groups as well as municipalities or foundations. Second, actors involved in experimentation might take over **new roles** such as researchers and / or local governments that might fulfil an intermediating role next to other roles that they have. Third, the **aims** of these experiments can be seen as socially innovative insofar as they can involve aspects of learning that also address the innovation process itself and the actors and roles involved in this process. This can be considered as a reflexive innovation process (Windeler 2016). Fourth, the experimentation process is taking place in settings that are supposed to be closer to **real-world contexts**. This means that experimentation is framed as something that does not happen in protected, scientific environments but in every-day settings involving every-day problems, linked to every-day actor constellations. Finally, experimentation settings are clearly referring to local contexts and have a **temporally and spatially limited scope**. Especially the spatial embeddedness of these formats can be described as socially innovative.

From the perspective of SIE-field-actors, new formats for experimenting with new energy pathways were developed especially after experiences with smart-meter technologies in Germany. The diffusion of this technology failed due to lacking societal support and distrust. New multi-actor collaborative formats aimed to integrate diverse perspectives from early on in the process and also include regulatory flexibility that allows for policy learning. From the perspective of SIE-initiatives, new narrative activities and networks had to be developed that often highlight the local embeddedness of multi-actor collaborative formats.

How has the SIE developed over time (and space)?

We identified four phases that describe the emergence, development and institutionalisation of the SIE-field 'Participatory Incubation and Experimentation' in Germany.

The first phase that lasts until 2005 describes the early phase of SIE-field development. It laid the foundations for **transdisciplinary formats**. The FONA programme (FONA: Forschung für



nachhaltige Entwicklung - Research for Sustainability) funded by the German Ministry of Education and Research (BMBF) was established in this phase and collaborative multi-actors' formats institutionalised in the SIE-field of urban development.

One important milestone for the SIE-field development was the birth of the term '**living lab**' in 2005, which marks the starting point for a second phase. In this second phase, however, budgets for energy research and experimentation activities were rather small and concentrated on single technologies, without being embedded in an overall concept. This changed around 2010.

In the third phase of development, starting with this change in 2010, large scale energy research activities started that increasingly included experimentation formats in accompanying research activities. With the German **energy concept** in 2010 and the nuclear phase out decision after the Fukushima nuclear accident in 2011, the awareness for energy related activities rose on the political level. In this third phase of development, the term '**Reallabore**' emerged and first appeared in German research programmes.

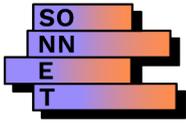
The fourth phase of the development is characterised by an **institutionalisation** of multi-actor collaborative formats for experimenting with alternative energy pathways. This happened in parallel in both strands of developments: in technological centred energy research with the BMWi-strategy (Bundesministerium für Wirtschaft und Energie - Federal Ministry for Economic Affairs and Energy) for 'Reallabore der Energiewende' in 2018 and in 2019 with the foundation of the network of sustainability oriented 'Reallabore' in the second more participatory strand in socio-ecological research.

How/ to what extent do narratives and activities by SIE-field-actors and other field-actors refer to power issues and include ambitions to improve them?

There are different aspects of power that can be observed in the SIE-field 'Participatory Incubation and Experimentation'. While one might initially assume that the aim to involve different actors in multi-actor collaborative settings targets a change in power relations, these formats and the trajectories of developing them actually include different **motivations** and might also involve the **stabilisation** of existing power relations. Especially the question, who is able to develop certain formats and put them in practice depends on power over **resources**.

In the German context, the field development is heavily influenced by R&D policies and the resources mobilised for these activities. While funding had been scarce in the early years of field development, more financial resources were mobilised after 2010 when the German government passed an energy concept. Formats that have been developed since then include multi-actor settings involving energy companies, technology developers and next to that also citizens and user perspectives. We did not observe in detail how these specific formats changed or reproduced existing power relations. However, one might argue that the actors involved in setting the agenda for these formats might reproduce existing power relations. In contrast, sustainability oriented labs developed by local initiatives rather target changes in power relations that also change the possibilities to set an alternative agenda.

As the SIE under study focuses on multi-actor collaborative formats, power relations are furthermore quite strongly depending on communicative micro-level activities. Actors in these settings have to try to convince each other in order to form alliances. One interviewee describes this as a communicative form of power (see Interview DE_PIE_02). Power in these activities is something that is situationally enacted and builds on communication and the building of



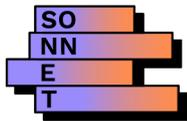
alliances. Therefore, it is not something 'you hold' but something you have to repetitively enact. In this case, power relations are influenced by scarce time resources of the actors involved.

What have been (shared) narratives, activities, knowledge, learnt lessons, etc. between alliances/ networks/ collaborations of SIE-field-actors and/ or other field-actors? How have they been reproduced, adopted and replicated in the SIE-field? To which extent have they been legitimised and/ or contested by several actors within the SIE-field? Have there been any key changes over time (if so)?

The SIE-field 'Participatory Incubation and Experimentation' and therefore the multi-actor collaborative settings under study in Germany are shaped by two different lines of development: First, the development of transdisciplinary approaches for social-ecological research and second, changes in research and innovation paradigms. Both of these developments shape different networks and alliances that are hardly overlapping. While the former is rooted in a longer tradition starting in the 1980s, the later describes more recent shifts in energy related R&D policies that took place during the last 10 years.

Regarding the first strand we find that transdisciplinary approaches are rooted in socio-ecological research starting in the 1980s as well as in participatory claims emerging especially around protests against urban development projects. The **narratives** of these approaches have not been in focus of the case study work. However, what links these approaches is that they involve a sense of shared responsibility for sustainability goals and acknowledge the importance of integrating different kinds of knowledge in the process of defining problems and developing solutions. Shared **activities** especially led to the establishment of transdisciplinary methodologies in the academic field. Furthermore, in 2019 different initiatives formed a **network** that aims to strengthen these methodologies through knowledge exchange. Next to these networking activities, these formats are furthermore **institutionalizing** insofar as they are supported by policy activities, especially on the international level. For example, the 1992 UN conference on Environment and Development in Rio de Janeiro highlighted the role of the local level to address sustainability problems and in this sense might also be interpreted as encouragement for local initiatives. Another important step towards the acknowledgement and therefore also the institutionalization of these activities in the national context of Germany is the 2011 report 'A Social Contract for Sustainability' in 2011 by the German Advisory Council on Global Change (WBGU: Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen), which emphasised the importance of a new interplay between politics, society, science and economy.

While the transdisciplinary approaches strengthened the acknowledgment of different types of knowledge in sustainability research, R&D policies adopted this development towards participatory and transdisciplinary research much later. Here, the most dominant framing is the **'Laboratory'-metaphor**. It emerged around 2005 with the first Living Lab formats. The (politically loaded) message of this metaphor is: Research does not have to be transferred to real world contexts but rather directly takes place where the real world is. Multi-actor collaborative formats that emerged out of this strand of development are much more shaped by (national) **R&D policies** and strategies that also provide a frame for shared activities, shared framings and networking activities. For example, in 2018 the Federal Ministry for Economic Affairs and Energy (BMWi) published a strategy paper on 'Reallabor'-Research and, in the following year, institutionalized a network for this topic.



Reflections on the main research question

Studying the SIE-field 'Participatory Incubation and Experimentation' requires to trace back the histories of different multi-actor collaborative formats. In the case of Germany, two different strands of development could be identified, with different patterns of development and different processes of institutionalization. It is especially challenging to trace the institutionalisation of the SIE-field as part of the developments are closely linked to and rooted in strongly institutionalized structures such as R&D policies. Further research could pay more attention on the potentials of top-down driven social innovation processes in contrast to bottom-up processes of social innovations. Questions concerning changing power relations or institutionalization processes might have to be answered differently for these two directions of social innovation processes.

Furthermore, while the boundaries around different formats seems easy to draw, the SIE-field boundaries can also be understood in a much wider sense. For example, understanding developments towards participatory society thinking requires approaches that target meta-analysis of broader societal trends. Here, it is particularly difficult to trace back how these developments emerged in energy related contexts or shifted from other societal spheres to energy related issues. Further research could therefore concentrate on contrasting developments in the field of energy with developments in other fields.

5.2.2 How do SIE-field-actors and other field-actor interact with the 'outside' institutional environment and thereby co-shape the SIE-field over time?

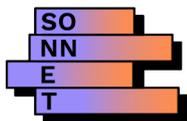
Which institutions (regulative, normative, cultural-cognitive) within the 'outside' institutional environment have shaped (including enabled/impeded) SIEs and its SIE-fields (and how)?

Institutions in the 'outside' institutional environment of the SIE-field 'Participatory Incubation and Experimentation' play a crucial role in shaping the SIE-field.

First, **regulative institutions** heavily influence the SIE-field under study by shaping conditions for multi-actor collaborative formats in the energy sector. In some cases, e.g. in the context of the so called SINTEG projects (on Smart Energy Showcases), 'experimentation clauses' enabled the exploration of new pathways through temporal exemptions from existing regulatory frameworks. Here, regulative institutions started to move into the focus of experiments and to become themselves subject of experimentation.

Second, **cultural-cognitive institutions** influence the SIE-field insofar as they set boundaries around the question of who can be involved in technical debates and what kinds of knowledge are represented in the innovation process. The SIE with its SIE-field 'Participatory Incubation and Experimentation' in this sense pushes the question of "how we set boundaries around the legitimate contribution of the general public to the technical debates" (Collins and Evans 2009, p. 113).

Third, **normative institutions** can be identified when looking at the juxtapositions of socio-economic interests in the development of energy technologies (innovation for growth) and the socio-ecological interests of participatory engagement for sustainable transitions (innovation for sustainability). Both build on different normative assumptions, which currently meet in multi-actor experimental formats.



What are the key events, external shocks, trends and inter-field interactions that enable/ impede SIEs and its SIE-fields (now and in the past)

Some of the key events, external shocks, and trends that have **enabled** the SIE-field over the past ten years are summarized in the table below (i.e. this is not to a comprehensive list, but only showcases key highlights). Also, note that inter-field interactions have not been studied for this case study and are therefore excluded from the table.

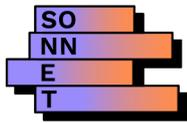
Table 5: key enabling events, external shocks and trends in the SIE-field Participatory Incubation and Experimentation In Germany

Key events	External shocks	Trends
Energy Concept of German government for an environmentally friendly, reliable and affordable energy supply (2010)	Fukushima nuclear catastrophe encourages funding for research on alternative energy pathways - 2011	Long tradition of participation especially in urban development projects
Joint programming initiative (JPI) Urban Europe established (2010), with nearly half of the 73 projects applying urban living lab approaches	'Migration crisis' boosts citizens engagement	Mission oriented frames of innovation move into focus, highlighting the role of social innovation
Baden-Württemberg Ministry of Science, Research and Arts announced new funding line for real-world labs entitled BaWü Labs (2015)		Fridays for Future climate movement encourages youth (and broader) participation
BMW Strategy and funding for real world laboratories (2018)		
The Institute for Technology Assessment and Systems Analysis (ITAS), which is part of the Karlsruhe Institute for Technology (KIT), the Faculty of Sustainability at Leuphana University Lüneburg, the Wuppertal Institute and the Ecological Research Network (Ecornet) launch "Network Real Laboratories for Sustainability" (2019)		

Some of the key events, external shocks and trends that have **impeded** the SIE-field over the past ten years are listed below (again, this is not meant as a comprehensive list):

Table 6: key impeding events, external shocks and trends in the SIE-field Participatory Incubation and Experimentation in Germany

Key events	External shocks	Trends
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Lisbon strategy pushes the idea of (technological) innovation for growth	Financial crisis limits financial resources especially on the local level of municipalities	Contestations between different approaches and different funding lines
	Corona pandemic makes it impossible to meet face-to-face in multi-actor collaborative settings	

Some of the key events, external shocks and trends that have had an impact on the field, but it is not that clear whether they **enabled and/ or impeded** the SIE-field over the past ten years are (no comprehensive list):

Table 7: further events, external shocks and trends influencing the SIE-field Participatory Incubation and Experimentation in Germany

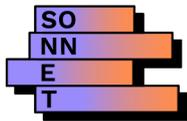
Key events	External shocks	Trends
Red-Green coalition government: decision to phase out nuclear energy, renewable energy act (EEG, 2000)		
Smart metering and the Energy Transition Digitisation Act		

When looking at the lists it becomes apparent that the SIE-field is heavily influenced by policy events especially those linked to funding programmes. Further SIE-field events can be found in detail in the timeline of the case study report. The report timeline further differentiates between policy events, policy instruments and **core SIE-field milestones**. Identified milestones were the birth of the term living labs in 2005, the WBGU report ‘A Social Contract for Sustainability’ in 2011 by the German Advisory Council on Global Change and the establishment of the network “Real Laboratories for Sustainability” in 2019.

How (if so) have the SIEs and their SIE-fields and ‘outside’ institutional environment been shaped by these events, external shocks, trends and inter-field interactions (now and in the past)?

Influences of the **‘outside’ institutional environment**, in the case of multi-actor collaborative formats have been studied mainly by identifying external shocks and societal trends.

External shocks played a crucial role in shaping the SIE and SIE-field. The 2011 **Fukushima** nuclear catastrophe had a major influence on changing energy policies in Germany. It led to the decision to (nearly) reinstate the original nuclear phase-out until 2022. Energy related R&D funding significantly increased during the following years, leading to large scale projects for the energy transition. Also the 2015 **migration ‘crisis’** had an impact on the SIE-field development. As a reaction to the large amount of people in need arriving in Germany and the lack of administrative capacities to react to this, civil society actors started to get involved in significant ways. Much of this engagement happened on the local level in cooperation between NGOs, municipalities and individual citizens. This strengthened the overall engagement of citizens and the role of



municipalities which later transferred to an increase of engagement also in the field of sustainability related activities.

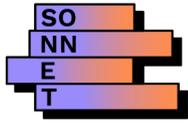
Also **broader societal trends** have shaped the development of the SIE-field insofar as **participatory approaches** have emerged in the context of urban development projects earlier on and then kind of 'diffused' to the energy sector. The **Fridays for Future** movement further encouraged these participatory approaches.

The SIE-field 'Participatory Incubation and Experimentation' is closely linked to policy events that have been studied as part of shaping the SIE-field. Here the year 2010 marks an important turning point for the further development of the SIE-field. First, in 2010 the Joint Programming Initiative '**JPI urban Europe**' was established as European programming initiative. It put a focus on lab formats and the co-creation of knowledge on the urban level to encourage systemic change with most of its funding addressing multi-actor collaborative formats. On the national level, the **German energy concept** raised the awareness for energy related activities on the political level. Energy related R&D funding significantly increased during the following years, leading to large scale projects for the energy transition, some of which incorporating a real-world laboratory approach (Reallabor).

What have been the most important alliances/ networks/ collaborations SIE-field-actors and/ or other field-actors that emerged from these events, shocks, trends, and inter-field interactions (when, how and for what reasons)?

Alliances and collaborations are regarded here as informal network relations while **networks** are understood as formalized relations. In the context of the SIE-field under study, collaborations are at the core of the SIE with actors from different societal spheres interacting in project-like settings. However, and due to the often temporally limited character of these formats, long term collaborations are much harder to maintain for some actors. For example, the aim of establishing a German Living Lab network failed because of lacking time resources of the actors involved. Nevertheless, informal networks are crucial especially in the processes of policymaking for energy related R&D programs. Alliances here include an important element of power and that is situationally enacted and builds on communication and the building of alliances.

Furthermore, two formal **networks** were established. One network called 'Reallabore der Energiewende' was founded in 2019 by the Federal Ministry for Economic Affairs and Energy (BMWi). It accompanies a funding line and provides the opportunity for actors involved in related projects to exchange. A second network was established by the Institute for Technology Assessment and Systems Analysis (ITAS) that is part of the Karlsruhe Institute for Technology (KIT), the Faculty of Sustainability at Leuphana University Lüneburg, the Wuppertal Institute and the Ecological Research Network (Ecornet).. Among others it aims at strengthening 'Reallabor'-research by increasing network activities, joint discussion paper series and annual meetings. Even if both networks have similar names, their approaches, aims and goals largely differ. Therefore, these networks coexist without much interaction.



How have the SIE-fields co-evolved with the policy context (if so) (and what was the relative importance of the urban, regional, national and European level)?

As already outlined above, the SIE-field 'Participatory Incubation and Experimentation' is closely linked to R&D policies and therefore nested in developments around R&D policy making. In the German context, several policies on the national and European level have occurred over the past years that could be interpreted as influential on the SIE-field development.

First of all, several policy developments on the **European level** have influenced the SIE-field. The 2007 Leipzig Charter for Sustainable European Cities was an initiative by the ministers responsible for urban development in the EU Member States that suggested an integrated urban policy approach. The process itself was considered a 'very open process' (Interview DE_PIE_02) and the Charter furthermore emphasised the role of participation for integrated urban development processes. Three years later, with the establishment of the Joint Programming Initiative 'JPI urban Europe' funding lines were established that put a focus on lab formats and the co-creation of knowledge on the urban level. More recently, EU funding lines for energy citizenship and transition super labs further encourage the SIE-field development.

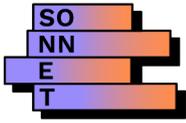
Several policies on the **national level** have significantly shaped the SIE-field development. An early step in the development of multi-actor collaborative formats can be seen with the establishment of a federal research programme for socio-ecological research FONA (funded by the Federal Ministry of Education and Research, BMBF) and the neighbourhood management programme 'Soziale Stadt' (funded as joint programme by the German Government and the Federal state governments) that encourages participation in 'disadvantaged' neighbourhoods. Both of these programmes started in 1999. However, in the energy sector, participatory multi-actor collaborative formats only emerged after 2010. The German energy concept of 2010 and the nuclear phase out decision after the nuclear catastrophe of Fukushima in 2011 laid the foundation for increased financial support for energy research. This can be understood as an important turning point for more integrated energy policies. In 2018, the German Federal Ministry for Economic Affairs and Energy launched a strategy for funding 'Reallabore' in the energy sector.

Concerning policies on the **regional level** it is important to note that the first funding line for 'real world laboratories' in Germany was initiated in 2015 by the Federal government of Baden-Württemberg. These formats were picked up later in national level funding lines. The 7th programme for energy research funding published in 2018 explicitly describes real world laboratory approaches "as a new program pillar" (BMW 2018a, p. 6) that supports the link to praxis contexts in innovation processes.

How are which power relations (such as inequality, exclusion, oppression, exploitation, injustice) being transformed and/ or reproduced by the SIE-phenomenon under study? (and vice versa – how are SIEs enabled and impeded by power relations?)

Multi-actor collaborative formats studied as part of the SIE-field 'Participatory Incubation and Experimentation' have both the potential to transform as well as reproduce existing power relations (see section 5.1.1.7).

On the one hand, multi-actor collaborative formats **change existing power relations** insofar as new types of knowledge are being integrated in innovation processes. This means that these



formats allow actors who might not have been heard in the past to have the possibility to contribute to developing new solutions for improving energy systems. One aim of the SIE-field is that energy is not framed as a field that requires expertise knowledge only and can therefore not be understood by broader society. Instead, multi-actor collaborative formats encourage to frame the energy system as something everybody could potentially contribute to.

On the other hand, multi-actor collaborative formats **reproduce existing power relations** insofar as these formats depend on financial and temporal resources. The shaping of funding lines however depends on powerful funding authorities. This means that SIE-initiatives might not be able to influence the agenda setting process of these formats and their requirements. Furthermore, participating in multi-actor collaborative formats can be a time intensive task. Especially when financial resources are not provided for 'non professional' participants, this limits access to participating in these formats and rather contributes to reproducing existing power relations.

Reflections on the main research question

No additional reflections.

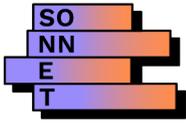
5.2.3 What are the enabling and impeding factors for the SIE-field-actors and other field-actors to conduct institutional work and change the 'outside' institutional environment?

How, why, and where do SIE-field-actors and/ or other field-actors conduct activities linked to creating, maintaining and transforming institutions?

Institutional work refers to the activities of actors that aim to create, maintain and disrupt institutions. In the context of multi-actor collaborative formats studied as part of the SIE-field 'Participatory Incubation and Experimentation' institutional work refers to activities that target alliance building, networking and the promotion of different participatory and experimental formats.

The SIE with its SIE-field contributes to **maintaining** institutions insofar as the SIE-field is heavily influenced by R&D policies. These policies are shaped by administrative bodies that have influence on setting the agenda of different research programmes. While the actors involved in energy-related experimentation processes change in the course of the formats under study, the actor constellations involved in 'setting the agenda' are not per se affected by these changes. Furthermore, from a critical perspective, one could interpret the developments in the SIE-field under study in a way that national funding authorities have picked up certain approaches developed by SIE-initiatives and incorporated them while changing the aims and goals of these formats. Participation in energy experiments then might lose critical aspects.

One important aspect of **transforming** institutions refers to the role of a 'Laboratory'-metaphor. It serves as a narrative for funding policies that, in contrast to former approaches, as described as a 'sexy' approach (see Interview DE_PIE_06), as 'trendy' (see Interview DE_PIE_08) or as part of the current 'Zeitgeist' (see DE_PIE_01). The metaphor frames energy research formats as innovative themselves. It implies that innovations do not have to be transferred to real world contexts but rather directly take place where the real world is. This, however, might mainly express a political



interest (see Interview DE_PIE_01). Insofar it contributes to transforming the understanding of innovation processes.

Finally, also **creating** new institutions is part of the SIE-field under study, among others by establishing networks or establishing new methodological approaches in the academic research community (e.g. by establishing conferences and journals for transdisciplinary research or for research in Living Labs such as the International Transdisciplinarity Conference, the Open Living Lab Days or the STRN research community). These activities are directed towards establishing research in multi actor formats in scientific communities and therefore contribute to institutionalizing these approaches. On the national level in Germany, in 2019 the network 'Reallabore' was established by the Institute for Technology Assessment and Systems Analysis (ITAS) that is part of the Karlsruhe Institute for Technology (KIT), the Faculty of Sustainability at Leuphana University Lüneburg, the Wuppertal Institute and the Ecological Research Network (Ecornet). The aim of the network is strengthening 'Reallabor'-research by increasing network activities, joint discussion paper series and annual meetings.

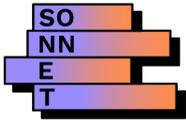
Who is involved in conducting institutional work (and who is not)? Which actors benefit from this work (or not)? How does this shape the SIE-field?

Different actors are involved in different aspects of conducting institutional work in the SIE-field 'Participatory Incubation and Experimentation'. In the case of creating institutions such as the establishment of networks and methodological approaches in scientific communities, this mainly involves researchers working in multi-actor collaborative settings. A clear limit for conducting institutional work are the scarce time resources of many actors involved. The aim to establish a German Living Lab network e.g. failed because of lacking time resources of its potential members who are described as 'hopelessly overworked' (Interview DE_PIE_01).

Overall, institutional work requires a certain degree of organisation among actors that seems to have happened rather in settings where individuals are already 'organized'. For example, researchers or policy makers are conducting institutional work within their professional contexts, while participants in multi-actor collaborative formats from the broader public might participate locally without further engaging in conducting institutional work.

What have been the most important activities linked to creating, maintaining and transforming institutions? Outline these activities through describing 2-4 examples.

Example 1: An important activity for creating institutions has been the establishment of the network 'Reallabore der Nachhaltigkeit', a network of sustainability oriented real world laboratories founded by the Institute for Technology Assessment and Systems Analysis (ITAS) that is part of the Karlsruhe Institute for Technology (KIT), the Faculty of Sustainability at Leuphana University Lüneburg, the Wuppertal Institute and the Ecological Research Network (Ecornet) in 2019. It provides a platform for information and cooperation between different real world laboratories in Germany. Activities linked to this network are e.g. the organisation of events or the distribution of information such as scientific articles and other materials via mailing lists. The network contributes to creating institutions by establishing research approaches and multi-actor collaborative formats as a way to address sustainability related problems. Note that this network is not limited to energy related labs only.



Example 2: In contrast to the network described above, networking activities by the Federal Ministry for Economic Affairs and Energy (BMWi) can be interpreted as an example for creating as well as maintaining or transforming institutions. This network called 'Reallabore' was established in 2019 and links business, research partners and municipalities with the aim of increasing economic competitiveness through joint R&D activities. First of all, the network contributes to establishing multi-actor collaborative formats focusing on energy research and can therefore be regarded as contributing to creating institutions. However, it might furthermore contribute to maintaining the status of business partners in these settings as well as the agenda setting function of political authorities. The transforming part of the 'Reallabor'-research approaches represented by this network can be seen in the integration of 'regulatory clauses' in these research settings which allow for policy learning and the potential transformation of existing institutional context conditions.

What forms do these activities linked to maintaining, creating and transforming institutions take (i.e. emotion work, boundary work, strategy work, practice work and/ or values work)? Link back to the 2-4 examples

The mentioned aspects of institutional work such as emotion work, boundary work or strategy work have not been studied as part of the case study 'Participatory Incubation and Experimentation' in Germany.

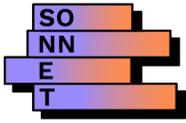
What factors have enabled and/or impeded institutional work? E.g. Resources, learnt lessons and competences connected to actors/ alliances/ networks/ collaborations. Link back to the 2-4 examples

Resources for multi-actors collaborative formats are always depending on funding. Especially until about the year 2010, funding for energy research has been rather low and mostly did not include multi-actor collaborative formats. After the German Energy Concept in 2010 and the nuclear phase-out decision in 2011 these funding resources increased. However, SIE-field actors especially refer to limited time resources that impede institutional work.

Example 1: There was the aim to establish a German Living Lab forum similar to the European level network ENOLL. This was considered useful as Living Labs are cost intensive research infrastructures that require to share these settings among different partners. The network could have supported research cooperation and knowledge exchange. However, after the first meeting the attempt to continue the forum failed because of lacking time resources of actors involved.

Concerning enabling factors, a long tradition of participation in Germany, which especially emerged in the context of urban development projects, provides important competences for the work in multi-actor collaborative settings. In the context of energy, lessons learnt from earlier projects enabled the development of the SIE-field.

Example 2: One important lesson learnt that enabled the development of multi-actor collaborative formats refers to the failed attempts to implement smart meter technologies, where in earlier projects social aspects were not considered. As one interviewee describes the failure of these projects: There were really big protests [...] because of data protection issues and people were afraid they would be spied and such things and then this first wave of smart meters actually failed (Interview DE_PIE_02). The experiences of the failed smart meter implementation increased the awareness for questions of social acceptance and encouraged the development of formats that included different actor groups early on.

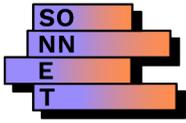


What have been intended and unintended effects (i.e. contributions) derived from conducting institutional work? What influence have they had on SIE-field and 'outside' institutional environments? Link back to the 2-4 examples

The effects of institutional work in the SIE-field under study are difficult to measure. One aspect that can be mentioned here is that 'lab' approaches have been picked up by several actors such as municipalities, foundations, private companies and energy providers. This contributed to blurring the boundaries between public engagement and private interests. For example, while 'living labs' first described a form of research projects with a certain degree of public interest, the term later diffused to more market oriented private companies. Here the term 'lab' more generally refers to temporally and spatially bounded projects, which integrate user perspectives and not necessarily have to include research partners. Here the attempt to widen the scope of actors involved also influenced the re-interpretation of the concept.

Reflections on the main research question

No additional reflections.



5.3 Case study 2: Cooperative Organisational Models for Renewable Energy in Germany

5.3.1 How have the SIE and SIE-field emerged, developed and institutionalised over time?

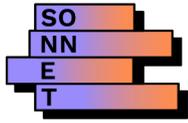
What are the relevant SIE-field-actors and other field-actors within the SIE-field and what are their roles within the SIE-field? How have these changed over time?

The SIE-field “Cooperative Organisational Models for Renewable Energy” in Germany refers to organisational models through which citizens jointly own means of and participate in renewable energy production. Despite the focus on citizens the field is characterised by a variety of **SIE-field-actors** (actors who work on SIE) and **other field actors** who shape and influence processes of the SIE-field under study.

The main SIE-field actors are the **citizens** involved in the cooperatives. Their **roles** can vary significantly as they can engage with the cooperatives either through their financial contribution or through the various tasks of cooperative work (e.g. being a member of the board etc.). Cooperatives cooperate with **municipal utilities, other energy providers, farmers, banks, other cooperatives** and **municipalities** (Klagge et al., 2016). The importance of municipality support for energy cooperatives is also shown by Meister et al. 2020, particularly regarding the provision of roof space, land, and help in the planning and permit procedure. As initially described **cooperation partners** are crucial for the development of the SIE-field under study, since they enable energy cooperatives to assemble their projects.

The SIE-actors changed over time in the way that new actors emerged and therewith additional cooperation partners entered the field. **Regional intermediaries** (like e.g. **Landesnetzwerk Rheinland-Pfalz e.V.**, **Landesnetzwerk Hessen e.V.** or **BürgerEnergie Thüringen e.V.**) offered energy cooperatives an easy way to be in touch with local policy makers and attend events in the name of energy cooperatives. Regional intermediaries get involved in regional decision-making processes and therewith can impact the development of energy cooperatives in their region. Their boards are advising energy cooperatives and prospective cooperative initiators, equipping them with information, initiating network or information events and engaging in current discussions in the form of press releases and political statements. They furthermore inform their members via newsletters and their active social media presence thus leading to a more informed and connected group of energy cooperatives. Moreover, regional intermediaries function as a network and communication platform between cooperatives and potential **project developers**. Their status as a recognised actor in the field of energy cooperatives gets acknowledged by several regional state networks receiving financial support by **federal-state ministries**. This assists regional intermediaries in gaining the financial resources to commission studies, hiring staff (at least to some extent - as a “helping hand”) and engaging in more activities. However, for the missing national representation of energy cooperatives in national energy politics the field formed additional national intermediaries.

The **national intermediaries** can be differentiated regarding the activities they fulfil for energy cooperatives and in terms of their scope (representation of only energy cooperatives or also other



forms of citizen energy). **'Netzwerk Energiewende Jetzt e.V.'** and **'Bürgerwerke e.G.'** both fulfil specific cooperative related tasks in the field of energy cooperatives while the main tasks of the 'section for energy cooperatives at the **DGRV (German Cooperative and Raiffeisen Confederation)**' and the **'Bündnis Bürgerenergie e.V.'** include a focus on political representation. The two differ in that the section for energy cooperatives at the DGRV only represents the interests of energy cooperatives while the Bündnis Bürgerenergie e.V. represents the interests of citizen energy in general (thus also includes other organisational models than just cooperatives).

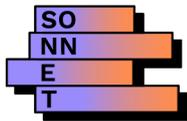
Important cooperation partners for regional as well as national intermediaries include foundations like the **100% Renewable Foundation** ("100 Prozent erneuerbar Stiftung"), **research institutes** like the **German Institute for Economic Research (DIW)**, **federations** like the **Federation of Cooperatives** ("Genossenschaftsverband"), the **German Federation for Environment and Nature Conservation (BUND)** and various **project developers** for the implementation of their projects. Other key actors in the field are the two large and professionalised energy cooperatives **Greenpeace Energy** and **Elektrizitätswerke Schönau**.

Other field actors are the **German government** as well as the **European Union** who impact the field's political framework conditions for energy cooperatives through changes of legislation.

What are relevant activities, aims/ goals and narratives that have been developed and manifested by SIE-field-actors and/ or other field-actors within the SIE-field over time?

Energy cooperatives tend to share fundamental characteristics regarding their **aims** and **goals**. The overarching main goal is often to contribute to the energy transition by means of active participation of citizens. By financing, constructing and managing renewable energy sites energy cooperatives enable citizens to directly partake in the energy transition. The democratic structures of the cooperative model usually contribute to the participation opportunities for citizens and thereby replace the previous role of the passive consumer by the active "prosumer" (see Interview DE_EC_05). Through the increased participation of citizens, energy cooperatives aim to support the decentralisation and democratisation of the energy system. Another common characteristic among energy cooperatives is their regional orientation and their aspirations to contribute to regional development through their activities. Those ideational aims often have priority over financial motives (Klagge et al., 2016). However, the aims and goals of SIE-field actors also differ considerably regarding their scope. While individual energy cooperatives often aim to implement goals on a local level, like the installation of a new solar panel, the introduction of electric cars, etc., regional as well as national intermediaries on the other hand aim for more structural changes on a regional and national scale.

Activities in the field of "Cooperative Organisational Models for Renewable Energy" in Germany are equally versatile. Concrete activities differ from SIE-field actor to SIE-field actor. They range from financing renewable energy sites to working voluntarily in a cooperative or one of their related intermediary organisations. They furthermore include activities such as conducting networking activities within the SIE-field or between the SIE-field and other field actors, engaging in political representation and the commissioning of studies and publication of press releases, as well as discussions with political representatives, political statements, the publication of petitions etc. Those activities furthermore include the enhancement of knowledge exchange in the SIE-field.



Several **narratives** characterise the SIE-field under study. One narrative energy cooperatives and other SIE-field actors emphasise is the **power imbalance resulting from the perceived power of German politics** and their ability to restrict new business models and the expansion of renewable energy in general. The perception of being less powerful than others is reinforced by the resource problems of energy cooperatives. Restricted time and financial resources of their voluntarily working staff result in fewer investments in PR and lobbying compared to other actors which contribute to the self-description of cooperatives as “small players” with restricted resources in opposition to the “big players” of the energy industry. This is in opposition to another prevalent narrative in the field in which citizen energy is described as a powerful counterpart to the conventional energy sector. Energy cooperatives awareness of power imbalances regarding national energy policy is accompanied by the awareness of worldwide energy-related power relations resulting in the aim of becoming **independent of gas and oil imports** of non-democratic countries which constitutes another narrative in the SIE-field.

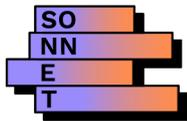
What types of interactions/ relations exist between SIE-field-actors and/ or other field-actors? What types of informal and formal alliances, networks, collaborations have existed (and possibly still do)?

The field of energy cooperatives is characterised by **strong personal ties and collaborations** between board members of energy cooperatives, members of intermediary organisations and other relevant organisations. Those personal relations often occur as “Personalunion” meaning that the same person is a member of several boards of relevance for energy cooperatives. Those double roles lead to synergy effects and make it easier to coordinate and shift tasks between important organisations. As a result, processes of collaboration are often initially characterised by **informal** agreements which later lead to **formal** procedures and agreements.

Those personal relations and knowledge of the surrounding SIE-field actors also often determine the selection of prospective collaboration partners. Thus the **“networking capacity” of single SIE-field actors** is crucial for the development of single SIE-initiatives or other SIE-field actors. Personal ties do not just exist among the different organisations within the SIE-field but can also reach into regional politics leading to **informal alliances** between SIE-field actors and other field actors.

Another important form of collaboration for cooperatives is the **relationship with municipalities**. Meister et al. 2020 focussed on the linkages between energy cooperatives and municipalities and emphasised the important role of municipalities for energy cooperatives and vice versa. Nevertheless, the support of municipalities is not guaranteed automatically and the perception about their role is contested. The collaboration between energy cooperatives and municipalities is regulated and therewith represents a **formal collaboration**.

Further **alliances** exist between national intermediaries and various organisations in favour of renewable energies and citizen energy to achieve their shared aims. Finally, the establishment of several **regional and national representatives** for energy cooperatives and their regular exchange and cooperation led to a **network** of organisations working for the further development of the field.



How can the interactions/ relations between SIE-field-actors and/ or other field-actors be characterised (e.g., cooperation, exchange, competition and conflict)? How have they changed over time?

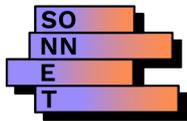
In SONNET we linked the SIE-field “Cooperative Organisational Models for Renewable Energy” to an SIE that is based on social interactions (and changes of social relations) that aim to bring about changes in the energy system that are often based on **‘cooperation’** (rather than conflict, exchange and competition) and make use of novel ways of **doing** cooperation. Those cooperations can take place in different formats and between different actors as described in the previous section (5.6.1.3). The interviews indicated that the high commitment of individual cooperative board members was an important prerequisite for advanced cooperation within the SIE-field.

The interactions and relations between SIE-field actors and other field actors are furthermore characterised by **conflict, exchange** and **competition**. This concerns, first of all, the relation between energy cooperatives (and their representatives) and incumbents of the conventional energy system (and their representatives). The latter include renewable energy opponents such as wind energy opponents or advocates of fossil fuel and nuclear energy and can be described as **conflictive** relations. Secondly, this concerns the relations between SIE-field members and policy makers which can be characterised by **conflict** if their aims or ways to achieve those aims differ considerably. Thirdly, conflictive interactions occur additionally between intermediaries and other SIE-field actors regarding the goals of energy cooperatives and the different measures to achieve them. This dispute also reveals a fundamental underlying cause of contestation which is that several SIE-field and other field actors tend to marginalise the effects and potentials of citizen energy. Debates about the right way to achieve hundred per cent renewables or the energy transition, in general, do not only take place within the SIE-field or between the SIE-field and other field actors but also within intermediary organisations. Fourthly, the relations between energy cooperatives and regional as well as national intermediaries can be further characterised as **exchange** since many of their interactions target the exchange of information and experiences. Finally, the relation between SIE-field actors and existing energy providers can be characterised as **competitive** as they engage in the production and distribution of the same commodity despite the different “production conditions”.

What is ‘socially innovative’ about the SIE (including SIE-initiatives and/ or SIE-field-actors)? How and to what extent do which ideas, objects and/or actions demonstrate a change in social relations and new ways of doing, thinking and/or organising energy?

The relation between **social innovation** and **energy cooperatives** can be found in several ways.

The use of the cooperative model differs significantly from other users of the legal form of a cooperative. Usually, the cooperative model is used in the way that members obtain economic advantages through their membership - for example cheaper goods, cheaper rents etc. What is specific about cooperatives in general is that cooperatives are supposed to promote their members economically. The cooperative promotion purpose (“Genossenschaftlicher Förderzweck”) is paramount and not the payment of revenues (Genossenschaften in Deutschland, 2020). That is different for energy cooperatives. Herein members hand in their capital and obtain financial revenues for their membership instead of material economic



advantages (DE_EC_01 and 05). Another significant difference of how energy cooperatives use the cooperative model is that their aims like the democratisation of the energy system and the implementation of the energy transition are usually seen as more important for the members than the amount of their prospective revenues. This implies that the implementation of **their goals tends to be more important than the economic advantages** of their participation which is in contrast to the previous application of the cooperative model till then.

The co-operative model is additionally seen as a sustainable organisational model which enables citizens to actively engage in the energy transition, thus going beyond being passive consumers of energy but instead to participate actively in the generation of energy - or in short, to become so called **prosumers** (DE_EC_04). Klagge et al. 2016 support those findings. The authors describe the innovative part of energy cooperatives today in the way they enable citizens to participate in the energy transition through the participation possibilities in renewable energy sites. This led to a change in the German power industry through the engagement of new extra players besides conventional energy suppliers (Klagge et al., 2016).

Another aspect of social innovation are the **pioneering activities** of energy cooperatives: Energy cooperatives can lead to social innovation in that they have the time to show other market players new models. While some activities might be too risky for established actors like energy providers, energy cooperatives are so positively convinced of their ideas that they experiment or look into alternative ways of doing, thinking and organising - sometimes regardless of the time it takes. One example would be the introduction of the functionality of metres to a conventional energy provider. Thus, energy cooperatives are creating SIE's with their activities. This stands in opposition to the statement that many cooperatives suffer from financial and time resources and therewith represents the oppositional perception of energy cooperatives capacities.

Another aspect of social innovation could be seen in the focus on **regionality**. Many energy cooperatives and their representatives emphasise the importance of regional development. For the "local energy transition" it is important that the revenues remain in the region as this leads to ties with the regional services and the feeling of connectivity. This behaviour is socially innovative in that it represents a new way of doing (dealing with) energy in opposition to central energy providers where the profits do not benefit the region and are rather centrally accumulated.

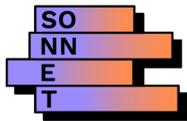
Energy cooperatives and their activities **change social relations** in several ways.

The organisation of cooperatives and the therewith related participation creates a feeling of togetherness among cooperative members (DE_EC_03). This leads to **closer bonds** between their members and potentially influences the relationship between members and the cooperative itself (and the therewith represented aims and ideals) as well.

The expansion of energy cooperatives led to the foundation of several other cooperative forms i.e. community-supported agricultures ("solidarische Landwirtschaften"), mobility associations, village stores or communal living forms that made use of the cooperative organisational model. Energy cooperatives thus influenced the field through their role as **trendsetters** and changed social relations by the further dispersion of the cooperative model.

The majority of energy cooperatives used to rely on voluntary work. Since the changed policies complicated the conditions for energy cooperatives, they start to **professionalise** more which might restructure the working conditions and related relationships within energy cooperatives.

In addition to that, the establishment of several regional, as well as national **intermediaries**, changed the relations between single energy cooperatives and representatives of politics,



administration and other networks. Therewith the work of intermediaries – regional networks of energy cooperatives as well as national associations - leads to more potential cooperation partners for energy cooperatives and subsequently to an expansion of their social relations. The work of intermediaries also influences the relations between energy cooperatives by strengthening the exchange and relations among cooperatives.

How has the SIE developed over time (and space)?

Our analysis describes an innovation timeline for the emergence and development of the SIE-field of energy cooperatives in Germany, which can be divided into four phases.

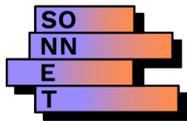
The **first phase** from 1998 till 2006 can be characterised as the **“policy foundation phase”** wherein the fundamental policy conditions for the establishment of the field have been implemented. The liberalisation of the German electricity market as well as the introduction of the Renewable Energy Sources Act (EEG), with its technology-specific feed-in tariffs and priority grid access for renewables, constitute the main policy foundations for the establishment of the field. The second prerequisite for the establishment of the field was the amendment of the German cooperative law which facilitated the conditions to initiate cooperatives and caused administrative relief for smaller cooperatives.

Those policy changes in addition to the increased environmental awareness and the general trend of citizen participation led to the **second phase**. Starting from 2007 onwards and propelled by the investment security guaranteed by the feed-in tariffs for 20 years, the **number** of newly established **energy cooperatives increased remarkably** and finally spiked in 2011. The shock of the financial crisis, as well as the nuclear catastrophe of the Fukushima accident, were described as additional boosters of the steep increase of newly established cooperatives during the second phase.

The **third phase** is characterised by a **change** of the previously **favourable policy conditions** for renewables through, on the one hand, the amendments of the Renewable Energy Sources Act in 2012 and 2014 as well as increased uncertainties due to the introduction of the Capital Investment Act and, on the other hand, increased networking activities of the SIE-field. These networking activities led to the creation of regional intermediaries and several national intermediaries which from then on guaranteed the political representation of energy cooperatives and contributed to enabling the continuation of existing energy cooperatives despite changed conditions. At the same time, the number of newly established energy cooperatives started to drop, a trend which continued in the fourth phase from 2017 on.

In this **fourth phase** the implementation of the auction model in 2017 for the majority of renewable energy systems (for exceptions see p.44 in the cases study report) replaces the previous feed-in tariff model on which the main business model of energy cooperatives relied on. Through the continued work of national as well as regional intermediaries, **new business models** emerged and dispersed. Consequently, the field started to **diversify** its business models and the first signs of **professionalisation** evolved further. It is also during this phase that the Fridays for Future movement creates further momentum for environmental awareness and increases participation in existing energy cooperatives, despite the stagnation of newly established energy cooperatives.

Overall, the development of the field can be divided into three main movements (when combining the first and second phase described above). At first an expansion of energy



cooperatives induced by favourable policy conditions for renewable energies in general and facilitated conditions for cooperatives. Second, partially in reaction to changed policy conditions and the need for political representation, increased networking activities between cooperatives and other SIE-field actors and the structuration of the field through the establishment of regional and national intermediaries. And finally, third, diversification processes of business models and a starting professionalisation of the field also partially as a reaction to changed policy conditions while the establishment of new cooperatives further stagnated.

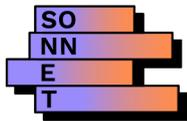
How/ to what extent do narratives and activities by SIE-field-actors and other field-actors refer to power issues and include ambitions to improve them?

Power issues are an often occurring topic in the field of energy cooperatives. The overarching **narrative** of energy cooperatives relates to power relations concerning energy infrastructure and how they can be changed. In particular, the question of how the prevalent energy system can be decentralised and therewith the uneven power relations between particularly the four biggest incumbent energy providers, other energy providers and citizens can be more “equalised”. The organisational model of energy cooperatives serves thereby as a mean to **empower citizens** through their joint participation in the cooperative and the subsequent implementation of renewable energy-related aims. This overarching theme is accompanied by the awareness of actors in the SIE-field about international power relations regarding energy. In particular, the dependency of German energy supply on energy sources from non-democratic countries delivering gas and oil was mentioned as a motivation to become independent from conventional electricity provision.

Another power related **narrative** is the uneven power relation between SIE-field actors and other field actors in the energy system concerning institutional work. According to the interviewees, big energy suppliers are more able to focus on lobbying due to their financial resources. They could thereby influence politics to a larger extent than the representatives of energy cooperatives. Furthermore, they could invest more in advertisement and thereby gain attention from the general public which might possibly help them to maintain the status quo. An additional power related narrative is the power of German politics perceived by SIE-field actors (over the SIE-field developments) and their ability to restrict new business models and decelerate the expansion of renewable energy in general. The frequently recurring narrative of being less powerful than other field actors is reinforced by resource problems of energy cooperatives. Restricted time and financial resources of their voluntarily working staff result in fewer investments in PR and lobbying compared to other actors. The **development of new business models** as well as the aspirations and activities of SIE-field actors to **engage** in the **political sphere** and influence upcoming legislations can be seen as a way to counteract these power issues.

Additionally, the cooperation between national intermediaries and the European federation for energy cooperatives (REScoop) is another attempt to **improve** those uneven power relations and change the legal situation for energy cooperatives at the European level.

The constant work of energy cooperatives and their representatives to influence the general public and convince others of the model of energy cooperatives can be interpreted as another way to diffuse the alternative model of energy generation and thereby support the construction of a new energy system in which power is less unevenly distributed.



What have been (shared) narratives, activities, knowledge, learnt lessons, etc. between alliances/ networks/ collaborations of SIE-field-actors and/ or other field-actors? How have they been reproduced, adopted and replicated in the SIE-field? To which extent have they been legitimised and/ or contested by several actors within the SIE-field? Have there been any key changes over time?

The question about the degree of institutionalisation of the field of energy cooperatives has a two-sided answer. On the one hand, the cooperative model itself is institutionalised in that it exists as a legal form and its application is present in many other parts of German society. On the other hand, the cooperative model regarding energy cooperatives is not specifically addressed in the cooperative law and its specific application of the cooperative model is only starting to disperse into other contexts.

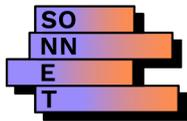
Nevertheless, the SIE-field of cooperative organisational models for renewable energy production is recognised by other actors and contributes to its institutionalisation through different activities. An example of the acknowledgement of the field by regulatory institutions can be seen in the adaptation procedures of a conventional energy organisation. One federation recently implemented a business section for citizen energy which according to one of our interviewees “is only a trend thing and not meant a hundred per cent seriously” (Interview DE_EC_04). Nevertheless, the inclusion of a previously rather niche topic into a conventional, established organisation shows a change in the perception of the importance of citizens in the energy sector and as a consequence a change in an established institution (which could evoke further regulatory or cultural-cognitive institutional changes).

An additional indication of the level of institutionalisation are inner SIE-field developments. As a reaction to changed policy conditions, the actors in the SIE-field under study started to increase their cooperation and established regional as well as national intermediaries, such as the LANEC Rheinland-Pfalz (regional) or the Bündnis Bürgerenergie e.V. (national). The resulting enhanced degree of organisation in the SIE-field as well as the activities of those newly established actors resulted in a wider acknowledgement of the SIE by established SIE-field actors and other field actors. Their activities additionally led to the cooperation with already institutionalised other actors which further supports the institutionalisation of the SIE.

Another indication of the advancing institutionalisation of the SIE-field under study can be seen in the recent legislation of the European Union. The Clean Energy Package acknowledges the important role citizens and energy communities play in the energy transition. Moreover, it stipulates its Member States to integrate them and their activities into national energy and climate plans and to enable their further participation in the electricity systems (EU, 2020). The procedures of the SIE-field are therewith addressed and supported by an acknowledged supra-national institution that can be interpreted as a progressing level of institutionalisation of the field.

Reflections on the main research question

In order to understand the field developments better it would be interesting to include more of the historical aspects of the field and the individual cooperatives. On the one hand, because energy cooperatives have a long tradition in Germany which might be insightful, and on the other



hand because some cooperatives already existed in the form of another organisational model before they changed their organisational model into a cooperative.

5.3.2 How do SIE-field-actors and other field-actors interact with the 'outside' institutional environment and thereby co-shape the SIE-field over time?

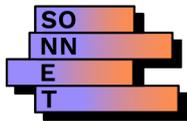
Which institutions (regulative, normative, cultural-cognitive) within the 'outside' institutional environment have shaped (including enabled/impeded) SIEs and its SIE-fields (and how)?

The SIE-field of energy cooperatives is influenced by a variety of regulative, normative and cultural-cognitive institutions of the 'outside institutional environment'. In this empirical case study of Germany, the focus was mainly on the regulatory institutions of the outside institutional environment.

The German electricity market as well as the financial market constitute two relevant **regulative** institutions of the outside institutional environments that influenced the emergence of the field under study. Energy cooperatives are embedded in the German energy system which influenced the development of the field in different ways: One aspect is the resulting changes in the energy system subsequent to the liberalisation of the energy market. Those changes form a precondition for the establishment of the field since they enabled smaller players such as energy cooperatives to enter the electricity market. In contrast, the price trading mechanisms on the energy spot market constitute an impeding factor for the development of the field, since the high EEG-surcharge contributes to the negative perception of renewables as 'expensive energy sources for everyone'.⁴ Additionally, the financial market can be considered as another enabling outside institutional factor for the field establishment during the last 20 years. The comparably good situation of cooperative banks after the financial crisis led to the approval of positive connotations with the cooperative model in general and potentially increased the trust in the organisational model for other purposes as well. Furthermore, the currently (2020) low-interest rates led to an increase in capital investment into energy cooperatives thereby enabling an increased potential for further project developments and increased activities of the field.

Other important regulatory institutions with an impact on the SIE-field are a result of the institutional embeddedness of energy cooperatives in the German federal system. Due to the partial independence of the federal states, they possess the means to financially support regional intermediaries or to interfere with federal state-bound regulations, as the example of the Bavarian building law ("10H Abstandsregel") illustrates. The latter is an example of an **impeding** factor for the field development since the regulation hinders the realisation of new wind energy

⁴ The electricity price, which goes down with higher shares of renewables through the merit order effect, determines the amount of the EEG-surcharge needed for the level of support guaranteed to renewables. This mechanism is designed in a way that a reduction in electricity prices through renewables at the electricity exchange leads to higher EEG-surcharges borne by electricity consumers.



systems for energy cooperatives. On the other hand, it can be argued, that impeding factors of the outside institutional environment **enable** - or necessitate - the further development of the field in that energy cooperatives need to adapt to the changed conditions and thereby create new ways of doing and thinking about energy. The diversification of business models partially as a response to the changed policy conditions in the past few years can be seen as a further indication for this development. Besides that, the German federal system is furthermore a prerequisite for the specific role municipalities play as a cooperation partner for energy cooperatives. They enable the work of energy cooperatives through their cooperation and further support their activities by becoming a member of an energy cooperative.

It can be argued that the **normative** democratic values engrained in the German constitution serve as an **enabling** prerequisite for the motivation to choose the cooperative model and to engage in a SIE-initiative adhering to democratic values.

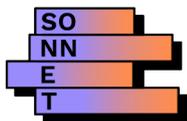
One relevant SIE-field actor described the lack of trust of the population in citizen-led energy cooperatives and their ability to accomplish the energy transition. That suggests that the trust in other – not citizen-led - institutions is a **cultural-cognitive** institution **impeding** the development of the SIE-field. Societal trends in favour of sustainable investment and with a critical stance towards economic growth as well as concepts like solidarity and sharing economy are counted as **enabling** cultural-cognitive institution for the SIE-field. Those commonly shared values and goals make energy cooperatives more attractive for a broader audience that is already engaged in similar activities. The shared common beliefs are further maintained and contribute to a wider expansion of the field. The shared values of environmental protection and a focus on regional development represent an impeding and simultaneously enabling cultural-cognitive institution for the SIE-field. The distribution of values like environmental protection beyond the SIE-field lead to more cooperation partners for potential cooperations or other supportive collaborations and more interested citizens in the work of the individual SIE-initiatives. On the other hand, those shared values can constitute an impeding condition for the SIE-field, since paths and ideas on how those shared values are best achieved differ considerably. One example of that is the ongoing dispute between energy cooperative opponents and anti-wind energy advocates. Both parties are - in their eyes - in favour of environmental protection, nevertheless, the activities of wind energy opponents can constrain the activities of energy cooperatives.

What are the key events, external shocks, trends and inter-field interactions that enable/ impede SIEs and its SIE-fields (now and in the past)?

Some of the key events, external shocks and trends that have **enabled** the SIE-field over the past ten years are included in the table below. Note that these are not intended to represent a comprehensive list and that inter-field interactions have not been studied for this case study and are therefore excluded from all relevant tables.

Table 8: key enabling events, external shocks and trends in the SIE-field Cooperative Organisational Models for Renewable Energy in Germany

Key events	External shocks	Trends
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Liberalisation of the German electricity market in 1998	Financial crisis in 2008 leading to low interest rates	Rising environmental awareness leading to increased interest of the general public
Renewable Energy Sources act (EEG) in 2000 (and its amendments)	Fukushima nuclear catastrophe in 2011 and the following nuclear phase out by 2022	Trend of increased citizen participation encourages participation
Amendment of the German Cooperative Law in 2006		Fridays for Future movement encourages participation
Establishment of the association "Energiewende Jetzt e.V."		
Establishment of regional intermediaries		
Establishment of national intermediaries		
Foundation of regional cooperative electricity suppliers		

Some of the key events, external shocks and trends that have **impeded** the SIE-field over the past ten years are included in the table below.

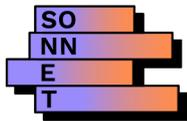
Table 9: key impeding events, external shocks and trends in the SIE-field Cooperative Organisational Models for Renewable Energy in Germany

Key events	External shocks	Trends
Amendment of the Renewable Energy Sources Act (EEG) in 2012 and 2014		
Adoption and discussions around the Capital Investment Act (CIA) in 2013		

Further SIE-field events can be found in the timeline of the case study report which includes more detailed descriptions. The timeline of the case study report further differentiates between policy events on the national and European level as well as relevant societal trends, the development of intermediary organisations and the numerical development of energy cooperatives.

How (if so) have the SIEs and their SIE-fields and 'outside' institutional environment been shaped by these events, external shocks, trends and inter-field interactions (now and in the past)?

The implementation of the Renewable Energy Source Act (EEG) in the year 2000 and its introduction of guaranteed feed-in tariffs (alongside other provisions) enabled an immense increase in energy cooperatives in Germany, particularly due to the secure long term investment opportunities for energy cooperatives. The accompanying feature of this **key event** in the SIE's institutional environment and consequentially the SIE-field is the amendment of the German Cooperative Law in 2006 which facilitated the establishment of energy cooperatives as well as



the administrative procedures for smaller cooperatives. Both policy changes were the main enabling conditions for the enormous increase of newly established energy cooperatives from 2006 onwards.

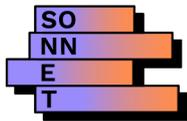
The amendments of the previously very supportive energy policies characterise another key event in the SIE-field. The amendments of the Renewable Energy Sources Act (EEG) of 2012 and 2014, in particular, led to the gradual decrease of the previously very attractive, main business model of energy cooperatives who relied on the remuneration through feed-in tariffs. The decreasing margins for investments in renewable energies connected with lower feed-in tariffs, paired with new restrictions on plant sizes, regulations about self-consumption, the EEG-surcharge and the 'breathing lid' led to a decrease in the number of newly founded energy cooperatives. At the same time, these impeding conditions evoked the diversification of business areas and models of existing energy cooperatives.

As a reaction to the previously mentioned key policy changes, the actors in the SIE-field under study started to increase their cooperation and established regional as well as national intermediaries, such as the LANEG Rheinland-Pfalz (regional) or the Bündnis Bürgerenergie e.V. (national). This resulted in an enhanced degree of organisation in the SIE-field and led to increased networking and exchange activities in the SIE-field.

There are two main **external shocks** that had an influence on the SIE-field under study.

The financial crisis in 2008 influenced the field in two ways. Firstly, it led to the approval of the positive connotations with the cooperative model and potentially increased the trust in the organisational model for other purposes as well. Secondly, the low-interest rates caused by the crisis led to an increase in capital investment into energy cooperatives. The Fukushima catastrophe in 2011 was recognisable in the field of energy cooperatives through the following policies about the reinstated nuclear phase-out by 2022 and the immediate shutdown of the seven oldest German nuclear sites. This in addition to the shock led to an increase in customers for energy cooperatives involved in the distribution of electricity (see Interview DE_EC_03).

Regarding **trends** in the field of energy cooperatives in Germany, three main trends must be mentioned. First of all, the rising environmental awareness in German society and societal trends in favour of a more sustainable lifestyle (see Interview DE_EC_05) led to a heightened curiosity about the resources and mechanisms behind energy production and an increased interest in renewable energies. Secondly, the general trend among citizens to self-organise and to get involved in the creation and management of public goods created further momentum for the engagement in energy cooperatives (Debor, 2018). Finally, while it is contested among members of the SIE-field how much impact the Fridays for Future movement had, the majority agreed that it positively impacted energy cooperatives to a certain extent. One of the major outcomes, besides the raising of awareness in the general public about climate change and therewith also for renewable energy-related topics is the increase of younger people interested in the field of citizen energy and ways to engage in the generation of renewable energies.



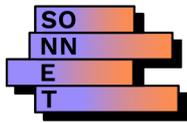
What have been the most important alliances/ networks/ collaborations of SIE-field-actors and/ or other field-actors that emerged from these events, shocks, trends, and inter-field interactions (when, how and for what reasons)?

Several SIE-field actor alliances/ networks/ collaborations have emerged from the previously described changes. In the following the formation and role of regional networks and national networks will be described in more depth:

Firstly, **regional networks** (intermediaries) such as the LaNEG Rheinland-Pfalz e.V., LaNEG Hessen e.V., BürgerEnergie Thüringen e.V. or BürgerEnergie Bayern e.V. represent important networks for the field. The reasons for the foundations of regional intermediaries from 2012 onwards are multifaceted. Since the favourable policy support deteriorated which impeded the work of the majority of energy cooperatives it became progressively important to represent energy cooperative's interests in the realm of regional and German energy politics. Another factor for the foundation of regional intermediaries was the lack of information from auditing associations. Every cooperative has to be a member of an auditing association to get assessed once per year. By 2012 energy cooperatives were still a new phenomenon to them which led to the necessity for energy cooperatives to organise themselves. In addition to that, regional intermediaries offered energy cooperatives a way to be recognised by different actors and to get included in regional matters and politics, hence offered cooperative members a way to participate even more in the energy transition – one of the main motivation of their members.

Secondly, the lack of particular representation of energy cooperatives at the national level (besides the representation in overarching general renewable energy or cooperative related organisations) further increased the urge of cooperatives to form overarching **national networks**. The formation of regional representatives on the federal state level marked a first step for the establishment of representative organisations at the national level. Through the enhanced cooperation structures and the exchange between the different regional intermediaries, national organisations were formed in cooperation with other relevant organisations for renewable energies. One of them is the **Bündnis Bürgerenergie e.V.** (BBEn) which has been established through the cooperation of several regional intermediaries and other actors of the renewable energy field out of the necessity that already existing umbrella organisations like the federation for renewable energies did not specifically address the particular interest of citizen energy. This national network unifies locally, regionally and nationally active networks, includes associations, companies and private persons and counts over 200 members accumulating around 500,000 “energy citizens” nationwide (as of 2020). Besides its function as a networking platform for citizen energy actors, BBEn focuses on the political representation of interests at the national level.

Other relevant emerging actors for the field are the Bürgerwerke e.G., the section for energy cooperatives at the German Cooperative and Raiffeisen Confederation (DGRV) or regional cooperative electricity distributors. As a result of the emergence of new actors in the SIE-field under study **new collaborations** emerged as well. Those exist for example between national intermediaries and foundations, research institutes and other relevant SIE-field actors.



How have the SIE-fields co-evolved with the policy context (if so) (and what was the relative importance of the urban, regional, national and European level)?

In Germany, the policy context played a crucial role for the development of the SIE-field 'Organisational Models for Renewable Energy'. The main **national policy** developments have been outlined above as "key events" for the SIE-field in section 5.7.1.3. In addition to that several other national policies concerning the "Energiewende" have been influential for the field like e.g. the nuclear phase out among other policies, as well as policies regarding the energy economy. Together, this policy mix influences the general conditions for renewable energies and thereby impacts the field of energy cooperatives as well.

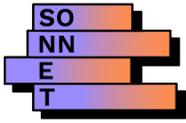
A variety of policy developments on the **European level** have influenced national policy making and therewith also the SIE-field under study. With the liberalisation of the German electricity market in 1998 Germany complied with the regulations of the 1996 EU directive about the liberalisation of the electricity market. Consequentially this changed the organization of the German electricity market significantly: Among other changes the previously regional monopolies were replaced with a system in which several market players were able to enter the market and thus also included smaller players like energy cooperatives. The introduction of the Capital Investment Act based on EU Directive 2011/61/EU and the treaty violation proceedings against the German feed-in tariffs by the European commission further illustrate the influence of the European Union on national policies, with further repercussions for the field. A final example concerns the attention to citizen energy in the recent EU Clean Energy Package (see section 5 of the case study report). Overall, this implies that even though the emphasis of this report was on the national policy context, some of the national policies would not have been triggered without previous policy interventions on the European level, thus the European level is considered to be equally important for this SIE field.

When it comes to the **urban** and **regional** policy context, the interventions of the federal state ministries, federal state policies such as the "10H Abstandsregel" in Bavaria as well as the impact of municipalities illustrate the importance of those levels for the SIE-field as well.

How are which power relations (such as inequality, exclusion, oppression, exploitation, injustice) being transformed and/ or reproduced by the SIE-phenomenon under study? (and vice versa – how are SIEs enabled and impeded by power relations?)

'Cooperative Organisational Models for Renewable Energy' transform and reproduce existing power relations in different ways.

Energy cooperatives are starting to become an established player in the electricity market and therewith contribute to the reduction of the market share of the big electricity utilities, thereby contributing to the **transformation of existing power relations**. The SIE-field under study furthermore contributes to a shift of power relations in that they enable citizens to jointly own means of and participate in renewable energy production. They thereby empower citizens to actively engage in the energy transition and have more resources at their disposal in comparison to an individual person. In addition to that, the increased networking activities of the field and the establishment of intermediaries are a way to change existing power relations. On the one hand, they equip the SIE-field with more means to engage in the political sphere, on the other hand



they enable individual cooperatives to make use of already existing knowledge in the field and therewith become a more powerful actor.

The SIE-field under study furthermore **reproduces power relations** through the membership constellations of energy cooperatives and their board members. Despite low costs for shares of an energy cooperative, membership is very unevenly distributed between male and female members as well as between highly educated (in terms of a university degree) members and members without a higher education degree: The majority of energy cooperative members as well as their representatives are male and highly educated. This could be an indication of conscious or unconscious selection criteria or hurdles for new members and a reproduction of societal power imbalances. In addition to that the impact of the SIE-field might be in some areas restricted by their resources in comparison to other field players of the energy sector. The SIE-field might therewith reproduce some of the power relations it tries to change.

Reflections on the main research question

Due to the field specificities of energy cooperatives, it was sometimes difficult to draw clear boundaries between the inside and outside institutional environment and its related actors. This might be sometimes recognisable in the answers.

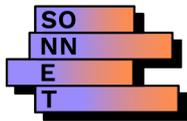
5.3.3 What are the enabling and impeding factors for the SIE-field-actors and other field actors to conduct institutional work and change the 'outside' institutional environment?

How, why, and where do SIE-field-actors and/ or other field-actors conduct activities linked to creating, maintaining and transforming institutions?

The focus of this case study was on the institutional work conducted within the SIE-field by SIE-field actors. Institutional work regarding 'Cooperative Organisational Models for Renewable Energy' in Germany mainly refers to activities of energy cooperative board members and the activities of regional and national intermediaries.

The reasons for the institutional work in the field under study are versatile. One reason mentioned by several interviewees were the changed policy conditions after the amendment of the Renewable Energy Sources Act in 2012 and 2014 which were perceived as a constraint for the activities of energy cooperatives. Consequently, the need to form political representatives for energy cooperatives became more pressing and led to the structuration of the field itself and the **creation** of new organisations. Another reason for the creation of those organisations was the intention to connect existing cooperatives, to bundle and share their knowledge and to introduce their concerns to a broader audience. As a result, several energy cooperatives in several federal states started to join forces and created regional intermediaries for energy cooperatives. Several of those regional intermediaries and like-minded organisations founded the "Bündnis Bürgerenergie e.V.", a nationwide acting network to support energy cooperatives and citizen energy participants and to represent their interest at the national level. Thus, institutional work led to the creation of newly established intermediaries on the regional and at the national level.

The work of intermediaries themselves aims to **transform** current institutions. Particularly national intermediaries work on press releases, organise collective statements about prospective



laws and try to influence politics through lobbying, the publication of reports and similar activities. They thereby aim to influence existing or emerging new laws and change existing regulative institutions. Another form of institutional work aiming to transform current institutions addresses normative, as well as cultural-cognitive institutions. By serving as an example of successful citizen energy, energy cooperatives influence the view of the general public on citizen energy and their related goals (DE_EC_01). A more direct way of changing cultural-cognitive as well as normative institutions is the result of the constant work by energy cooperatives to provide the public with information about their ongoing work, the reasons for it and individual regional topics in general. Those measures are accompanied by the continuous spread of petitions on their websites and their social media channels. The additional aim of intermediaries to act as advisors for and to spread information about their goals also contributes to a change of normative and cultural-cognitive institutions. Finally, the support and commissioning of studies by bigger cooperatives and intermediaries to confirm their personal experiences with scientific results is an additional contribution to that. The representation in Brussels and the cooperation with the European federation for energy cooperatives (REScoop) are other examples of institutional work with the aim to transform existing institutions.

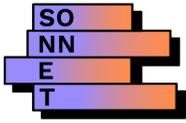
The SIE and its SIE-field contributes to **maintain** institutions in several ways. First of all, the use of the cooperative model contributes to maintain the related normative and cultural-cognitive institutions represented by the cooperative model itself. Additionally, the work of regional as well as national intermediaries maintains existing structures in the field through the collection and dispersion of know-how and experiences for already existing and prospective cooperatives. In addition to that, changes of the policy conditions by other field actors as well as lobbying activities of conventional energy providers can be regarded as a way to maintain or transform institutions.

Who is involved in conducting institutional work (and who is not)? Which actors benefit from this work (or not)?

The different aspects of institutional work in the field of energy cooperatives require various actors and actor constellations. The creation of institutions is mainly to be linked to energy cooperative board members and board members of regional and national intermediaries sometimes with the support of renewable energy or citizen energy-related organisations. It is important to mention that institutional work in the field of energy cooperatives, in particular, the creation of new institutions is to a large extent influenced by the high ambitions of individual board members who are particularly committed to their work. Energy cooperatives themselves are often not consciously involved in the types of institutional work concerning transforming institutions. As a reason for that, the interviewees mentioned their restricted time and financial resources.

In types of institutional work in regard to maintaining institutions energy cooperatives as well as other SIE-field actors are involved. Regarding the institutional work to transform institutions different SIE-field actors are engaged including different foundations, research institutes federations and various organisations of the field of renewable energies and related federations of the SIE-initiatives.

Other actors involved in institutional work, but who have not been specifically investigated in this case study, are conventional energy providers trying to lobby in favour of conventional electricity production as well as regional and national policy makers.



What have been the most important activities linked to creating, maintaining and transforming institutions? Outline these activities through describing 2-4 examples.

Example 1: An example of institutional work with the aim to transform institutions is the influence of the Bündnis Bürgerenergie e.V. and the section for cooperatives at the German Cooperative and Raiffeisen Confederation (DGRV) in the decision making process about the recent EEG amendment in 2020. The duty for tender offers should have been lowered from 750 kW to 100 kW, which would have affected energy cooperatives and their business models significantly. During that time the association was active lobbying, e.g. through the release of a publication where the topic was addressed. Even though they did not reach their intended goal, the final result was the decline from 750 to only 500 kW – which might indicate the partial influence of their work.

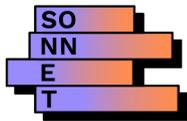
Example 2: An example of institutional work regarding the creation of institutions in the field of 'Cooperative Organisational Models for Renewable Energy' is the foundation of the association "Energiewende Jetzt e.V.". The association was founded in 2010 by members of already existing cooperatives and prospective board members of national organisations for energy cooperatives. The main goals of the association are to support energy cooperatives in terms of foundations and enhancements, to help with the development of new business models or entry into sectors other than only related to energy generation (e.g. via electric cars), to support their competencies and to increase the cooperation and networking between actors in citizen energy. It serves therewith as an example for the creation of a new institution and the maintenance of already existing or evolving institutions through its work.

What forms do these activities linked to maintaining, creating and transforming institutions take (e.g. emotion work, boundary work, strategy work, practice work and/ or values work)? Link back to the 2-4 examples

Emotion work, boundary work, strategy work, practice work and values work are specific types of activities that can be used to maintain, create and transform institutions. However, these specific aspects and concepts of institutional work have not been studied for the case study.

What factors have enabled and/or impeded institutional work? E.g. Resources, learnt lessons and competences connected to actors/ alliances/ networks/ collaborations. Link back to the 2-4 examples

The institutional work of energy cooperatives is hindered by various **impeding** factors. First of all, SIE-field **internal** factors. Those include e.g. the widespread dependency on voluntary working members which is partially a result of lacking financial resources. On the one hand, voluntary work can be seen as an advantage as it enables energy cooperatives to experiment and try new things independent of the time resources it takes. On the other hand, it can be seen as a disadvantage at the same time as it can also cause restricted time capacities and restrict energy cooperatives activities. The lack of financial resources further contributes to a lack of restricted capacities to invest in professional PR strategies or other business sectors which cannot always be fulfilled in the same professional way by cooperative members, which thus hinders the



professionalisation of the field. This leads to SIE-field external hindering factors for the SIE-field. Since some incumbents of the energy system are not in favour of a decentral energy transition their lobbying interests are in opposition to the interests of energy cooperatives. Their size, financial resources as well as their status in the prevalent energy system equip them with the resources to hinder further institutional work of energy cooperatives. Another hindering factor for the institutional work for energy cooperatives might be the sceptical view towards citizen-led initiatives of parts of the general public and the trust in public institutions for the management of energy. This counteracts the intended change of the normative and cultural-cognitive institutions by energy cooperatives. The previous hindering factor gets amplified by a general lack of awareness about the role of citizen energy for renewable energy production in the general public as well as among politicians which is described as a hindering factor for the work of intermediaries in the field.

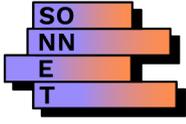
In contrast, **enabling** field **internal** factors for energy cooperatives are versatile as well. Energy cooperatives and their representatives possess accumulated knowledge resources through their members and their engagement in different organisations. This is accompanied by the high levels of motivation and personal commitment of their members which leads to engagement beyond the cooperative work and e.g. the creation of intermediary organisations. In addition to that, the high levels of interconnectivity in the field of energy cooperatives, e.g. through the engagement of intermediary board members in several other boards constitute additional enabling conditions for the institutional work of the SIE-field under study. The resulting synergy effects as well as the widespread cooperation with other relevant organisations of the renewable energy field further advances those developments.

An **external enabling** factor for energy cooperatives institutional work can be seen in the financial support of the federal state ministries for regional intermediaries. It equips them with the financial resources to perform their work as political representatives and advisors of the field. The long tradition of the cooperative model in Germany forms another enabling condition for the institutional work of the SIE-field. On the one hand, it leads to more acceptance of energy cooperatives and their related goals, on the other hand, it facilitates the political interest representation of energy cooperatives since related organisations (like the German Cooperative and Raiffeisen confederation, DGRV) have been already established and facilitated the foundation of a national intermediary for energy cooperatives. The establishment of regional and national intermediaries constitutes another enabling factor for the institutional work of the field since they enable energy cooperatives to represent their interests in the realm of politics.

One impeding condition - for example 1 outlined above - were lobbying activities of other field members not in favour of citizen- or renewable energy. One enabling condition - for example 2 outlined above - was the interconnectedness of the different SIE-field actors as well as the already existing regional intermediaries of the SIE-field which facilitated the creation of the association "Energiewende Jetzt e.V."

What have been intended and unintended effects (i.e. contributions) derived from conducting institutional work? What influence have they had on SIE-field and 'outside' institutional environments? Link back to the 2-4 examples

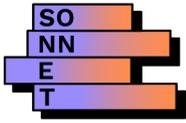
Not all effects of institutional work in the SIE-field are easy to measure or have an immediate outcome. The institutional work regarding cultural-cognitive changes by serving as an example of successful citizen energy and the dispersion about their aims and activities can be slow and



cannot be fully assessed yet. However, the rising membership of energy cooperatives, as well as the use of the cooperative model in other contexts could be seen as an indication of its effectiveness. In the same way, the institutional work of intermediaries regarding the transforming of institutions is difficult to measure and would need to be analysed more in detail and per case of attempt to transform institutions over a longer period. One effect of the work of intermediaries is represented by the fact that the SIE-field is more acknowledged and recognised by other SIE-field actors as well as other actors. Their acknowledgement at the EU level as well as in regional politics and by the federal state ministries illustrate that effect. The effects of the aspirations for a political representation and knowledge exchange on the other hand can be clearly seen in the SIE-field development. On the regional as well as on the national level several intermediaries have been established with the aim to represent the needs of energy cooperatives and to serve as their network facilitator.

Reflections on the main research question

No further reflections.



5.4 Case study 3: City level competitions for sustainable energy in Germany

5.4.1 How have the SIE and SIE-field emerged, developed and institutionalised over time?

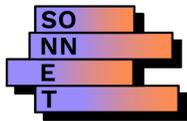
What are the relevant SIE-field-actors and other field-actors within the SIE-field and what are their roles within the SIE-field? How have these changed over time?

The SIE-field 'City level competitions for sustainable energy' is shaped by competition formats that happen at the city level. Referring to the 'city level' in this context means that competition formats involve **city administrations**, which are part of organising, participating in, leading and/or carrying out these competitions. City administrations are therefore by definition the main SIE-field-actors and, in the case of Germany, play an active role in developing sustainable energy pathways.

However, it is important to note that city administrations can take on different roles. While city administrations can be the organizer of competition formats that take place within cities, they can also be participants in competition formats that take place between cities. The formats under study therefore also include further SIE-field-actors. **City-networks** on the international level such as ICLEI or C40 as well as on the national or regional level in Germany, such as the Hessian network 'Klimakommunen', are part of developing, organizing and carrying-out competitions between cities. In these formats also **research institutes** might be involved in planning competition indicators or evaluating cities' performances. Other field actors are sponsors or federal ministries supporting the competition. Formats taking place within cities in many cases include a number of different **local actors** which can be local businesses, associations, schools or different city organisations (e.g. the local utility or mobility organisation). The aim of formats taking place within cities often is to include a large variety of different actors. The 'event character' of temporal limited competitions within the cities in this sense provides the opportunity to overcome barriers within the city.

What are relevant activities, aims/ goals and narratives that have been developed and manifested by SIE-field-actors and/ or other field-actors within the SIE-field over time?

The SIE-field 'City level competitions for sustainable energy' is characterised by its novel ways of engaging in different (playful) energy competition formats. Competition is here not limited to formats that are characterized by a strong sense of 'competitiveness' but might also include joyful 'fun formats', awards or labels. One main **goal** of these formats usually is to **create awareness** for sustainable energy issues and facilitate engagement. A central main **narrative** of the field particularly refers to the growing **responsibility** of individual actors to engage in sustainable energy activities to overcome the slow progress in this field. City administrations are taking up this responsibility by developing energy related goals on the local level and competing for resources for and recognition of their activities. Depending on the format and the actors involved, the overall goals, aims and narratives can however differ.



When it comes to competition formats taking place between cities, cities are often interested in **gaining recognition** for their engagement in sustainable energy and, furthermore, **funding opportunities** linked to their engagement. On the one hand, these competitions help to improve the image of cities; on the other hand, participating in competitions can also encourage cooperation between different administrative units or municipal departments. In order to apply for awards, these units have to jointly work together.

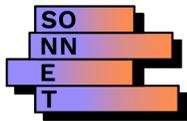
When it comes to competition formats taking place within cities, the focus is mainly on **raising awareness** among local citizens. They do so by developing 'fun formats' for promoting and mainstreaming sustainable energy and for making sustainable energy a more 'fun' topic. Participating in a competition and having fun doing so is considered a good way of **motivating** people for getting engaged, of knowledge transfer and learning. Competition formats are therefore often embedded in information campaigns.

What types of interactions/ relations exist between SIE-field-actors and/ or other field-actors? What types of informal and formal alliances, networks, collaborations have existed (and possibly still do)?

The SIE-field 'City level competitions for sustainable energy' is characterized by a very specific combination of informal, formal and semi-formal relations between SIE-field actors. On the one hand, city administrative structures are characterised by relatively strong **formalized** structures of responsibilities. When it comes to sustainability, these structures can be a huge problem as they lead to 'silo thinking', meaning that actors are only facing problems within their own area of responsibility while sustainability requires more holistic approaches. City level competition formats can now be understood as a **semi-formal** or partly formalized way of interacting with different actors from different stakeholder groups. Due to their 'event' or 'project' character, they include a certain degree of flexibility. These events, however, offer a platform for different actors from different stakeholder groups to meet and exchange. As one interviewee describes it, this is in many cases a good opportunity for overcoming 'silo thinking' and encouraging processes of cooperation between different administrative units (Interview DE_CLC_06), especially when a city works on participating in a competition or applies for an award. Furthermore, in many cases the **informal** structures that derive out of these meetings are considered important. Competition events also serve as networking platforms, where "a lot of people who wouldn't meet otherwise" (Interview DE_CLC_04) are getting together. This is where **alliances** come into play, such as city peer-to-peer networks, which are often engaged in organising competition formats. Cities learn in peer-to-peer networks from best practice examples of other cities. Also, in competition formats within cities actors are encouraged to work together, join forces and learn from each other.

How can the interactions/ relations between SIE-field-actors and/ or other field-actors be characterised (e.g., cooperation, exchange, competition and conflict)? How have they changed over time?

Within SONNET, the SIE-field 'City level competitions for sustainable energy' has been linked to an SIE that is based on '**organising**' as the most important type of activity and based on '**competition**' as the most important aspect of social relations among SIE-field actors and other field actors. However, the character of these competitions largely varies depending on the format of the competition and the actors involved.



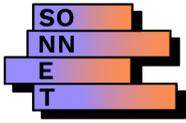
Competitions between cities can often take a more **competitive** character, with each city seeking recognition and funding. What characterizes these formats is the aim as well as the difficulty to create comparability and measurability between participating city administrations. These competition formats are in many cases based on a more formalized character than competitions within cities would be. They often involve other field actors that support the competition (e.g. financially) such as federal ministries or NGOs operating on the national or international level.

In contrast to competitions between cities, on the **inner-city level**, competitions are rather characterized by a **cooperative** and playful mood than by competitiveness between participants. Overall, they are described as an occasion to bring different actors together, create a sense of togetherness and stimulate learning. Helping each other is considered an important part of the competition (see Interview DE_CLC_05). Awards in this case serve as incentives but are less relevant than in competitions between cities.

Considering the change of these formats over time, what can be recognized is that city administrations are increasingly under pressure to develop new formats that reach out to different, sometimes 'hard to reach' actor groups in order to mainstream issues related to sustainable energy. In the context of Germany, this goes hand in hand with the aim to decentralize the energy system and encourage local engagement. In contrast to this, digital competition formats such as apps are still not very far diffused to city administrations as a mean to develop competition formats.

What is 'socially innovative' about the SIE (including SIE-initiatives and/ or SIE-field-actors)? How and to what extent do which ideas, objects and/or actions demonstrate a change in social relations and new ways of doing, thinking and/or organising energy?

City level competitions for sustainable energy include new **ideas** insofar as formats are striving towards a more playful character. This is in contrast to former attempts, which were so far dominating the German discourse and framed energy related issues as mostly technical or political topics. These new ideas of a playful way of getting engaged in energy related issues is furthermore linked to new **actions** in terms of new formats being developed and new actor constellations involved in these competition formats. The SIE under study is therefore changing **social relations** insofar as SIE-initiatives are actively trying to include new actor groups. SIE-actors are aiming for reaching out to different stakeholder groups such as citizens, city administration staff as well as private companies ('big players'). They do so by developing 'fun formats' for promoting and mainstreaming sustainable energy and for making sustainable energy a more 'fun' topic. The main change is about who is included in the 'game' and which forms of engagement the game offers: participating in a competition and having fun doing so is considered a good way of motivating people for getting engaged, of knowledge transfer and learning. New **actor** groups are getting engaged in developing games and competition formats. Civil society actors, private initiatives as well as city administrations are taking new forms of responsibility. Furthermore, the SIE-under study might also include new **objects** such as the development of digital applications, tools or platforms that help to carry out the competition, even if these objects are still not very far diffused among German municipalities as a mean to develop competition formats.



How has the SIE developed over time (and space)?

Competitive formats between cities first emerged out of the increasing sense of responsibility of city administrations to push sustainable change. With the Agenda 21 and later, in 2007, the Leipzig Charter for Sustainable Urban Development, the local level and especially cities were identified as important arenas to address sustainability targets. National or European associations started to develop competition formats directed towards city administrations in order to promote best practice examples. In the following years, this trend also inspired competition formats within cities, carried out by local administrations. These formats are developed to make the topic more attractive to a broader audience and include citizens.

We identified three phases of development.

In a **first phase**, from about the year 2000 until 2007, interviewees described an overall discourage mood concerning the lack of political engagement for sustainable energy and overall climate protection goals. City level competitions for sustainable energy during this phase occur rather as single activities than as an emerging SIE-field. This however changes around the year 2007.

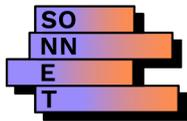
In a **second phase**, new formats of city level competitions for sustainable energy emerge. This happens against the background of a new sense of responsibility towards environmental issues and the aim of civil society actors as well as local policy actors to raise attention towards sustainability. One important milestone for this development was the Leipzig Charter for sustainable development in 2007. Competition formats during this phase are mainly developed by institutionalized actors such as federal ministries or associations operating on a national scale.

In the course of a **third phase**, starting around the year 2015, environmental awareness in Germany increases, which goes along with new efforts of civil society actors to engage in energy related topics. Competition formats during this phase start to diffuse to different stakeholder groups. In order to involve a variety of actors in energy and climate protection related issues, new playful formats are being developed, e.g. by city administrations on the local level.

How/ to what extent do narratives and activities by SIE-field-actors and other field-actors refer to power issues and include ambitions to improve them?

In the SIE-field 'city level competitions for sustainable energy' power relations can be analysed from two different perspectives: on the one hand, regarding who is involved in **shaping** competition formats, on the other hand, regarding who **participates** in competition formats. While formats, especially taking place within cities, encourage a wider participation of citizens, the shaping of competition formats and the decision about the 'rules of the game' are criticized by interviewees for taking place within existing structures and power relations, e.g. inside the academic 'filter bubble' as described by one interviewee (see interview DE_CLC_04). This is described as participation-dilemma, when seemingly open formats rather reproduce existing power relations between top-down decision makers and the bottom-up initiatives participating in competitions.

As described above, a central **narrative** of the field particularly refers to the growing **responsibility** of individual actors to engage in sustainable energy activities. This can be interpreted in a way that individuals are empowered to take responsibility and therefore aim to change existing power relations. However, it might also be interpreted in a way that it involves handling down responsibilities. Interviewees described that the engagement in certain energy



related competition formats emerged out of a discouraged mood. They claimed a lack of political engagement or a void that is not addressed by the ones responsible and now had to be filled by other actors. Rather than changing power relations, these narratives are directed towards responsible political actors to act and move forward.

What have been (shared) narratives, activities, knowledge, learnt lessons, etc. between alliances/ networks/ collaborations of SIE-field-actors and/ or other field-actors? How have they been reproduced, adopted and replicated in the SIE-field? To which extent have they been legitimised and/ or contested by several actors within the SIE-field? Have there been any key changes over time?

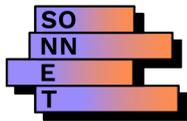
The SIE-field 'City level competitions for sustainable energy' in Germany can be described as a highly heterogeneous and fragmented field. It consists of a larger variety of different actors such as city administrations, city networks such as ICLEI or C40, civil society actors, and associations or local private businesses. Even if city administrations, which are identified as a central SIE-field-actors, are by definition linked to strong institutional structures, the overall field is not very strongly institutionalized in the sense that actors work together to reach joint goals. This especially refers to the fact that the competition formats themselves are often not in the centre of shared aims or goals but rather city-level competitions for sustainable energy are a means among others to reach certain goals, such as local climate protection targets or the increase of renewable electricity shares, in a certain municipality.

Shared activities on the city level are characterized by a strong sense of peer-to-peer learning through best-practice solutions. This can take place in international or national networks or alliances such as ICLEI, climate alliance or C40. In addition, networks on the national level in Germany play an important role, too, such as the alliances '100ee-Regionen' or 'Energiekommune'. What links municipalities is a new sense of responsibility on the local level combined with a 'new dimension of cities' competitive positioning' (Hodson and Marvin 2010, p. 478). This increases the pressure on cities to find new formats to engage different stakeholder groups.

Overall, in the case of the SIE-field 'City level competitions for sustainable energy' the answer for this questions feels a bit like turning the process upside down. Instead of starting from bottom-up development among single initiatives, city competition formats emerged out of existing institutional structures, aim towards a more flexible engagement of divers groups and do not tend to institutionalize in separate structures.

Reflections on the main research question (base on answering the minor ones)

No additional reflections.



5.4.2 How do SIE-field-actors and other field-actor interact with the ‘outside’ institutional environment and thereby co-shape the SIE-field over time?

Which institutions (regulative, normative, cultural-cognitive) within the ‘outside’ institutional environment have shaped (including enabled/impeded) SIEs and its SIE-fields (and how)?

The formation of city level competitions for sustainable energy is influenced by different forms of institutions that can be enabling as well as impeding the development of the SIE-field.

First of all, **regulative institutions**, such as laws or other policies, are by many interviewees described as rather impeding factor rather than enabling. This is the case because they are often experienced as insufficient for preventing climate change. When it comes to activities on the city level, local policy makers can only partly influence these regulative institutions, which can make them an **impeding** factor. On the other hand, and, in a rather discursive and normative sense – institutions are starting to manifest in political declarations and thereby encouraging policies. Especially the Leipzig Charter for Sustainable Urban Development can be seen as a milestone for activities on the city level and increased political support from the national level for local governments.

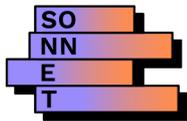
Furthermore, changes in **normative and cultural** institutions are **enabling** the field development, for example changing urban planning approaches, which encourage the development of different formats to engage citizens in competitions or a changed self-perception of city administrations in the global context (see: Barber 2014). City level competitions for renewable energies are also encouraged by a new sense of responsibility of civil society actors to get engaged and motivate others to rethink energy behaviour. Here, competition formats with more playful approaches purposefully aim at developing scenarios ‘outside cognitive routines’ (see Interview DE_CLC_01). This means that these (playful) competition formats explicitly target changes in **cultural-cognitive** institutions and encourage to change existing behavioural patterns.

What are the key events, external shocks, trends and inter-field interactions that enable/ impede SIEs and its SIE-fields (now and in the past)?

Some of the key events, external shocks, trends and inter-field interactions that have **enabled** the SIE-field over the past ten years are (is like not to be a comprehensive list):

Table 10: key enabling events, external shocks and trends in the SIE-field City level competitions for sustainable energy in Germany

Key events	External shocks	Trends
Leipzig Charter for Sustainable Urban Development (2007)	Fukushima nuclear catastrophe (2011) encouraged engagement in renewable energy	'Fridays for Future' movement (starting in 2018) encourages taking responsibility for renewable energy



Basque declaration on 'new pathways for European cities and towns' (2016)		New self-perception of city administrations and encouraged engagement for global problems
Awards on the European level such as the Green Capital Award		

Some of the key events, external shocks, trends and inter-field interactions that have **impeded** the SIE-field over the past ten years are (is like not to be a comprehensive list):

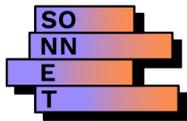
Table 11: key impeding events, external shocks and trends in the SIE-field City level competitions for sustainable energy in Germany

Key events	External shocks	Trends
Failure of smart-meter implementation impedes competition formats based on smart energy measurement	Financial crisis limits financial possibilities of cities to engage in developing renewable energy competition formats locally	Resignation concerning the lack of political narratives, activities, etc. (impeding on one hand but also increasing motivation of SIE-actors to engage)
	Corona Pandemic made larger face-to-face competitions impossible	

Further SIE-field events can be found in detail in the timeline of the case study report. The timeline of the case study report further differentiates between policy events on the national and international level as well as between competition formats on the national as well as international level.

How (if so) have the SIEs and their SIE-fields and 'outside' institutional environment been shaped by these events, external shocks, trends and inter-field interactions (now and in the past)?

One external development that influenced the SIE-field 'City level competitions for sustainable energy' in an **enabling** way is mentioned by several interviewees, which is the '**Fridays for Future**' movement. Several interviewees named this youth movement as an important cause of change. This is especially the case because 'Fridays for Future' triggered a new sense of individual responsibility and new pressure on topics around sustainable change (see Interview DE_CLC_05 and DE_CLC_07). This social movement is thereby part of a broader socio-cultural institutional shift but also directly caused concrete activities. For example, for one initiative called Hackerstolz e.V. the 'Fridays for Future' movement was the starting point for getting engaged in a local Climathon competition – a hackathon that aims at developing solutions for climate related problems. Hackerstolz e.V. engaged as local organizers of this competition and promoted the format in a German city. For another initiative, the German sustainability award (Deutscher Nachhaltigkeitspreis), the Fridays for Future movement caused a significantly higher engagement of actors in their competition formats. The willingness of participating



municipalities to invest in activities around sustainable energy since then significantly increased (see interview DE_CLC_07).

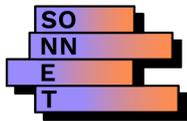
Next to this social movement several external developments shaped **energy policies** in Germany and therefore the role of local governments in energy transitions. Especially in the beginning of the century, the failure to reach sustainable development goals created a discouraged political mood, as one interviewee describes it: *“The 2000s started out very, very discouraged. Somehow, everyone thought: My God, we have just missed the Millennium Development Goals. How is all of this supposed to continue? Climate change is advancing. We overuse our resources. We experience increasing social problems and so on and so on. It was a very discouraged mood [...]”* (Interview DE_CLC_07). The **failure of nation states** to reach climate protection goals can be regarded as an **impeding** factor for the overall development of sustainable energy pathways. However, it also **encourages a new sense of responsibility of local** governments and local actors. (Playful) energy competition formats on the city level can be interpreted as a reaction to this discouraged political mood.

What have been the most important alliances/ networks/ collaborations SIE-field-actors and/ or other field-actors that emerged from these events, shocks, trends, and inter-field interactions (when, how and for what reasons)?

The two SIE-initiatives studied in-depth for this case study are good examples of alliances and collaborations that emerged out of the external developments described above.

First, the competition **‘Deutscher Nachhaltigkeitspreis’** (German sustainability award) was founded in 2008. The initiative describes the motivation for establishing the award as a response of the ‘discouraged political mood’ at the beginning of the century. It is organized by a foundation that is registered under the same name. The foundation gives awards to different actors such as start-ups or designers. Since 2012, one competition format is organized especially for municipalities. It brings together city administration actors that compete for winning up to 30,000€. Furthermore, research institutes, federal ministries and private companies are involved in organizing and supporting the competition. The final award ceremony is described as a glamorous event that offers good visibility and recognition to the winners and provides a **platform for networking**.

Second, a member of the local organizer of a competition in Mannheim describes the ‘Fridays for Future’ movement as starting point for their engagement in a local **‘Climathon’** competition. ‘Climathon’ is a ‘hackathon’ (a collaborative software and hardware development event) for problems related to climate change. The aim behind the development of this competition format is to develop (technical) solutions for solving pre-defined problems (challenges) in the context of climate change. This event is organized by a local organization together with the city of Mannheim, local organisations and sponsors and is open for volunteers to develop solutions for predefined problems together. The event in this sense provides a platform for **informal local networking** activities. Since the first Climathon competition in 2019, the event is now repeated annually.



How have the SIE-fields co-evolved with the policy context (if so) (and what was the relative importance of the urban, regional, national and European level)?

The SIE-field 'City level competitions for sustainable energy' is influenced in two different ways by policies on the national and international level.

First, a **lack of stringent policies on the national level** is considered to be the **starting point for local engagement**. Initiatives e.g. claim a discouraged political mood (see interview DE_CLC_07) or miss a political narrative (see interview DE_CLC_05). As a reaction to this, local governments and initiatives start engaging in developing different competition formats to create new motivation for sustainable energy issues.

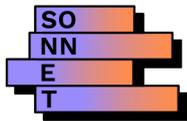
Second, policies especially on the **international level increasingly encourage the responsibility of local governments**. This development started with the Agenda 21, developed after the United Nations Conference for Environment and Development in Rio in 1992 which identified the local level as key to address activities for sustainable change (United Nations 1992). The discourse on cities' roles in sustainability transitions since then changed from framing cities as sustainability problems to understanding cities as sustainability solutions (Angelo and Wachsmuth 2020). A further milestone for this development was the Leipzig Charter in 2007. This initiative by the ministers responsible for urban development in the EU Member States highlighted the role of local engagement for sustainability and the role of knowledge exchange in and between cities (BMUB 2007). As a result of the increasingly important role of local governments, the pressure for cities to find new ways of solving problems related to sustainable energy increases. Competition formats are one answer to motivate a larger group of actors to engage in activities related to sustainable energy.

How are which power relations (such as inequality, exclusion, oppression, exploitation, injustice) being transformed and/ or reproduced by the SIE-phenomenon under study? (and vice versa – how are SIEs enabled and impeded by power relations?)

City level competitions for sustainable energy contribute to changing social relations insofar as they aim to encourage different stakeholder groups, such as citizens, different administrative units or private business, to engage in energy transitions on the local level. This process contributes to **transforming** power relations, especially due to the increasingly important role of local governments to contribute in shaping energy transitions locally and due to an increased sense of responsibility and engagement of citizens.

However, the shaping of competition formats and the decision about the 'rules of the game' take place within existing structures and power relations, e.g. inside the academic 'filter bubble' as described by one interviewee (see interview DE_CLC_04). This is described as participation-dilemma, when seemingly open formats rather **reproduce** existing power relations between top-down decision makers and the bottom-up initiatives participating in competitions, which are then judged according to these criteria.

Even if competition formats are encouraging the development of new ideas and the engagement of different stakeholders, the adaptation of new ideas still strongly depends on political will and local government support (see interview DE_CLC_04). An example for this is the Hackathon event 'Climathon'. It aims to develop ideas for concrete problems related to climate



change on the local level. The implementation of these ideas (such as local platforms to organize bike-sharing, or to measure energy consumption in local buildings or many more) however depends on formal policy-makers to decide over them and implement concrete activities. This examples illustrates the **limits** of the SIE-field to transform structures.

Reflections on the main research question (base on answering the minor ones)

No additional reflections.

5.4.3 What are the enabling and impeding factors for the SIE-field-actors and other field actors to conduct institutional work and change the 'outside' institutional environment?

How, why, and where do SIE-field-actors and/ or other field-actors conduct activities linked to creating, maintaining and transforming institutions?

Institutional work refers to the activities of actors that aim to create, maintain and disrupt institutions. In the context of the SIE-field 'City level competition formats for renewable energy' institutional work refers to activities that target the development of alternative scenarios supporting sustainable energy pathways, networking and the knowledge exchange through best-practice examples and the development of new standards to measure energy behaviour.

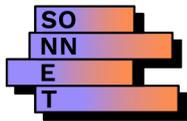
City administrations, associations, civil society actors engaged in the SIE-field of 'city level competitions for sustainable energy' are working towards **transforming** institutions by developing and testing new scenarios in playful competition formats, which allow for thinking 'out of the box' (see interview DE_CLC_01). The formats developed by SIE-actors are aimed at taking the topic of sustainable energy out of the niche, making it 'glamorous' and therefore allowing to mainstream it (see interview DE_CLC_04).

The focus of institutional work within the SIE-field under study lies on activities of relational work like networking and knowledge exchange. SIE-field actors contribute to **creating** institutions insofar as they establish new competition formats such as the award 'Klimakommune des Monats' (climate municipality of the month) organized by the Renewable Energies Agency since 2008. These competition formats serve as networking platforms, connect projects and people and inspire learning.

However, institutional work furthermore relates to **maintaining** institutions insofar as existing responsibilities and power relations are limiting changes in actor relations. One interviewee describes this as 'participation dilemma' (interview DE_CLC_04) when seemingly open formats rather reproduce existing power relations between top-down decision makers and the bottom-up initiatives participating in competitions.

Who is involved in conducting institutional work (and who is not, and why not)? Which actors benefit from this work (or not)?

Different actors such as city administrations, associations and civil society actors are involved in different aspects of conducting institutional work. Motivations for members of city administrations to network are mostly related to **relational work** such as knowledge exchange



and best-practice learning. Competition formats between cities encourage relational work by providing platforms and organizing events that allow to exchange experiences among peers. Furthermore, institutions are transformed through **symbolic work** by developing new scenarios, 'thinking out of the box' and motivating engagement. This kind of institutional work cannot be clearly related to a certain type of actor. Local associations, civil society groups, city networks and city administrations can be part of this aspect of institutional work. The role of city administrations can however be twofold. While some members of the administration might be very active in conducting institutional work, administrative structures can also be a major impeding factor that slows down processes, as mentioned by one interviewee. Furthermore, scarce resources are a clear limit for conducting institutional work, e.g. most of the municipalities that are engaging in networking around competition formats between cities are located in Western Germany while many Eastern German cities are still dealing with structurally less advantaged situations.

What have been the most important activities linked to creating, maintaining and transforming institutions? Outline these activities through describing 2-4 examples.

Example 1: As outlined above, the most important aspect of transforming institutions (mainly cultural-cognitive institutions) refers to taking sustainable energy out of the niche, mainstreaming it and making it a fun topic. As one interviewee describes it: "This aspect of fun is very important. It promotes learning processes and generates ideas" (see Interview DE_CLC_01). Examples of activities related to this aspect of institutional work can be found in a variety of initiatives. For example, one SIE-initiative developed a board game that encourages sustainable ideas (see Interview DE_CLC_01), the initiative 'Deutscher Nachhaltigkeitspreis' organizes a glamorous award ceremony (see Interviews DE_CLC_04 and DE_CLC_05) and the 'Climathon' competition is based on creating a shared experience, helping each other and having fun doing so, rather than competing against each other (see Interview DE_CLC_05).

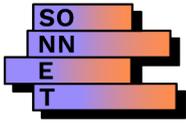
Example 2: What furthermore contributes to creating institutions are networking activities between cities. These networking activities can be encouraged by competition between cities that provide the opportunity for best-practice learning. In many cases, the creation of new competition formats derived out of these networks is organized with the help of city networks, e.g. the transformative action award co-organised by ICLEI.

What forms do these activities linked to maintaining, creating and transforming institutions take (e.g. emotion work, boundary work, strategy work, practice work and/ or values work)? Link back to the 2-4 examples

The mentioned aspects of institutional work such as emotion work, boundary work or strategy work have not been studied as part of the case study 'City level competitions for sustainable energy'.

What factors have enabled and/or impeded institutional work? E.g. Resources, learnt lessons and competences connected to actors/ alliances/ networks/ collaborations. Link back to the 2-4 examples

Institutional work in the SIE-field 'City level competitions for sustainable energy' was influenced by a number of different factors such as societal trends or urban governance structures. One overall factor influencing institutional work related to the SIE-field 'City level competitions for



sustainable energy' are the availability of resources. On the one hand, scarce time resources can impede the participation in competition formats. On the other hand, especially in the case of competitions between cities, the prospect of financial awards can be an important motivation to participate in competitions.

Example 1: A major enabling factor according to several interviewees were supporting societal trends which increased the engagement of city administrations, citizens, associations and other actors to engage in competition formats for renewable energy. According to interviewees, especially the 'Fridays for Future' movement triggered a new sense of responsibility and new pressure on the topic of renewable energies. For one SIE-initiative studied in-depth, the movement was described to be the starting point for their engagement in a local competition format and therefore also the starting point for closer cooperation with city administrations and other local actors.

Example 2: One factor that is impeding institutional work around 'City level competitions for sustainable energy' are institutional structures on the level of city administration. As outlined above, city administrations have to be seen as central actors on the SIE-field under study, either due to their role in organising or in participating in city competitions. On the city level, especially the slow progress within city administrations and in coordination between different administrative units is described as a key problem. According to one interviewee working on a competition format that takes place between members of the city administration, it can be frustrating and complicated to involve different municipal actors (see interview DE_CLC_06).

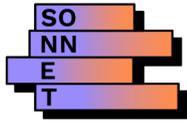
What have been intended and unintended effects (i.e. contributions) derived from conducting institutional work? What influence have they had on SIE-field and 'outside' institutional environments? Link back to the 2-4 examples

Unintended effects of institutional work were not in focus of the analysis of this case study. However, one interviewee describes that cities often gain attention and recognition through participating in national or European competition formats or gain awards. While this recognition of a wider scope is certainly an intended effect, some cities less expect that the award also helps to open a conversation within the city. "We often get the feedback from cities where they say that like, lots of citizens in our city weren't really fully aware of what we were doing, but then we won this award. And then there were like hundreds of news articles looking at our work. And it opened up a new conversation in this city" (Interview DE_CLC_04)

On the other hand, the competition formats can easily create a 'participation-dilemma'. This means that seemingly open formats rather reproduce existing power relations between top-down decision makers and the bottom-up initiatives participating in competitions. For example, this is the case when the 'rules of the game' are defined according to standards that reproduce structural differences within or between cities (see Interview DE_CLC_04).

Reflections on the main research question (base on answering the minor ones)

No additional reflections.



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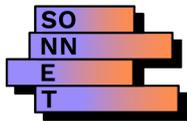
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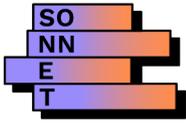
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7 APPENDIX: THREE CASE STUDY REPORTS

Each case study has the following structure:

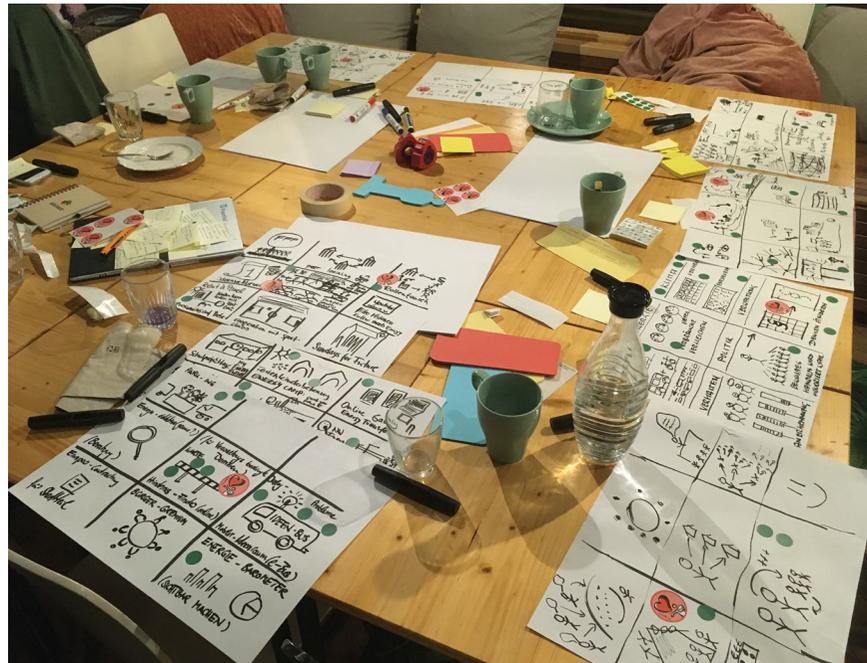
- Key insights
- Introduction to the SIE-field
- Timeline of the development of the SIE-field
- Historical account of the emergence and development of the SIE-field
- Conceptual boxes (blue boxes)
- SIE-initiatives (other boxes)
- Recommendations for our city partners, national and EU policymakers and SIE practitioner
- List of references
- Description of methodology
- More detail SIE-field timeline

SONNET – SOCIAL INNOVATION IN ENERGY TRANSITIONS

Co-creating a rich understanding of the diversity, processes, contributions, success and future potentials of social innovation in the energy sector

GA#: 837498 / Funding type: RIA

Research report on Participatory Incubation and Experimentation in Germany



Cover photo: © Karoline S. Rogge

About SONNET:

SONNET is a research project that aims to develop an understanding of diversity, processes, contributions and future potential of social innovation in the energy sector. It is co-funded by the European Commission and runs for three years, from 2019-2022. The SONNET consortium consists of 12 partners across Europe, including academics and city administrations. For more information, please visit our website: <https://sonnet-energy.eu>

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Date:

14th June, 2021

Authors:

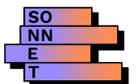
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1 FORWARD

SONNET (Social Innovation in Energy Transitions) brings diverse groups together to make sense of how social innovation can bring about a more sustainable energy sector in Europe. The project aims to co-create a rich understanding of the diversity, processes, contributions, successes and future potentials of social innovation in the energy sector (SIE). We define SIE as combination of ideas, objects and/ or actions that change social relations and involve new ways of doing, thinking and/ or organising energy. As part of this work, we make use of an embedded case study approach to build a better understanding of the development of diverse SIE-fields (e.g. participatory incubation and experimentation, framings against specific energy pathways, local electricity exchange) over time. Our research questions that frame the case study work are:

- How do SIEs and SIE-fields emerge, develop and institutionalise over time?
- How do SIE-field-actors and other field-actors interact with the 'outside' institutional environment and thereby co-shape the SIE-field over time?
- What are the enabling and impeding factors for SIE-field-actors and other field-actors to conduct institutional work and change the 'outside' institutional environment?

A SIE-field is an arena/space that includes a specific SIE as well as SIE-field-actors working on it and other field-actors enabling and/or impeding it. In this arena/ space these actors take one another and their actions into account and have a shared (but not necessarily consensual) understanding of a SIE and of their relationship to other actors. They recognise (but not necessarily follow) shared norms, beliefs and rules. SIE-fields are often not homogenous but are composed of actors with diverse and contradictory aims and interests. An example: The UK cooperative energy field includes SIE-initiatives and SIE-field-actors (e.g. Brighton Energy Co-op, Cooperative UK, Community Energy England, UK Government, City of Brighton), who have a shared understanding of an SIE, which exists as 'organising under cooperative principles to generate renewable energy'.

The structure of this report is as follows. Section 2 provides a summary of the SIE-field relevant for this report and lists some key insights. Section 3 outlines the boundaries of the SIE-field and shows how it has been studied in the country context. Section 4 shows a visual development of the SIE-field. Section 5 tells the historical development of the SIE-field over time, including analytical/ interpretive reflections from the SONNET researchers and quotes from the actors involved in the field developments. Section 6 outlines key research findings, providing answers to the three research questions. Section 7 outlines recommendations for policymakers based on the findings. Finally,

Section 9 outlines the methodological approach and includes a more detailed timeline of the SIE-field and its actors.

The following boxes are used within the report:

Conceptual work
...

Introduction to SIE-initiative
...

2 Participatory Experimentation and Incubation in Germany

In SONNET, we investigate the development of the SIE-field called 'participatory experimentation and incubation', i.e. multi-actor, collaborative formats that aim to experiment with and/or try out novel energy solutions in specific (local and temporal limited, project-like) settings. This report analyses formats that bring together actors from different societal spheres to collaborate (rather than to have a dialogue only) in a project-like setting. To qualify, a collaboration needs to be considered by at least one of the actors as an 'experiment' meaning that it aims at testing, investigating or trialling a specific solution and/or clearly aiming at learning from putting certain solutions in practice. To be included in this report, the experimentation clearly focuses on energy topics and takes place in Germany. Although terms and concepts are often not clearly defined, we could distinguish and trace the developments of at least five collaborative multi-actor experimentation formats during the last twenty years.

Key insights

For the SONNET project, Participatory Experimentation and Incubation is particularly interesting because through its aim to bring diverse stakeholder groups together to develop energy-related topics and its close interlinkage with national energy policies, it reveals a number of important issues for social innovation in energy transitions. In particular, it illustrates that:

- The SIE-field development in Germany is based on a long tradition of bottom-up claims for participation e.g. through grassroots movements or protests against specific (urban) planning projects. These bottom-up protests are rooted among others in the 1970s and 1980s anti-nuclear protests as well as in protest for participation in urban development projects that came up as a reaction to the technocratic planning approaches which dominated urban planning until the 1960s and 1970s. These bottom-up claims for participation strengthened socio-ecological and transdisciplinary research approaches and, in the beginning of the 2000s, inspired national research programmes for sustainable development (FONA¹).
- Energy related research and development projects in Germany are, however, traditionally rather technology concentrated. They build on a strong belief in progress and economic growth through technological innovations. Research and Development (R&D) policies in Germany for a long time concentrated on key technologies. However, developments such as the failure of smart meter implementations and the often quite critical public perception of

¹ FONA: Forschung für nachhaltige Entwicklung (Research for sustainability), see: <https://www.fona.de/en/>

wind projects were important turning points that encouraged research programmes, which aimed at integrating user perspectives in R&D projects.

- As the SIE-field in Germany is strongly linked to national R&D policies, it is also strongly institutionalised. Today, 1) participatory and transdisciplinary research for sustainability (funded by BMBF²) and 2) the development of new energy technologies which are now also aiming to integrate different actors in innovation processes (funded by BMWi³) are slowly moving towards similar targets. Examples are large scale projects like the BMBF funded Kopernikus project, which integrated 'Reallabor'-approaches or the BMWi funded energy program that stresses the importance of 'Reallabore' for energy research. Even if there is ongoing competition between BMBF and BMWi funding approaches, they are currently converging in the format of 'Reallabor' (real world laboratory) for energy transition research. It is important to notice though, that the approach of 'Reallabore' reach beyond the integration of different actor groups. Another aspect is to consider real market conditions or regulatory exception clauses. The 'Reallabor'-approaches might differ largely depending on the aims of the projects.
- While the SIE-field of participatory incubation and experimentation institutionalises around the concept of 'Reallabore', lab approaches are also diffusing and start blurring the lines between research and innovation projects for energy transitions (public interests) and lab approaches used by private actors to investigate consumer behaviours in short term project settings.
- While the multi-actor formats in which learning happens bring different stakeholders together, only recently approaches emerged, which integrate policy learning in these settings and it remains difficult to integrate policy actors into these settings.

² BMBF - Bundesministerium für Bildung und Forschung (Federal Ministry of Education and Research)

³ BMWi – Bundesministerium für Wirtschaft und Energie (Federal Ministry for Economic Affairs and Energy)

3 Introduction to Participatory Incubation and Experimentation in Germany

This report investigates the development of the SIE-field 'participatory experimentation and incubation' and its social innovation in the energy sector (SIE, see analytical box 'SIE changing social relations' below). This SIE-field stands for multi-actor, collaborative formats that aim to experiment with and/or try out novel energy solutions in specific local settings. It includes formats that bring together actors from different societal spheres to work together (rather than to have a dialogue only) in a project-like setting. To qualify, a collaboration needs to be considered by at least one of the actors as an 'experiment' meaning that it aims at testing, investigating or trialling a specific solution and/or clearly aimed at learning from putting certain solutions in practice. Such experimentation focuses on energy topics and within SONNET is researched in Germany, Poland and the Netherlands & Flanders.

SIE changing social relations

In the context of the SONNET project, social innovation in the energy sector (SIE) are defined as 'a combination of ideas, objects and/or actions that change social relations and involve new ways of doing, thinking and/or organising energy' (Wittmayer et al. 2020b, p. 4). In order to observe the diversity of SIE, the SONNET project first developed a typology of contrasting SIE (Wittmayer et al. 2020a). One identified type of SIE is called 'participatory incubation and experimentation'. A main characteristic of this type is that activities focus on organising experimentation and incubation of ideas and/or technology (as object) through multi-actor constellations, including different actors across society like researchers, policy makers, private companies or citizens. Insofar, changing social relations is at the core of these formats as they explicitly aim for changing innovation processes by integrating different stakeholders in research and innovation settings.

In the German context, multi-actor collaborative formats have been referred to as e.g. labs, living labs, urban labs, regulatory sandboxes⁴, showcases or 'Reallabore' (real-life laboratories). The term Reallabore so far is used mostly in Germany (McCrory et al. 2020) and describes an hybrid form of experiments between generating and applying knowledge (Schneidewind 2014, p. 2). The term might also be interpreted as a pendant to the German expression 'Realpolitik', emphasising that research has to be closely interlinked to the conditions of the real world (see Interview DE_PIE_1). These relatively young terms are, however, often neither clearly defined (Parodi et al. 2016) nor used in a consistent way and there is still ongoing change in naming and framing experimental approaches (see Interview DE_PIE_1). Changes in these formats refer to: 1) the actors involved (e.g.

⁴ In German often also referred to as 'Reallabore'

energy and technology companies, research institutes, citizens, municipalities, foundations), 2) the roles of actors (e.g. citizens as test users vs. citizens as generators of ideas, policy actors as funders vs. policy actors as learning actors), 3) the aims of experimentation (e.g. testing and experimenting with technologies vs. testing and experimenting with regulations, integrating user perspectives in experiments vs. users generating the ideas of change), 4) the representation or integration of 'real world settings' into these formats (e.g. experimenting within in real-world market conditions and regulatory settings vs. experimenting in controlled test environments or representations of the real world in settings), 5) the geographical and temporal scope of activities and degree of local embeddedness. However, what links these formats is that 'these hybrid arrangements [are] framed as settings, where radical alternatives can be co-produced and shaped in limited space and time' (McCrorry et al. 2020).

In Germany, the development of these experimentation formats is based on a long history of a) participatory approaches, which especially emerged in the context of urban development and inspired transdisciplinary research approaches for sustainable development and b) technology focused research and innovation funding programmes for sustainable energy. In the beginning of the 2000s, approaches emerged, which aimed at integrating user perspectives in technology development projects. In 2004, the term 'living lab' first appeared to describe these forms of test environments for innovation processes, which were soon picked up in German research and innovation programmes. These early living labs, are to be understood as material arrangements or experimentation and innovation infrastructures (see Interview DE_PIE_1). At the same time, in the later 1990s and early 2000s, transdisciplinary approaches for socio-ecological research emerged in the social sciences. Since 1999, the German Federal Ministry of Education and Research (BMBF) funds the transdisciplinary programme 'research for sustainable development' (FONA). In contrast, the Federal Ministry for Economic Affairs and Energy (BMWi) concentrated for a longer time on funding the development of key energy technologies. Several developments such as the failed implementation of smart meters' technologies (due to lacking societal support) or the difficulties around the acceptance of wind farms influenced a shift towards a better and earlier integration of user perspectives in innovation processes in BMWi funded projects. In 2018, the BMWi strategy and funding programme 'Reallabore der Energiewende' (real world laboratories of the energy transition), was launched. Next to other aspects, it makes use of lab approaches to systematically integrate multiple stakeholders in R&D processes.

In the German context, lab-approaches have been picked up by diverse actors such as municipalities, foundations, private companies and energy providers. In some cases, (e.g. concerning labs carried out by municipalities), these approaches include educational as well as participatory aspects and try to raise awareness for energy or sustainability related problems. At

the same time, however, lab-like formats are also contributing to blurring the boundaries between public engagement and private interests. While 'living labs' first described a form of research projects with a certain degree of public interest, the term later diffused to more market oriented private companies (see Interview DE_PIE_1). Here the term 'lab' more generally refers to temporal and spatially bounded projects, which integrate user perspectives and not necessarily have to include research partners (see Interview DE_PIE_3). What links these formats is, however, the recognition that energy, or more generally, sustainability transitions are to be understood as highly complex processes. Developing, planning and implementing solutions must therefore also 'represent' these complexities, as one of our interviewees describes it: *"Well, if anyone says that they know how to mechanically implement the policy, then they're either lying or they don't know what they're talking about. Because if you just open your eyes to see it, well, there's so many moving parts in this system. It's so fluid, but also so much friction as so many kind of bushfires that can start that. No way you can do it without moving forward in a kind of an open experimental approach"* (Interview DE_PIE_2).

The innovation history of the SIE-field 'participatory experimentation and incubation' outlined in this report covers the development of different multi-actor collaborative experimentation formats in Germany during the period between 2000 and 2020.

We started this innovation history in the year 2000 because one important early milestone is the birth of the term living lab and its introduction to the German context. The birth of the term is 'ascribed to MIT's prof. dr. Mitchell, who used it to refer to a purpose-built lab where the routine activities and interactions of everyday home life can be observed, recorded for later analysis, and experimentally manipulated [...]' (Ballon and Schuurman 2015). This concept was picked up in Germany in the early 2000s, however the transdisciplinary research programme FONA (research for sustainability), starting in 1999, already laid the foundation for experimental and collaborative multi-actor formats in energy related R&D policies. Therefore, this innovation timeline starts around 2000 and traces different formats. This is especially difficult as terms are in most cases neither clearly defined nor used in a consistent way. Furthermore, one characteristic of the SIE-field development is that approaches are starting to diffuse to different contexts, blurring the line between R&D projects with public funding interest and diverse private interests (see analytical box: Key changes in the SIE-field over time, page 14f). However, for this report we mainly concentrate on experimental formats and concepts linked to R&D policies and traced their changes and how these changes contributed to blurring the lines between different formats.

The table below gives an overview of the five different formats, including central terms and concepts

and provides definitions or explanations by actors involved. Even if more terms exist to describe lab-like settings, we focus on the following five concepts which play a key role in the German context and can relatively well be distinguished from one another.

Format	Actors	Aims	Definitions and example
Living Labs (no German translation)	<ul style="list-style-type: none"> Academic researcher Users Businesses 	Integration of user perspectives in technological innovation processes	<p>'A user-centric research methodology for sensing, prototyping, validating and refining complex solutions in multiple and evolving real life contexts' (Eriksson et al. 2005)</p> <p>Originally not necessarily focused on energy related topics but e.g. on ICT technologies or consumption behaviours; concept picked up for energy research</p> <p>Energy related example in Germany: Living Lab Walldorf (see: www.living-lab-walldorf.de)</p>
Urban labs (Stadtlabor)	<ul style="list-style-type: none"> Academic researchers Citizens and civil society actors (Local) policy makers (Local) businesses 	Participation in energy transitions and awareness raising in local urban contexts	<p>'Urban labs ... explore alternative futures in a collective approach, without fixed ideas or preconceived solutions... provide opportunities for diverse and marginal actors to participate in and influence processes and activities... are hybrid niches positioned at the boundary between local administration and society... have transparent leadership and organizational structures tailored to specific goals and local conditions... carry out time-limited experiments with the ambition of creating long-term relationships... aim to maximize learning from lab experiments by multiple actors ... co-create public values, distributed transparently and fairly... disseminate and anchor lab lessons throughout urban governance structures' (Scholl et al. 2017)</p> <p>Focus often on broader sustainability issues than on energy (technologies) only, transdisciplinary approach as key component as well as embeddedness in local context</p> <p>Energy related example in Germany: urbane Wärmewende (urban heat transition), Berlin (see: www.urbane-waermewende.de)</p>
Showcases (Schaufenster)	<ul style="list-style-type: none"> Academic researcher National, regional, local governments technology providers 	Large technology demonstration projects for new energy technologies	<p>'The idea behind it is to promote showcases in which you can actually show the application of digital technologies. It is more about the integration of renewable energies, but also about participatory concepts for promoting energy [technologies]' (interview DE_PIE_4).</p> <p>Development and demonstration of large scale technologies, especially concentrating on ICT technologies and the digitalization of the German energy system</p> <p>Example in Germany: SINTEG projects (see: www.sinteg.de)</p>

	<ul style="list-style-type: none"> • Grid operators • utilities 		
'Reallabore'	<ul style="list-style-type: none"> • Academic researchers • Policy actors • Civil society actors • Businesses 	Can be either technology or societal focused; real world contexts as key component	<p>'The idea of 'Reallabore' transfers the scientific term laboratory to the analysis of social and political processes. It is rooted in the experimental turn in social and economic sciences. There are close links to concepts in field and action research.' (Schneidewind 2014)</p> <p>Reallabore can either be technology oriented or focus on social and political questions. The concept saw its first larger scale implementation in 2015 in the German federal state Baden-Württemberg with their R&D funding programme 'Reallabore, BaWü-Labs' which included projects on energy but also many other topics in other sectors. In 2019, the new BMWi funding line 'Reallabore of the energy transition' started and shaped the term in a technological sense (see: https://www.energieforschung.de/spotlights/reallabore). In the same year, a network of sustainability oriented real world laboratories (Reallabore der Nachhaltigkeit) was founded by the Karlsruhe Institute for Technology (KIT), Leuphana University Lüneburg and Wuppertal Institute, following a broader societal approach (see: www.reallabor-netzwerk.de).</p> <p>Energy related example in Germany: Energielabor Tübingen (see: https://uni-tuebingen.de/einrichtungen/zentrale-einrichtungen/internationales-zentrum-fuer-ethik-in-den-wissenschaften/forschung/natur-und-nachhaltige-entwicklung/energielabor-tuebingen/)</p>
Regulatory sandboxes (no German translation, often also referred to as 'Reallabore')	<ul style="list-style-type: none"> • Academic researchers • Policy actors • Businesses • Users 	Regulatory and policy learning as important part of the experiment	<p>'[Regulatory] sandboxes mainly arise from experimentation or flexibility clauses in laws. Such experimentation clauses authorize the executive to deviate from the existing law by a predefined degree' (Bischoff et al. 2020).</p> <p>Still upcoming form of experimentation, integration of policy makers in experimental settings currently remains difficult in Germany.</p> <p>Energy related example in Germany: tender procedure for promoting renewable energy systems (see: https://www.ikem.de/wp-content/uploads/2018/06/20180719_WGB.pdf)</p>

Given that the innovation history described in this report takes the year 2000 as its starting point, it concentrates on the last 20 years of the development of the SIE-field 'participatory experimentation and incubation' in Germany. These developments are, however, nested in broader developments beyond the German context. These developments mainly consist of two strands: 1) the development of transdisciplinary approaches for social-ecological research and 2) changes in research and

innovation paradigms. These broader developments were important to lay the foundation for the later development of participatory experiment formats and are therefore briefly outlined here:

An important starting point for international attempts towards the development of socio-ecological research approaches for sustainability was the 1987 Brundtland report (World Commission 1987), which stressed the interconnected and complex nature of environmental problems and their possible answers (see Interview DE_PIE_6). While the foundation of transdisciplinary research for sustainability was rooted in the 1980s, especially the 1990s were key for increasing the role of citizens participation in developing answers to environmental problems (Di Giulio and Defila 2019). The 1992 UN conference on Environment and Development in Rio de Janeiro increased the global awareness for the need to take action towards sustainability and 'Agenda 21' identified the local level as key to address activities for sustainable change (United Nations 1992) – just as participatory formats later also highlight the importance of local approaches. The role of cities thereby changed and discourses starting to shift from framing 'the city as sustainability problem to the city as sustainability solution' (Angelo and Wachsmuth 2020). Indeed, urban contexts have been increasingly recognised to play an important role in increasing participatory claims, e.g. in the tradition of the IBA (international building exhibition)⁵, and city labs and urban experiments will later be seen as important building block for encouraging change towards sustainability (Bulkeley 2013; Hodson and Marvin 2010). In Germany, especially the German Advisory Council on Global Change (WBGU), established in 1992, can be seen as an important and 'paradigmatic' (Di Giulio and Defila 2019) milestone for acknowledging the interconnectedness of environmental and social issues. The WBGU also later influenced the SIE-field development with its report 'a social contract for sustainability' in 2011 (WBGU 2011), which emphasised the importance of a new interplay between politics, society, science and economy.

While the transdisciplinary approaches strengthened the acknowledgment of different types of knowledge in sustainability research (Di Giulio and Defila 2019), R&D policies adopted this development towards participatory and transdisciplinary research much later. As Schot and Steinmueller (2018) describe it, an early framing of 'innovation for growth' arose after World-War II, which built on 'a clear division of labour and responsibility' (Schot and Steinmueller 2018, p. 1557) between scientists, public and private sector stakeholders. A second framing of 'national systems of innovation' emerged in the 1980s and emphasised the role of 'sticky' tacit knowledge as well as the

⁵ During the 1970s the importance of the social dimension of urban planning increased (Häußermann et al. 2008) and later, the IBA 1987 Berlin played an important role in participatory urban planning approaches as it introduced the concept of 'cautious urban renewal' (behutsame Stadterneuerung) which ended the trend of large scale urban housing project popular since the 1960s. These developments of participatory urban planning also strengthened the role of the social sciences (Siebel 2010).

integration of users in innovation processes, even if their role was mainly seen in providing feedback (Schot and Steinmueller 2018, pp.1558–1559). Finally, a third framing of policies for 'transformative change' is emerging in the context of directing innovation to address sustainability challenges, with a key focus being an experimental approach and the integration of multiple actors in the innovation process (Schot and Steinmueller 2018, p.1562). This third framing clearly points towards the emergence of the SIE-field under study. In the German context, approaches which took the diffusion of knowledge into account appeared in the 1990s and inspired larger research programmes (e.g. the FONA programme) which are still continued today (Schot and Steinmueller 2018). However, integrated and cross-sectoral R&D policies were often missing (see Interview DE_PIE_7). At around the same time, in the 1990s, the first living lab formats appeared in Germany, such as the Distributed Artificial Intelligence Laboratory (DAI) which was founded in 1992 at TU Berlin or in 1998 the Fraunhofer InHaus in Duisburg (see Interview DE_PIE_1), many of those concentrating on ICT technologies (Ballon and Schuurman 2015). With these Living Labs, the first settings occurred, that used the term 'lab' to describe a space for experimental R&D approaches.

Rooted in these two strands of development, the integration of multi-actor experimental formats in energy related experimentation formats increased during the last five years and gained importance. In this report, we do however trace earlier steps that enabled these changes and the institutional structures which these developments are nested in, taking a closer look from the start in the 2000s.

'Outside' institutional environment shaping the development of the SIE-field

SONNET looks at the interactions and relations between actors, working on a SIE and a broader institutional context in which the SIE is nested in (Wittmayer et al. 2020b, p. 7). An empirical focus lies on the development of SIE-fields. Following Fligstein and Adam's field definition (Fligstein and McAdam 2011), an SIE-field within the SONNET project is understood as 'an arena/space that includes a specific SIE as well as SIE-field-actors working on it and other field-actors enabling and/or impeding it. In this space these actors take one another and their actions into account and have a shared (but not necessarily consensual) understanding of a SIE and of their relationship to other actors. They recognise (but not necessarily follow) shared norms, beliefs and rules. SIE-fields are often not homogenous but are composed of actors with diverse and contradictory aims and interests' (Hielscher et al. 2020, p. 17). While the SIE-field is constituted by SIE-actors and SIE-field-actors' activities, it is also influenced by the outside institutional environment, which can interact, shape, enable or impede the development of the SIE. This institutional environment is constituted by formal as well as informal institutions (Hielscher et al. 2020, p. 19).

The SIE-field 'participatory incubation and experimentation' is nested in broader societal trends such as increasing participatory engagement or protests for climate protection activities. These trends are influencing the SIE-field. Furthermore, for the development of the SIE-field, a number of **external shocks** have been crucial: In the beginning of the 2000s investments in energy related research projects was comparatively low and focused on single technologies rather than on integrated socio-technical transitions. After the *financial crisis in 2008*, the German government started an investment programme for municipalities, which also helped investments in new energy technologies (see Interview DE_PIE_8). The *2011 Fukushima nuclear catastrophe* had a major influence on changing energy policies in Germany. It led to the decision for nuclear phase-out and the revision of the German energy concept. Energy related R&D funding significantly increased during the following years, leading to large scale projects for the energy transition such as the 'Kopernikus' projects⁶ (BMBF funded) or the SINTEG showcases⁷ (BMW funded – see table p. 9-10). This was a turning point insofar as energy research was not necessarily a subject of larger political debates (see Interview DE_PIE_8) and a more systemic approach to energy research started to develop. Also the *2015 migration 'crisis'* had an impact on the SIE-field development. As a reaction to the large amount of people in need arriving in Germany and the lack of administrative capacities to react to this, civil society actors started to get involved in significant ways. Much of these engagement happened on the local level in cooperation of NGOs, municipalities and individual citizens, This strengthened the overall engagement of citizens and the role of municipalities which later transferred to an increase of engagement also in the field of sustainability related activities (see Interview DE_PIE_2).

Concerning its **institutional embeddedness** - referring to the nested character of an SIE-field as being situated within larger institutional structures - the SIE-field builds on a long tradition of participatory engagement and a strong role of municipalities in the German federal system. Furthermore, the SIE-field is shaped by the institutional structures of German research and innovation policies as well as EU funding policies, e.g. in terms of depending on funding possibilities

⁶ See: <https://www.kopernikus-projekte.de/en/home>; „Just as Nicolaus Copernicus brought about a transformation of science and society by introducing the heliocentric model of the solar system, the Kopernikus projects aim to cause a paradigm shift – towards research projects that can prompt a transformation of our entire society [...] Economists, scientists, and civil society work in close cooperation in all of the projects. Together they develop solutions to the point of market maturity, in three phases spread over ten years [...]”

⁷ See: <https://www.sinteg.de/en/>; „The funding programme "Smart Energy Showcases – Digital Agenda for the Energy Transition (SINTEG)" comprises five large model regions known as showcases, in which model solutions for the energy supply of the future are developed and demonstrated. The focus of the programme is on digitalising the energy sector. More than 300 project partners are involved in the project, in which they seek to tackle the technical, business-related and legal challenges that digitalisation brings.”

for concrete activities. It is closely linked to R&D activities and thereby also to decisions of the national government, e.g. the nuclear phase out law after the Fukushima catastrophe in 2011 (BGBl 2011 I 43 S. 1704-1705) or the decision for the digitalisation of the energy transition in 2016 (BGBl 2016 I 43 S. 2034-2064). In terms of funding lines, especially the differences in the FONA-related BMBF funded research on societal questions and BMWi funded research for energy technologies influence the SIE-field. The tensions between the two approaches also represent more generally the debate on how transitions towards sustainability can be achieved: by either societal change or technological change. Participatory approaches so far only partially influenced this setting insofar as they also start to diffuse to technological oriented research activities. This seems to have been especially influenced by developments such as the failed implementation of smart meter technologies due to lacking societal acceptance among other aspects (see Interview DE_PIE_4).

To define the boundaries of the SIE-field, the experimental character of the multi-actor constellations under study is a key element. One important debate around the role of experimentation concerns the use of the term vs. the process itself: on the one hand, activities might be *labelled* as experiments in order to stress their innovative and inclusive character (e.g. by using the terms Living Lab, 'Reallabor' etc.; see table above). On the other hand, the process of experimenting with energy pathways is described as an important new way of encouraging change (see Interview DE_PIE_2). As this case study asks about the institutionalisation of the SIE over time, we therefore have to put the focus on "the institutionalisation of experimentation [which] sets contemporary activities apart from more broadly experimental approaches [...] practiced in previous decades" (Evans et al. 2018, p. 2). This does not mean that we are interested in the label more than in the modes and processes of experimentation, but rather, that the uptake of *experimental* approaches in energy related policies and energy research approaches is of key interest.

In doing so, we furthermore ask about key changes in energy related experimentation and the development as well as re-interpretation of experimental approaches in the German context. This especially concerns the changing role and integration of 'real world' contexts in experimental settings in the process of the institutionalisation of the SIE-field as well as the diffusion of the concept.

Key changes in the SIE-field over time

One of the central research questions and empirical foci within the SONNET case studies is to understand the development of the SIE and its SIE-field over time (Hielscher et al. 2020, pp. 15–18). We therefore take a 'process perspective' and investigate change through focusing on the

emergence of the SIE-field and the activities of SIE-actors shaping them (Wittmayer et al. 2020b, p. 33). For example, we look at external shocks, internal field events and key changes in the development of the SIE-field and its relationship with the 'outside' institutional environment (Wittmayer et al. 2020b, pp. 29–30). Moreover, changes in the SIE-field also concern changed narratives and societal trends that enable or impede the development of the SIE and its SIE-field.

In the case of the SIE-field of 'participatory incubation and experimentation' in Germany, we have identified two key changes in the SIE-field development. These are especially crucial to the development of the SIE-field, as they describe 1) the institutionalisation of transdisciplinary approaches in large nationally funded research projects as well as 2) the diffusion of these formats, which contribute to blurring the boundaries of the SIE-field. We have chosen these two processes as major changes as they describe how approaches have been taken up and (re-) interpreted by different stakeholders.

Firstly, lab approaches have been picked up by national ministries and influenced large scale funding programmes, such as the new BMWi programme 'Reallabore der Energiewende' (real world laboratories of the energy transition). While lab approaches first described innovation infrastructures for user-centric innovation as 'Living Labs' (Ballon and Schuurman 2015), the term was picked in Germany in sustainability oriented projects. In 2015, the first funding line for 'Reallabore' was launched in Baden-Württemberg (Wagner and Miller 2018). Since then, it inspired funding by national ministries and over time institutionalised as new state-of-the-art research format. What changed in this process was the integration of 'real world' contexts in research processes. While living labs focus on simulating real life conditions, the 'Reallabor' approach is rather oriented towards defining 'real-world' problems (see Interview DE_PIE_1) and gather stakeholders to create 'sound processes' for finding answers for real-world problems (Interview DE_PIE_2). Most interviewees describe this format as 'sexy' (see Interview 6), 'trendy' (see Interview DE_PIE_8) or part of the current 'Zeitgeist' (see Interview DE_PIE_1). In 2019, a network for 'Reallabore' was founded by the Karlsruhe Institute for Technology (KIT), Leuphana University Lüneburg and Wuppertal Institute. Also funding on the European level promotes the approach and is currently supporting research activities addressing 'energy citizenship' as well as 'transition super labs', which are described as promising avenue for tackling sustainability challenges.

Secondly, parallel to the increasing institutionalisation of participatory approaches in energy research, lab-like approaches have also been picked up by a number of different actors (such as private companies or energy providers but also municipalities and foundations). With changes in the actor constellations, in some cases, also the aims of these labs are changing. While the transdisciplinary character was originally in core of the lab-approach, in these newly emerging approaches the involvement of academic research partners is no longer a necessary condition (see

Interview DE_PIE_3). Some labs e.g. might rather aim for exploring market interests. Due to the lack of clear definitions, the concept thereby diffuses and often describes more generally temporally and spatially limited projects settings which are interested in analysing the interests or energy behaviour of citizens. In some cases, this might make it more difficult to distinguish between public and private interests around the analysis of energy behaviour (see Interview DE_PIE_1).

As the SIE-field is quite strongly linked to institutional structures of R&D policies and research activities, it was important to take the perspectives of actors involved in these institutional settings into account. Besides actors involved in SIE-initiatives, we identified two groups of actors as crucial for better understanding the development of the SIE-field over time, namely researchers with long term experiences in energy research and transdisciplinary research and actors involved in managing national and European funding frames. Besides interviewing SIE-field-actors, strategy documents, funding programmes and conference reports were, among others, important documents analysed for this report.

To get deeper insights in the formats, processes and actors involved, we exemplarily describe two SIE-initiatives and their development more in-depth. One is the '**Quartier Zukunft**' in Karlsruhe. This initiative is especially interesting to study in the context of the innovation history of the SIE-field, as it was part of the first German lab funding line for 'Reallabore' in Baden-Württemberg in 2015. The lab itself, however, was established already in 2011 and its founders were key actors in the establishment of the German network 'Reallabore'. Furthermore, with its embeddedness in an urban context and its open and participatory approach, it represents the transdisciplinary strand of the SIE-field development, which was inspired by urban participation attempts. The lab puts a focus on urban energy transformation pathways which are, however, one topic among other related topics such as mobility and climate change.

The second SIE-initiative under study is the Reallabor '**Energieavantgarde Anhalt**'. This 'Reallabor' was established in 2012 and aims for establishing a decentralised energy system in the region Anhalt-Bitterfeld-Wittenberg. Its multi-actor constellation includes municipalities, utilities, (energy) businesses, foundations and research institutes. It also aims for including citizens in an energy dialogue. Furthermore, this 'Reallabor' is linked to national energy innovation funding as it was involved in the SINTEG project WindNODE (funded by BMWi). Therefore, it represents the energy technology oriented strand of development of the SIE-field.

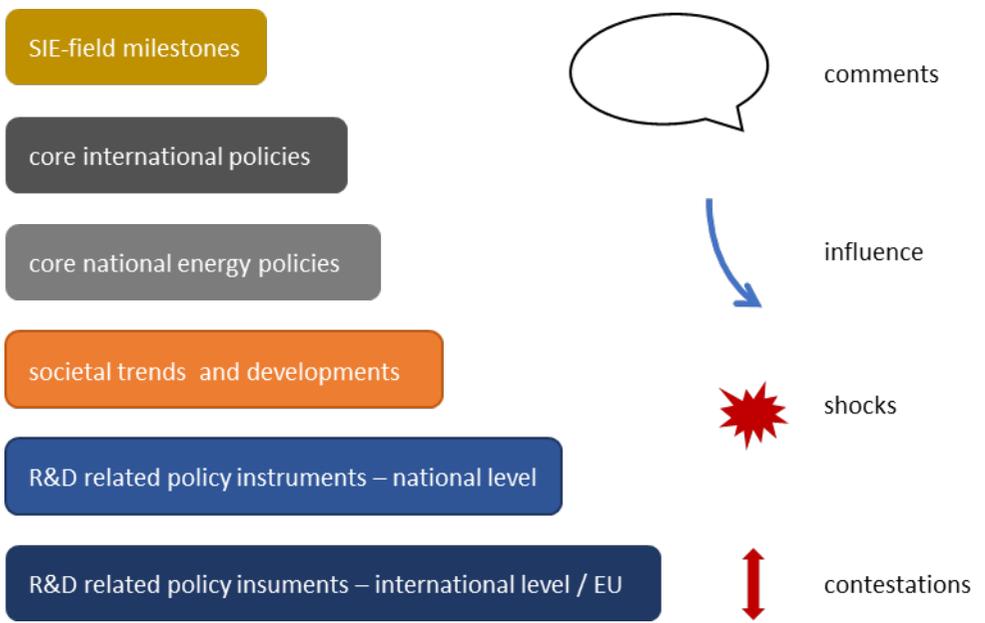
To summarise, for this report, we interviewed the following types of actors (8 in total):

- Actors involved in SIE-initiatives (2 interviews)
- Researchers involved in energy and transdisciplinary research (4 interviews)
- Actors involved in managing national and European funding frames (2 interviews)

The innovation history outlined in this report is structured around four phases:

- **PHASE A)** describes the early phase of SIE-field development in the beginning of the 2000s that laid the foundations for transdisciplinary formats, which were later picked up in more energy focused R&D policies.
- **PHASE B)** is characterised by small budgets for energy research which lasted until 2010. One important milestone in this phase is, however, the emergence of living lab approaches at the beginning of the 2000s that, at this time, were rather focused on single technologies.
- **PHASE C)** starts with the increase of activities around energy related R&D activities in 2010. It is closely linked to the development of larger frames for energy policies on the national level, such as the energy concept of 2010 and the decision for the nuclear phase out after the Fukushima nuclear catastrophe in 2011. In this phase, the term 'Reallabore' first appears in German research programmes.
- **PHASE D)** describes the current situation, which is characterised by the increasing institutionalisation of multi-actor collaborative formats for experimenting with alternative energy pathways. This is marked by a new BMWi-strategy for 'Reallabore der Energiewende', published in 2019, and the foundation of the network 'Reallabore' in the same year.

The next section, will present a visualisation of the innovation timeline. Thereby, the following colours and symbols are used to explain the SIE-field development:



4 Timeline of Participatory Incubation and Experimentation in Germany

This is a visualisation of the innovation history of participatory incubation and experimentation in Germany. An overview of the listed events can also be found in Appendix 2.

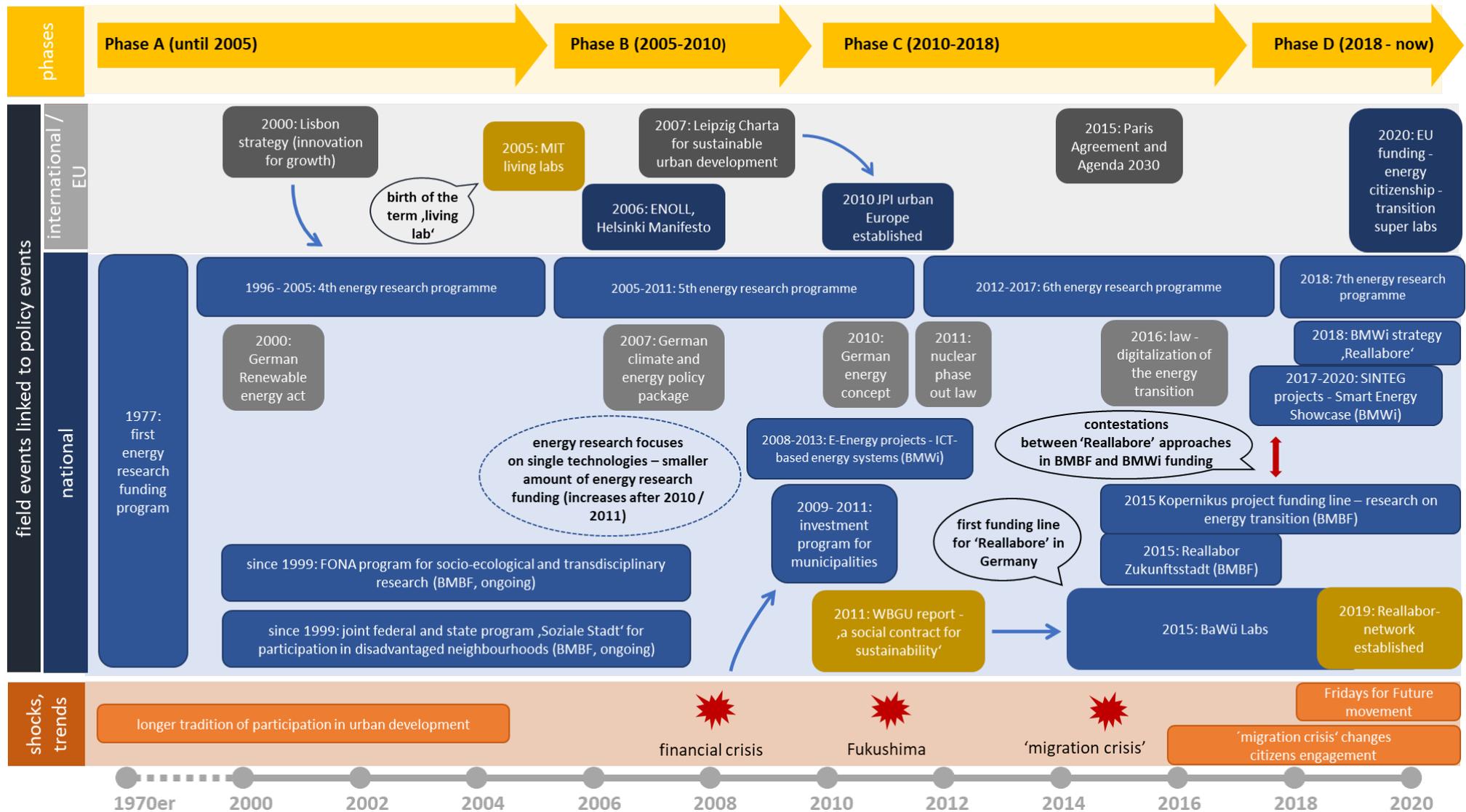


Figure 1: Timeline of Participatory Incubation and Experimentation in Germany

5 Emergence and development of participatory incubation and experimentation in Germany over time

The innovation history of the SIE-field 'participatory incubation and experimentation' in Germany is structured around four phases.

PHASE A: technological energy research and participatory formats as separated SIE-fields (2000-2005)

Looking at the development of the SIE-field, the starting point in the early 2000s is characterised by the existence of two separated SIE-fields: one focusing on the funding of technological energy R&D activities and the second on socio-ecological research activities. Participatory approaches at this time, were mostly present in the context of urban development projects.

Energy research was funded in Germany in a national funding programme starting in 1977 (first German energy research programme). The early programmes were concentrated on the aim of increasing economic competitiveness through providing low-priced energy. An important aspect to achieve this was seen in increasing R&D activities around nuclear technologies. Three separate phases are identified: research, development and demonstration, each of them was said to possibly taking 'decades' (BMW 2017, pp.10–21). In the beginning of the 2000s, the fourth energy research programme was running (1996-2005). It framed energy research activities in relation to the 1992 'Conference on Environment and Development' in Rio de Janeiro and to Germany's commitment to reduce CO₂ emissions (BMW 2017, p. 232). According to Geels (2020), the election of the 'red-green' coalition government in 1998 can be seen as 'landscape shock, which disrupted the cosy regime-level relations between utilities and policy makers' (Geels 2020, p. 15). With the 'Renewable Energy Sources Act' (EEG) in 2000 the generation of renewable electricity was encouraged through feed-in tariffs and complementary measures such as priority access to the grid (Agora Energiewende 2015). This was the start for enabling private households to become 'prosumers' and therefore an important part of the energy transition. Furthermore, the liberalisation of the electricity market from 1998 started to contribute to transforming and diversifying the actors of the German energy market (e.g. new actors entering the market such as green electricity provider or energy cooperatives; for further information on this process see SONNET case study report on energy cooperatives in Germany (Heidary et al. 2021)). During this time, however, only small amounts of funding were available for energy R&D activities. As one interviewee summarises it: *'At the beginning of the 2000s, or actually since the end of the nineties until about 2007, only small amounts of money were invested in energy research. Of*

course, this also left little room for greater accompanying socio-ecological research' (Interview DE_PIE_8).

At the EU level, the Lisbon strategy of 2000 was another turning point. It aimed for transforming the EU into a knowledge-based economy and society, and thereby also had an impact on increasing triple-helix⁸ collaborative arrangements, i.e. between research, business and policy (Hervás Soriano and Mulatero 2010). Furthermore, it encouraged investments in research activities, which also influenced the development of funding for energy research activities. The Lisbon strategy is therefore described as 'the basis of which the funds for energy research have gradually increased' (Interview DE_PIE_8).

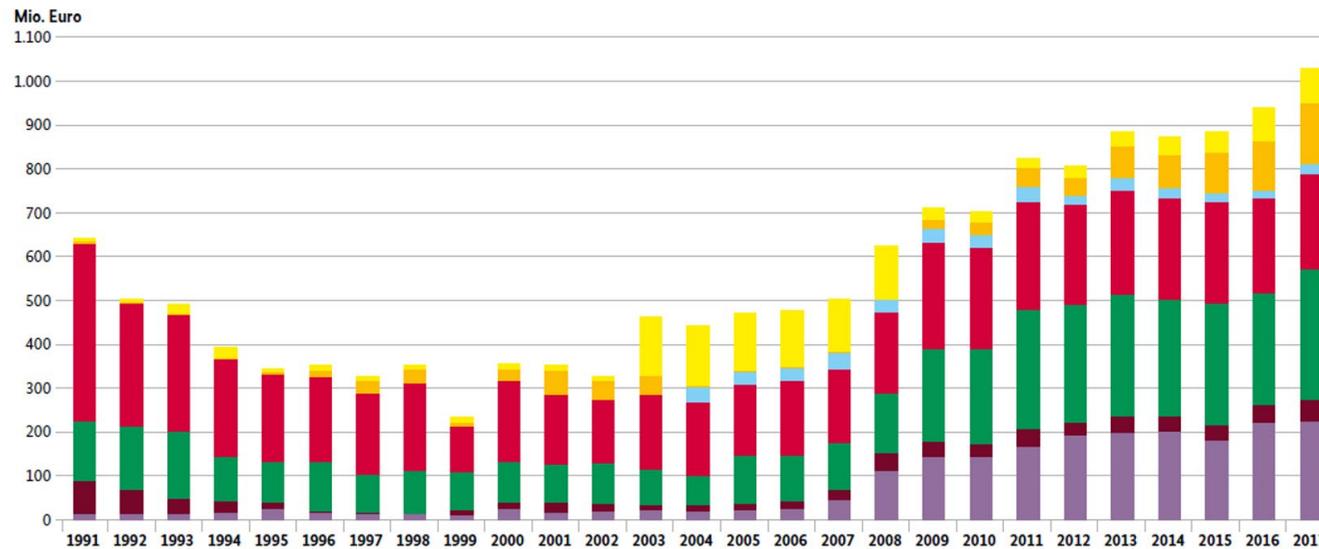


Figure 2: Expenditures for energy research from federal funds in Germany

Source: (BMW 2019a, p. 78)

⁸ The term 'triple-helix' describes a collaborative format of university-industry-government relations for joint R&D activities (see Etzkowitz and Leydesdorff 1998).

- Energy efficiency
- Fossil energy sources
- Renewable energies
- Nuclear technology
- Hydrogen and fuel cells
- Other energies and storage technologies
- Other cross-cutting technology research

The year 2000 also marked an important milestone for the development of the transdisciplinary research community with the International Transdisciplinary Conference held in Zurich (see Interview DE_PIE_6). This conference contributed to the aim of making it 'scientifically acceptable to deal with environmental issues in a transdisciplinary manner' (Di Giulio and Defila 2019, p. 158, own translation). Earlier transdisciplinary approaches were, however, not necessarily characterised by transformative attempts (see Interview DE_PIE_6), but more generally based on developing solutions for societal problems 'in collaboration with the people involved' (Akademie der Naturwissenschaften Schweiz 2000).

In Germany, an important step for the institutionalisation of participatory approaches took place at the urban level, with the establishment of the neighbourhood programme 'Soziale Stadt' (Social City) in 1999 (still running today). It went along with an increasing awareness of regional patterns of development, especially against the background of globalisation processes, but also an increasing manifestation of social problems in a regionally concentrated manner (Häußermann et al. 2008, pp. 8–21). In this context, the programme 'Soziale Stadt' can be understood as (socially) innovative, as it aimed for overcoming the boundaries between different urban departments (such as the boundaries between the different authorities responsible for urban planning, building, social affairs etc.) in managing change as well as the boundaries between civil society actors, administration and businesses (Häußermann et al. 2008, p. 254). More precisely, it explicitly aimed for 'activating' the local population to participate in change processes and anchored the motor of change in cooperative formats on the local level. This new form of urban governance also contributed to changing the role of social sciences (Siebel 2010).

While the neighbourhood programme 'Sozial Stadt' focused on socio-structural aspects, in 2000 the FONA programme for socio-ecological research was launched by the German Ministry of Education and Research (BMBF). FONA took the complex interrelations and embeddedness of social and ecological developments into account and had as its 'explicit goal [...] the continuous improvement of social and technical systems by processes and factors that are significant according to sustainability indicators' (Bührer et al. 2020, p. 15). Energy related research activities were part of the programme, while funding concentrated on broader topics around climate protection and sustainability research

(Bührer et al. 2020, p. 22). The FONA research programme can be understood as counterpart of the linear model of technological innovation for economic growth, promoted by the Lisbon strategy (Wächert and Janowicz 2012, p. 306), and complemented traditional R&D funding programmes of the BMBF, including in energy technologies.

Insofar, these two strands of development – (1) technological research related to energy technologies, and (2) socio-ecological as well as participatory and transdisciplinary research - at this early time exist as separated SIE-fields.

Regulative, normative and/ or cultural cognitive institutions

SONNET draws on Scott's conceptualisation of institutions, which consist of regulative, normative and cultural-cognitive elements (Scott 2014). Regulative institutions include laws, rules, standards and policies while normative institutions describe social norms, duties, and value systems (Wittmayer et al. 2020b, p. 21). The third element is referred to as cultural-cognitive institutions such as shared expectations and common beliefs (Wittmayer et al. 2020b, p. 22). In SONNET, we assume that SIE have the potential to transform existing institutions while they will also maintain parts of existing institutions (Wittmayer et al. 2020b, p. 20). We are therefore interested in understanding existing regulative, normative and cultural-cognitive elements that shape the SIE and its SIE-field.

Regulative institutions play a crucial role in the development of the SIE-field as it is heavily influenced and shaped by regulative frameworks that shape the conditions for experiments in the energy sector. In the context of 'regulatory sandboxes' as well as 'showcases' these regulative institutions slowly start moving into the focus of experiments and becoming themselves subject of experimentation (Bauknecht et al. 2020). In some cases, e.g. in the context of the SINTEG projects, 'experimentation clauses' enabled exploring new pathways through temporal exemptions from existing regulatory frameworks. On the other hand, lab approaches in the broader sense are also applied to overcome bureaucratic institutions and increase the speed of innovation with the help of its temporally and spatially bounded character. As one interviewee describes it: 'If you start to involve a municipality more intensively in the project, then you come to nothing. [...] That's nothing personally but based on the functioning of the [bureaucratic] system itself' (Interview DE_PIE_3).

A key **cultural-cognitive institution** influencing the SIE-field is that policy makers recognize different types of knowledge valuable for transforming energy pathways. The question here is,

“how we set boundaries around the legitimate contribution of the general public to the technical debates” (Collins and Evans 2009, p. 113). Barriers and prejudices around this question also exist in the academic field (see Interview DE_PIE_6). Transdisciplinary research attempts are contributing to changing this point of view, however, leading to the paradox situation that ‘transdisciplinarity’ still is an academic concept: *‘Other [non-academic] actors don't really understand what transdisciplinary is because it doesn't make sense because they just work with each other. [They say:] So what?’* (Interview DE_PIE_2).

A **normative institution** can be identified when looking at the juxtapositions of socio-economic interests in the development of energy technologies (innovation for growth) and the socio-ecological interests of participatory engagement for sustainable transitions (innovation for sustainability). Both build on different normative assumptions, which currently meet in multi-actor experimental formats. Still, the two different strands underlying the SIE-field development (technological development and participatory engagement) shape different conditions for the modes of interaction between actors.

PHASE B: Birth of the term ‘Living Lab’ whilst energy research in Germany was focusing on single technologies (2005-2010)

In the second half of the 2000s, funding for experimental approaches in energy research was still rather low, especially in technology-focused research projects. On the international level, however, especially the birth of the term 'Living Lab' changed research settings and approaches. This later also influenced the German development around ‘Reallabore’.

As Ballon and Schuurman (2015) note, the format of Living Labs already appeared earlier, but the term itself was first mentioned in a scientific publication in 2005 (Eriksson et al. 2005). Following the definition of Ballon and Schuurman, ‘living labs typically refer to co-creation and appropriation of innovations by users, often in an (online or offline) community setting, and involving also business stakeholders’ (Ballon and Schuurman 2015). Living Labs of this early type often focused on ICT technologies or smart homes with its co-creative approaches focusing on questions of cooperative design (Ballon and Schuurman 2015) rather than on, for example, user innovations. However, in 2015, Schuurman et al. identified ‘a new type of Living Lab constellation, based on multi-stakeholder collaboration and knowledge sharing, rather than on user involvement’ as ‘emerging’ (Schuurman et al. 2015, p. 24). Living Labs therefore contributed to opening up innovation processes to users,

stakeholders from civil society in which 'citizens are starting to act [as] innovators themselves' (Erdmann et al. 2018, p.10). Erdmann et al. (2018) therefore also identify a 'real-world-turn' in sustainability research and analyse Living Labs as part of the Green Economy.

While Living Labs in Germany, such as the Fraunhofer InHaus in Duisburg (established in 1998) or the Distributed Artificial Intelligence Laboratory (DAI) (established in 19992) existed much longer and concentrated on ICT technologies and smart home technologies, these early Living Labs did not necessarily concentrate on energy or sustainability topics. One important milestone for applying Living Labs to energy related research was the flagship project 'Effizienzhaus Plus' in Berlin funded by the German environmental ministry (BMUB 2016, pp.21–27). Since 2011, it serves as test environment for energy efficient and energy producing building technologies and was inhabited by two families, each of them testing the building in a one-year test phase. Since then, further projects followed which also experimented with integrated neighbourhood solutions such as the Living Lab 'FertighausWelt Wuppertal', funded by BMUB (BMUB 2016, p. 54).

In 2006, with the establishment of the European Network of Living Labs (ENOLL) the research approach started to institutionalise in Europe. In the same year, the 'Helsinki Manifesto' by the Finnish EU Presidency proposed the 'renewal of the European innovation system to create a new open, user-centric and networked innovation environment in Europe' (Finnish EU Presidency). This was understood as a revitalisation of the Lisbon strategy. Living Labs were framed as an important aspect of a future European R&D strategy where 'the users are involved in and contribute to the innovation process' (Finnish EU Presidency).

Even if these early living labs served as test environments and innovation infrastructures rather than spaces for participatory experimentation around alternative energy pathways, with the term 'living lab' user integration in innovation processes started to institutionalise. Since then, 'you can almost say that this laboratory term is hype' (Interview DE_PIE_1).

Institutional work conducted by SIE-field actors and other field-actors

SONNET investigates how SIE-initiatives, SIE-field-actors and other field-actors 'perform institutional work – meaning they engage in creating, maintaining and transforming institutions to be able to work on, enable and/or impede SIE developments' (Hielscher et al. 2020, p. 20). This analytical focus emphasises that institutional changes are actively influenced by actors within the SIE-field (Wittmayer et al. 2020b, p. 31). The term 'institutional work' refers to these activities of

creating, maintaining and transforming institutions and can include diverse types of institutional work, such as material, relational and symbolic work. Examples might be attempts to influence policy makers or the general public through lobbying activities or to influence informal institutions such as norms and values.

Institutional work in the case of participatory incubation and experimentation strongly refers to activities that target alliance building, networking and the promotion of different participatory and experimental formats, e.g. through specific narrative and metaphoric framings of approaches. The empirical findings show that especially the 'Laboratory'-metaphor is part of institutional work of SIE-field actors in Germany. It serves as a narrative for funding policies and is often described as a 'sexy' term (see Interview DE_PIE_6), 'trendy' (see Interview DE_PIE_8) or part of the current 'Zeitgeist' (see Interview DE_PIE_1). The metaphor frames energy research formats as innovative themselves. While the first energy concept of 1977 described energy research as a process that takes 'decades' and is separated in research, development and demonstration before being available for its use, lab approaches stress the flexibility of activities. The message now is: Research does not have to be transferred to real world contexts but rather directly takes place where the real world is. This, however, might mainly express a political interest while the methodological approaches still differ between lab types (see Interview DE_PIE_1). Here, the strong metaphor turns into a 'label' that stands for an innovative approach but at the same time also helps to distract from more clearly describing the exact processes that stand behind the label.

In many cases, the parameters that are important for conducting institutional work (e.g. the resource needed to build alliances) get visible by the difficulties that actors have in conducting institutional work. In the context of Living Labs, especially the material and socio-economic factors come into account as it is extremely cost intensive to establish and maintain large scale research infrastructures that are especially important for Living Lab approaches (with other experimental formats depend less on cost-intensive infrastructural settings). Therefore, alliances with private companies have to be found in order to share the infrastructure as well as the expenses (see Interview DE_PIE_1). Shaping alliances is, however, considered a time and effort consuming process. The aim to establish a German Living Lab network e.g. failed because of lacking time resources of actors involved in them, who are described as 'hopelessly overworked' (Interview DE_PIE_1). Therefore, it is seen as important to carefully consider who should be involved at which point of the process. Especially the involvement of actors from the 'bureaucratic systems' (e.g. policy makers working in public administration) might be seen as a barrier for the flexibility of the innovation process (see Interview DE_PIE_3). Thereby, however, the boundaries between public and private interests – between research activities for the common good vs. market interests - are starting to blur.

Institutional work in terms of networking activities between key stakeholders furthermore happens in the context of the academic research community, e.g. by establishing conferences and journals for transdisciplinary research or for research in Living Labs (e.g. the International Transdisciplinarity Conference, the Open Living Lab Days or the STRN research community). These activities are directed towards establishing research in multi actor formats in scientific communities and therefore contribute to institutionalizing these approaches. On the national level in Germany, only recently in 2019, the network 'Reallabore' was established by the Karlsruhe Institute for Technology (KIT), Leuphana University Lüneburg and Wuppertal Institute. Among others it aims at strengthening 'Reallabor'-research by increasing network activities, joint discussion paper series and annual meetings (see: <https://www.reallabor-netzwerk.de/>).

PHASE C: Energy transition projects with increasingly more integrative and transformative approaches (2010 – 2018)

The years 2010 and 2011 mark a milestone for the German energy transition. With the German energy concept and the nuclear phase out decision after the Fukushima nuclear catastrophe the German 'Energiewende' approached a more 'integrated policy framework' (Agora Energiewende 2015, p. 5). Funding for energy research increased in the following years. In addition, the WBGU report 'a social contract for sustainability' started to link participatory approaches to transformative attempts (WBGU 2011), thereby also supporting the development of the SIE-field 'Participatory Incubation and Experimentation'.

Policies and policy making

One important cross-cutting theme addressed in SONNET are the socio-political aspects and conditions of social innovation in energy. In SONNET, we are particularly interested in identifying enabling or impeding factors and how they influence social innovation processes. This case study therefore aims for identifying important policy events and policy making processes (Wittmayer et al. 2020b, p. 43). This includes asking about broader political debates, the role of different government levels involved in policy making, particular policy strategies and instruments used and how they enable or impede the development of SIEs.

As the SIE-field is closely linked to R&D policies, next to national level energy policies also innovation policies and policy making processes have played a crucial role for the field development. The following table provides a selective overview of key policies influencing the SIE-field under study.

Year	Short description of policy	Relevance for SIE-field	Source
2000	Renewable Energy Sources Act (EEG): generation of renewable electricity encouraged through feed-in-tariffs		(BGBl 2000 I 13 S. 305-309)
2006	EU directive on energy end-use efficiency and energy services (energy savings through implementation of smart meters and more customer engagement, not binding)		(EU DIR 2006/32/EC 2006)
2010	Energy concept of the German government (for an environmentally friendly, reliable and affordable energy supply)	Turing point for more integrated energy policies	(BMW 2010)
2011	Nuclear phase out law and announcement to close all of German nuclear power plants by December 2022 (thereby roughly reinstating the earlier nuclear phase-out decision of 2002)	Funding for energy research increases after nuclear phase out decision	(BGBl 2011 I 43 S. 1704-1705)
2013	Baden-Württemberg Ministry of Science, Research and Arts: funding line for real-world labs entitled BaWü Labs	First funding line for 'Reallabore' in Germany	(Wagner and Miller 2018)
2015	Initiative by BMBF and BMU to establish the Innovation platform 'Zukunftsstadt' (future city), which includes 'Reallabor'-formats	Reallabor'-formats are getting picked-up in national policies	(BMBF 2015)
2016	Smart metering and the Energy Transition Digitisation Act		(BGBl 2016 I 43 S. 2034-2064)
2017	SINTEG projects with its 'experimentation clause', funded by the German Federal Ministry for Economic Affairs and Energy (BMW) (BMWi)	Showcase format highlight integrated approach, linking technical, business-	(BGBl 2017 I 38 S. 1653-1656)

		related and legal challenges	
2018	Launch of 7th energy research programme	includes a funding strategy for ‚Reallabore‘	(BMWi 2018b)
2019	Climate action law: Germany’s first climate law makes emissions reduction legally binding		(BGBl 2019 I 48 S. 2513-2521)

Note: As this overview table only starts in 2000 it excludes an important earlier policy development: the liberalisation of the electricity market from 1998 which started to contribute to transforming and diversifying the actors of the German energy market. For example, in earlier days, many companies understood themselves as electricity suppliers ("Versorger") without customers but rather as measuring units and grid connection points ("Messstellen" and "Netzanschlusspunkte"), implying that back then companies typically did not speak with their customers, but only fulfilled their supply obligations ("Versorgungsauftrag").

The importance but lack of integrated approaches to address the energy transitions was frequently mentioned. Here, especially contestations between societal and technological approaches, pushed by different Federal Ministries, hinder integrated policy approaches: *'In the energy sector in particular you have to somehow organise that things don't develop in fragmented ways'* (see Interview DE_PIE_7). This is seen as a barrier for speeding up change processes. The SIE-field under study points in the opposite direction of multi actors formats that allow to follow more integrated and systematic approaches in experimentation settings. More systematic approaches, however, only started around 2010 and after the Fukushima nuclear catastrophe in 2011, but still developments are rather pushed within the frameworks and 'silos' of different national Ministries or European Directorates (interview DE_PIE_2). One aspect that is currently still developing is to directly address policy learning in experimental approaches (Bauknecht et al. 2020). There is, however, *'awareness that you have to work in a different way to make plans and policy work'* (Interview DE_PIE_2).

Besides activities on the national level, also policies on the European level have impacted the SIE-field development in Germany. Especially the Joint Programming Initiative (JPI) Urban Europe put a focus on lab formats and the co-creation of knowledge on the urban level to encourage systemic change (Bylund 2020). More recently, especially the European Green Deal links economic development with sustainability and is mentioned also by small scale SIE-initiatives as influential for their activities (see Interview DE_PIE_3).

The financial crisis in 2008 impacted the general economic situation and thereby also the development of budgets for energy related R&D activities. However, an investment programme for municipalities was launched and from 2009 until 2011. Municipalities are also moving into focus in terms of decentralised and participatory approaches for alternative energy pathways and a number of policies increased the attention for the urban level and its role in sustainability transition. One step in this process was the Leipzig Charter on Sustainable European Cities in 2007. It was an initiative by the ministers responsible for urban development in the EU Member States that suggested an integrated urban policy approach (BMUB 2007). The development of the Charter itself was considered a 'very open process' (Interview DE_PIE_2). It furthermore empathised the role of participation for integrated urban development processes. Another step on the European level was the establishing of the Joint Programming Initiative (JPI) Urban Europe in 2010 with its mission 'to develop knowledge, tools and platforms for dialogue on urban transitions' (JPI Urban Europe).

One important impulse for the development of participatory and more integrated approaches in the SIE-field of energy pathways was the 2011 WBGU⁹ report 'a social contract for sustainability' (WBGU 2011). It stressed the need for a new interplay of politics, society, sciences and the economy (WBGU 2011, p. 1) and furthermore, emphasised the need for policy-mixes to push fundamental systemic change: The WBGU recommended to focus not exclusively on technologies here, but also on encouraging changes in behaviour and social innovations (WBGU 2011, p. 193). The report empathised the link between participatory approaches and transformative attempts and later inspired the first funding for 'Reallabore' in Germany, the Baden-Württemberg Labs. It is described as 'decisive' for a turn towards *transformative* transdisciplinary research approaches (Defila and Di Giulio 2018b, p. 11).

Quartier Zukunft - Karlsruhe

'Quartier Zukunft' aims at establishing a multi-actor collaboration for transforming an urban neighbourhood into a sustainable urban district. Sustainability is thereby understood as including economic, ecologic, social, cultural and institutional aspects. Energy in this SIE-initiative is one aspect embedded in a broader understanding of sustainability. It is addressed e.g. by integrated research activities such as the 'energy dialogue' (see: <https://www.dialog-energie.de/>). Further activities are different open formats such as the "Nachhaltigkeits Experiment Second Future" (sustainability experiment second future) for promoting second-hand products or the production of podcasts. Initiated in 2011 by the Karlsruhe Institute for Technology (KIT), further actors included

⁹ WBGU: Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen – German Advisory Council on Global Change

in the participatory approach are the municipality of Karlsruhe, civil society actors and private businesses (Parodi 2011). In line with the 2011 WBGU report ‚a social contract for sustainability‘ its vision is to establish a participatory and cooperative process of transformation. The project describes itself as ‘Reallabor’ and defines the term as follows:

‘Reallabore’ experiment. They provide a frame for collectively developing, testing and researching conditions for a good life. Through a variety and density of sustainability experiments in the ‘Reallabor’, synergies and conflicts between individual and independent “sustainability solutions” are identified and processed (keyword: “dense sustainability”). The primary goal is to initiate and support the development of future cultures of sustainability - and, where possible, to already live them (see: <https://www.quartierzukunft.de/quartier-zukunft/reallabor/>; own translation).

The initiative officially is a project by KIT and understand itself as initiator of change, providing space for experimentation. A subsidiary project called ‘Reallabor 131’ was funded in the first German funding line for ‘Reallabore’ by the Baden-Württemberg (see Interview DE_PIE_6). In 2019, the initiators of ‘Quartier Zukunft’ founded the Network ‘Reallabore der Nachhaltigkeit’ and thereby institutionalised networking activities between sustainability oriented Labs in Germany. One aspect of institutional work conducted by the actors involved is to define the term ‘Reallabor’ and develop methodological approaches that target co-design and co-production to conduct research in these participatory settings.

During this phase of development, technological oriented funding programmes put increasing attention to aspects of digitalisation of the energy system. These attempts already started earlier, e.g. in 2008 with the pilot project E-Energy, funded by BMWi and BMUB (BMW 2014). ICT technologies were considered to have great potential for efficient energy systems. Therefore, joint research teams, mainly consisting of business and academic partners worked on developing smart grid solutions. The SINTEG projects in 2017 continued the attempt to build smart Energy systems. However, one important learning from earlier projects especially with smart meter technologies was, that social aspects and questions of social acceptance are to be integrated into the development process of energy technologies. As one interview formulates it: *‘There were people who [...] actually believed in smart meter technologies. They made first attempts with the E-Energy project which then failed due to data protection issues and because people didn't go along. There were really big protests [...] because of data protection issues and people were afraid they would be spied and such things and then this first wave of smart meters actually faded’* (Interview DE_PIE_4). The experiences of the failed smart meter implementation increased the awareness for questions of social acceptance and encouraged accompanying research in technological development projects. Still, technological

oriented projects set the stage and define much clearer frames for societal questions in energy related research. Thereby, they differ from more transdisciplinary approaches.

Contestations and relations between actors

SONNET is interested in understanding interactions between SIE-field-actors and/ or other field-actors. These relations can be formal or informal, take different forms (e.g. formal alliances, networks, collaborations) and might differ in their quality (e.g. conflicting, competitive, collaborative or exchange-oriented relations; Wittmayer et al. 2020b, p. 14) as well as in their content (e.g. concentrating on learning, networking, lobbying etc.). Furthermore, SIE-field contestations between SIE-field-actors and/ or other field-actors are of interest as they can 'unsettle' the existing 'outside' institutional environment (Hielscher et al. 2020, p. 19). Contestations are debates among relevant actors over SIE-field structures and processes such as disagreements about common aims or approaches to lobbying policymakers. Both, contestations and relations can provide an indication of how institutionalised (or not) the SIE-field is (e.g. are there formal networks).

As the example of smart meter technology developments indicate, contestation between SIE-field actors are targeting the role of citizens or users in energy related experimentation settings. While transdisciplinary requires an open process in which practitioners are more than just the target group (Defila and Di Giulio 2018a, pp. 10–11) (e.g. in their role as users), accompanying research in technological project rather addresses people as users and asks about acceptance for technological developments. As both approaches use the term 'Reallabore' for describing their approaches, this makes it easier to distinguish between different processes. The 'contestation' – in this case not a direct conflict but rather two separate developments – therefore also is about the use of the use of the term 'Reallabor' as a 'label' for innovative research approaches versus 'the processes' of transdisciplinary co-creation.

In the German case, the different uses of the term 'Reallabor' and the actors involved in shaping them becomes clearer when also considering the institutional work these actors conduct. In 2018, the BMWi established a network 'Reallabore' which includes business, research partners and municipalities (BMW 2019b, p. 16). Its aim is to increase economic competitiveness through joint R&D activities. In 2019, another network 'Reallabore' was established by the Karlsruhe Institute for Technology (KIT), Leuphana University Lüneburg and Wuppertal Institute. This second network focuses on transformative sustainability research and aims for transdisciplinary approaches. As the term starts to diffuse, further actors such as foundations, municipalities, urban planning agencies,

private companies e.g. energy providers are picking up 'lab'-like settings and further contribute to shaping different meanings related to the term 'Reallabor'. These networks exist in parallel and rather shape different research directions than interact in order to jointly shape the SIE-field development.

Furthermore, contestations are to be understood as elements that characterises the process of policy making per se. Therefore, as the SIE-field is closely linked to R&D policies, contestations are also part of this processes. One interview describes it as follows: *"Of course, not formal contestation in that sense, but I mean, if you start looking at the political practice you come down to people and people who sometimes have very good intentions then starting playing soap opera games around their policy lines"* (Interview DE_PIE_2)

PHASE D: 'Reallabor' research approach institutionalises in energy related research activities (2018 – now)

With the start of the Fridays for Future movement in 2018, an important societal shift started to get visible which boosted the participatory dimension of sustainability attempts, which increased the involvement of bottom-up participation by civil society actors across different societal spheres and stakeholder groups (see 'scientists for future, 'farmers for future' etc). For the year 2019, the yearly report by Agora Energiewende about the development of the German energy transition describes 'climate protection and energy transition' as the number one political topic (Agora Energiewende 2020).

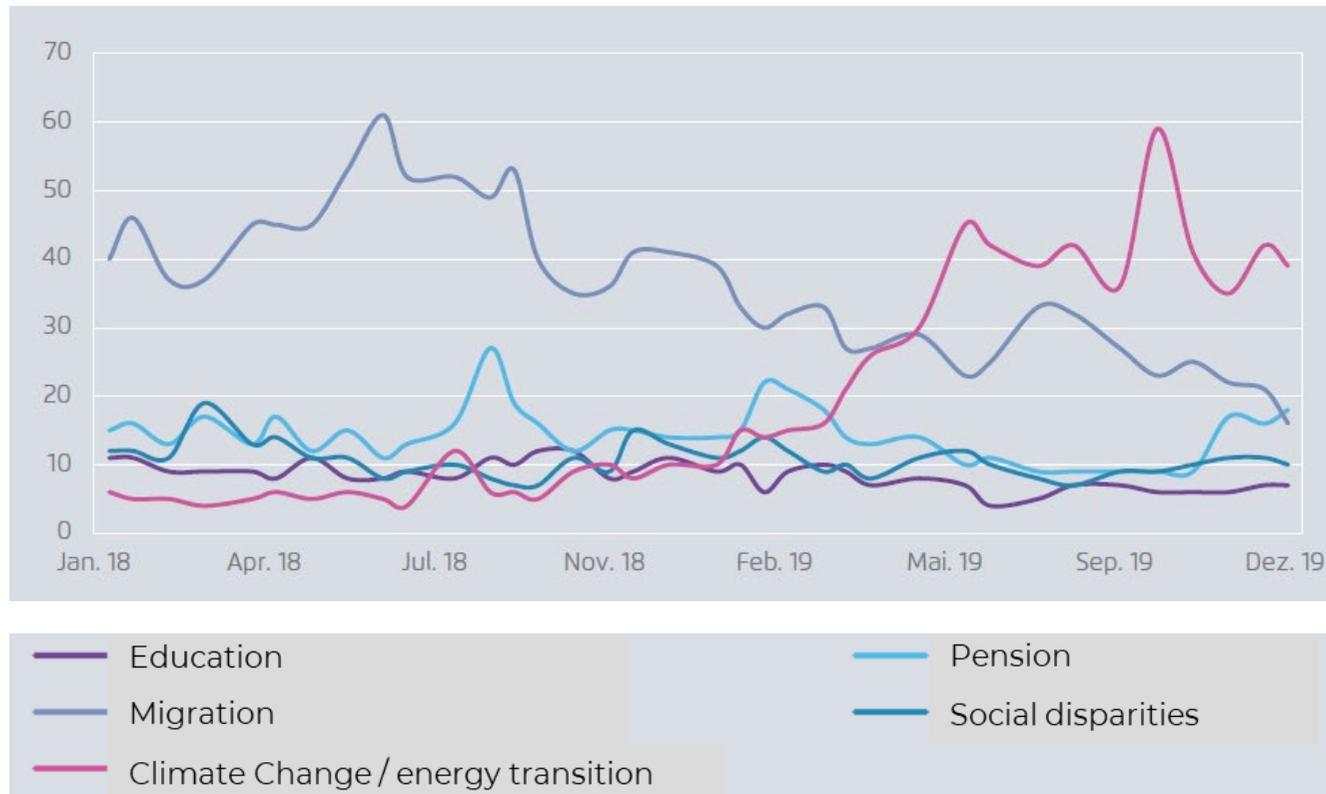


Figure 3: Top 5 political problems in Germany 2018-2019 according to 'Politbarometer'

Source: (Agora Energiewende 2020, p. 65)

This societal shift towards a broader engagement for climate protection and the transition towards a more sustainable energy system got picked up on the political level. In 2018, BMWi published its new strategy paper 'Reallabore' (BMWi 2018b). 'Reallabore' are thereby framed in the context of the increasing need of flexibility when experimenting with digital technologies and described as policy instrument for the fields of economy, innovation and digitalisation (BMWi 2018b). The 7th energy research programme from 2018 explicitly emphasised the role of 'Reallabore' which are here described as holistic approach with the intention to increase flexibility of energy research (BMWi

2018a, p. 18). Flexibility here refers to the regulatory conditions that can be adapted in the temporally and spatially limited setting of the 'Reallabore'. While also former programmes included 'Reallabor'-approaches, this was BMWi's first funding line that named research activities as 'Reallabore' (see Interview DE_PIE_8).

It is only in this phase of the SIE-field development that participatory multi-actor collaborative formats started to be more strongly institutionalised: First, through large scale funding lines such as the BMWi strategy for 'Reallabore' in the energy sectors. In parallel to institutional actors also network activities by single researchers and research institutes increased the institutionalisation of collaborative multi-actor formats for experimenting with new pathways to sustainability. Activities by researchers include joint conferences, discussion papers and the development of methodological guidelines and principles for transdisciplinary and transformative research for sustainability. Furthermore, one important aspect of institutional work conducted by researchers was the formulation of policy recommendations. Especially the BaWü-Labs were quite broadly evaluated and researched in accompanying research activities. This resulted in policy brief with recommendation for how to improve funding frames for transdisciplinary and transformative research activities (Defila and Di Giulio 2019). Among others, the short funding periods for transdisciplinary projects was identified as impeding factor for the development of the format, which might be in danger of being treated as short-term hype. Furthermore, the lack of funding for practitioners and citizens engaged in these projects is identified as problematic (Defila and Di Giulio 2019).

Meanwhile, as more and more actors are developing participatory formats for experimenting with sustainable energy solutions, the boundaries of the approaches are also starting to blur. In other words, the hype behind terms and 'labels' makes it increasingly difficult to distinguish between aims and interests behind the terms used. This stresses the importance to more clearly define concepts and methodological approaches for participatory multi-actor formats for experimenting with new energy pathways.

Reallabor Energieavangarde Anhalt

Energieavangarde Anhalt describes itself as a regional collaborative network consisting of citizens, municipalities, districts, businesses and further institutions. Its aim is to push a regional transition towards a more sustainable energy system, where energy is produced and consumed in the region

Anhalt-Bitterfeld-Wittenberg. On its website, the association describes its mission as follows: „The association wants energy to be produced and consumed in an environment friendly manner in the region. [...] This contributes to protecting environment and climate and avoids unnecessary costs for consumers. [...] The necessary technical, economic and socio-cultural changes are jointly shaped by partners such as the region’s municipal utilities, companies in the renewable energy sector and municipalities, including the city of Dessau-Roßlau and the Wittenberg district. We call this great experiment ‘Reallabor Anhalt’

(see: <https://www.energieavantgarde.de/verein/philosophie-ziele/>, own translation).

The initiative is a registered association, founded in 2012, which is supported by private business, foundations and state institutions on different levels, such as the government of Saxony-Anhalt or the Federal Ministry of Education and Research (BMBF). *The initiative participated in larger research projects such as the SINTEG projects.*

Activities carried out by the initiative include the development of mission statements, a regional network and competitions for start-ups for energy related innovations. A major focus lies on networking activities and bringing actors together to work on a regional energy transition, suggesting a regional ‘Balancekreis’ that allows a more integrated perspective on regional energy transitions. The initiative tries to combine economic aspects of a regional energy system with political questions around participation and can therefore be seen as sitting in the middle between the two strands of development described in this innovation history. On one hand, it targets multi stakeholder formats to jointly work on the technical and administrative dimension of local energy supply. On the other hand, the initiative targets the socio-cultural dimension of a regional energy transition and aims for co-production and the inclusion of citizens in an open approach, e.g. in workshops formats, by information campaigns but also by activities in public space such as art installations (see image above).

According to the initiative, it is their specific way of producing and integrating different forms of knowledge in research processes, that makes up the initiative’s character as ‘Reallabor’: *“Reallabore’ create a platform for new formats and new partnerships, thereby promoting networking and cooperation structures between science, business, politics, administration and civil society actors”*(see: <https://www.energieavantgarde.de/reallabor-anhalt/>, own translation).

Especially activities on the European level suggest that collaborative multi-actor formats during the next years will continue to play an increasingly important role in research for sustainability energy systems. The recent Horizon Europe draft work programme for the years 2021-2022 e.g. includes funding for research in transition super labs with a broad range of actors to be included in these

activities: “Transition Super Labs are real-life laboratories where rapid decarbonisation is conceptualised, implemented, monitored and revised in an integrated way. Similar to ‘living labs’ but operating at a much larger scale, they spur the transformation of whole entities – such as non-sustainable business complexes, mining regions and polluted metropolitan areas – in an economically, socially and environmentally sustainable manner. Designed as flagship demonstrators, Transition Super Labs involve a broad range of actors – businesses and industry, different levels of government, academia, civil society, citizens at large – working closely with communities and regions directly affected by climate change” (Horizon Europe 2020, p. 96).

Power and power relations (power to + power over + power with)

Shifting power relations is often considered as an important aspect, which defines social innovation processes (Wittmayer et al. 2020b, p. 47). The term ‘power’ thereby refers to actors capacities to mobilise resources and institutions (Avelino 2017). In the context of this case study, we aim for analysing which power relations are enabling or impeding SIEs and how they do so (Wittmayer et al. 2020b, p. 48). It is important to distinguish between different types of power. Actors might have power to, for example, to do certain things and push their interests (e.g. political power, economic power, innovative power), power over others or power with other to achieve collective goals (Wittmayer et al. 2020b, p. 48).

Power to: Looking at the overall development of the SIE-field, we see that key changes are often encouraged through policy actors and relate to developments of a broader context. Especially funding lines which define the actors included in experimentation settings can be seen as a powerful tool to include or exclude actors from experimentation. E.g. in many cases, it might not be possible to provide funding for non-professionals engaged in experimental settings and limited time frames make it difficult to encourage long-term engagement (Defila and Di Giulio 2019).

Power with: As the SIE under study focuses on multi-actor collaborative formats, power relations are quite strongly relating to activities that aim for joining forces of different actors. One important aspect thereby is how to join forces when the aims of actors involved might still largely differ. Bridging these differences requires good ways of communication. This means that actors are trying to convince each other for a certain standpoint and form alliances. One Interviewee describes the power in these settings as ‘communicative’ form of power: ‘Power not as something you hold but more like using the force of others, relational and communicative power’ (see Interview DE_PIE_2). Power in these activities is something that is situational enacted and builds on communication and

the building of alliances. Therefore, it is not something 'you hold' but something you have to repetitively enact.

Power over (shifting): One major aspect of change that is encouraged through the SIE under study, is a shift in power over the shaping of the energy system. This concerns the question_ who can contribute to shaping the energy system? One aim of the SIE-field is to frame energy not as a subject that requires expertise knowledge but establishing it as '*something that anyone could do*' (Interview DE_PIE_2)

6 Summary, synthesis and conclusions

6.1 How do SIEs and SIE-fields emerge, develop and institutionalise over time?

SONNET studies social innovation in energy (SIE). A SIE is 'a combination of ideas, objects and/ or actions that change social relations and involve new ways of doing, thinking and/ or organising energy'. In this case study, we analysed the development of one SIE - and its SIE-field - over time in the national context of Germany. The SIE under study in this report is referred to as 'participatory incubation and experimentation', i.e. multi-actor, collaborative formats that aim to experiment with and/or try out novel energy solutions in specific (local and temporal limited, project-like) settings. We traced back the development of these formats during the last 20 years and described the innovation history.

In the German context, we could identify different collaborative multi-actor experimentation formats that were referred to as 'living labs', 'urban labs', 'Reallabore', 'Showcases' or 'regulatory sandboxes'. However, the term most prominent in the German context to describe collaborative multi-actor for experimenting with new energy pathways is 'Reallabore'. This term was first used in a federal state level funding programme in 2015 and increasingly institutionalised in the last two years of the SIE-field development. The institutionalization of the approach especially builds on the establishment of funding lines that explicitly target 'Reallabor' approaches. Furthermore networks among researchers are formed to develop methodologies and establish 'Reallabor'-research in the academic field. The emergence of the SIE-field dates back much further. In Germany, there is a long history of participatory attempts that emerged in the SIE-field of urban development but also included bottom-up protests against nuclear energy in the 1970s and 1980s. These forms of bottom-up engagement encouraged socio-ecological research activities and inspired the national research programme for sustainable development, FONA (Forschung für nachhaltige Entwicklung (Research for sustainability)).

Overall, the SIE-field development in the German context is characterised by two strands of development: On the one side, research activities inspired by citizens participation experimented with transdisciplinary formats in a broader context of problems related to sustainability questions. On the other hand, energy focused forms of experimentation build on a strong belief in progress through technological innovation. Here, within the last ten years high potentials were identified for the digitalisation of the energy systems. Through different developments such as protests against specific technologies (e.g. the implementation of smart meter technologies) or the increasing diversification of actors involved in the energy sector in the course the liberalisation of the energy

market these technological experimentation formats increasingly recognised the need to include the perspectives of citizens (especially addressed in their role as 'users') in these R&D activities. Therefore, especially in the last two years, the two strands of developing started to approach each other, using similar terms for their activities, even if the concepts and aims behind these terms might still heavily differ.

In this innovation history, we identified four phases that describe the emergence, development and institutionalisation of the SIE-field. The first phase that lasts until 2005 describes the early phase of SIE-field development. It laid the foundations for transdisciplinary formats. The FONA programme got established in this phase and also collaborative multi-actors' formats institutionalised in the SIE-field of urban development. One important milestone for the SIE-field development was the birth of the term 'living lab' in 2005, which marks the starting point for a second phase. In this second phase, however, budgets for energy research and experimentation activities were rather small and concentrated on single technologies, without being embedded in an overall concept. This changed around 2010. In the third phase of development, starting with this change in 2010, large scale energy research activities started that increasingly started to include experimentation formats in accompanying research activities. With the German energy concept in 2010 and the nuclear phase out decision after the Fukushima nuclear accident in 2011, the awareness for energy related activities raised on the political level. In this third phase of development, the term 'Reallabore' emerged and first appeared in German research programmes. The fourth phase of the development is characterised by an institutionalisation of multi-actor collaborative formats for experimenting with alternative energy pathways. This happened in parallel in both strands of developments: in technological centered energy research with the BMWi-strategy for 'Reallabore der Energiewende' in 2018 and in 2019 with the foundation of the network of sustainability oriented 'Reallabore'.

However, parallel to the institutionalisation of multi-actor collaborative formats in energy related experimentation, the terms also started to diffuse and thereby blur the lines between different interests in changes the energy system. Especially, private businesses like energy providers or technology companies are increasingly also using 'lab' approaches to gain knowledge about user interests. In some cases, there are no academic research aspects integrated in these private lab settings, which is in contrast to the origins of these approaches. Overall, collaborations often happen in short-term project-like settings that make it difficult to integrate knowledge in experimentation processes on a constant and ongoing basis. So far, experimentation and learning starts to expand to including 'users' or sometimes more generally 'citizens'. Only recently first attempts emerge to develop formats and concepts for experimenting with energy related policy making in these.

For the future development of the SIE-field, activities on the European level might be crucial. New research programmes suggest activities around 'transition super labs' and fund projects on 'energy citizenship'. It seems quite likely, that these European activities encourage further activities on the national level.

6.2 How do SIE-field-actors and other field-actors interact with the 'outside' institutional environment and thereby co-shape the SIE-field over time?

In SONNET, a SIE-field is defined as an arena/space that includes a specific SIE as well as SIE-field-actors working on it and other field-actors enabling and/or impeding it. In this arena/ space these actors take one another and their actions into account and have a shared (but not necessarily consensual) understanding of a SIE and of their relationship to other actors. They recognise (but not necessarily follow) shared norms, beliefs and rules. While the field is constituted by SIE-actors and other field-actor's activities, it is also influenced by the outside institutional environment, which can interact, shape, enable or impede the development of the SIE. This institutional environment is constituted by formal as well as informal institutions.

In this case study, we identified a number of different actors as important for the SIE-field development. As the SIE-field is quite closely linked to research and development activities, researchers play a crucial role in shaping the SIE-field as SIE-field actors. SIE-initiatives in many cases have a rather local focus. Networking activities are therefore rather conducted by researchers, who are involved in different formats. Furthermore, looking at the SIE-field development it also becomes clear, that the emergence and institutionalisation of the SIE in Germany is strongly linked to the institutional embeddedness in R&D funding activities of national and federal policy makers. Even if the SIE-field is based on bottom-up attempts, major shifts mainly occurred when large scale funding programmes picked up participatory multi-actors' formats in their research programmes and provided funding. This refers especially to the FONA programme and the new BMWi strategy for Reallabore. These large scale funding programs highlight their character as 'Reallabore' and can therefore be seen as important milestones for the field development.

In the case of the SIE-field 'participatory incubation and experimentation' a number of external shocks as well as societal trends influenced the development of the SIE-field over time. A major impact in the German context was the 2011 Fukushima nuclear catastrophe, as it led to the German nuclear phase out decision and started what is internationally recognised as 'German Energiewende'. Engagement in increasing investments in renewable energy technologies as well as in developing alternative energy pathways started to intensify after the years 2010 and 2011. Concerning societal

trends, the 2015 migration 'crisis' also impacted the field development, as citizen engagement and the awareness for the need as well as the strength participation increased after the summer of 2015. This quite likely also inspired activities in sustainability and energy related topics. In addition, already the liberalisation of the electricity market from 1998 onwards - a formal institutional change - supported the intensification of cooperation between companies and other stakeholders, thereby partly preparing the ground for later participatory developments in the sector.

6.3 What are the enabling and impeding factors for SIE-field-actors and other field-actors to conduct institutional work and change the 'outside' institutional environment?

The analysis in this case study has outlined key changes in the SIE-field over time and identified actors relevant for influencing and actively shaping the SIE-field. We described how the SIE-field increasingly institutionalised during the last year of its development with increasing activities during the last 2 – 10 years. Regarding the factors that influenced the development of the SIE-field over time, we thereby identified key enabling and impeding factors in the German context.

Concerning the enabling factors, especially the longer tradition of participation formats in Germany can be seen as an important component. While participation is more common in areas such as urban development, this tradition has helped to encourage engagements of different actors including collaborative experimentations with sustainable energy pathways. Different forms of societal engagement for example in the context of the migration 'crisis' in 2015 and the Fridays for Future movement starting in 2018 have demonstrated, that there is a strong basis for civil society engagement and bottom-up protests in Germany. While energy might still be considered an 'expert' topic, this broad basis allows to encourage participation of societal actors also in energy related project settings. In addition, the initial pick-up of renewables since 2000 and the first peak of solar installations in Germany was also driven by societal engagement in general and a clash between the old nuclear energy industry and an ecological movement in particular. Furthermore, policy makers in Germany as well as on the EU level seem to be increasingly aware of the potentials of including multiple actors in experimenting with alternative energy pathways. A second enabling factors therefore lies in the German funding structures that picked up the topic especially during the last two years and provide funding frames and programmes which supports the development of diverse multi-actor collaborative formats. Concerning the intuitional work carried out by SIE-actors and SIE-field actors, a key enabling factor is the strong 'lab' metaphor. It works as a boundary concepts that

very different stakeholder groups can easily refer to and therefore allows to build alliances and joint activities between these stakeholders.

On the other hand, funding frames might also impede the multi-actor nature of these formats, as they are traditionally rather technology centred and provide funding only for formalised institutions and actors. Therefore, only specific projects and actors have the possibility to benefit from these structures. A second aspect is the increasing 'projectification' of these formats with short term frames that impede long term learning and the integration of different types of knowledge in an overall strategy. On the level of SIE-initiative, the lack of clearly defined terms and concepts and the consistent use of terms for different formats makes it difficult to distinguish between 'the label' and 'the process'. This often blurs the lines between different approaches and their aims. Furthermore, due the local focus of the activities of many SIE-initiatives, institutional work gets more difficult and actors might more likely concertation on their own activities instead of developing shared standards and joint activities. Concerning the intuitional work carried out by SIE-actors and SIE-field actors, a key impeding factor is that participatory processes have to be seen as extremely time intensive. This aspect, together with the lack of long-term funding possibilities, limits the engagement of SIE-actors and SIE-field actors.

7 Recommendations for our city partners, national and EU policy makers and SIE practitioners

SONNET city partners

- How are energy related issues connected to other topics in participatory processes? Encourage participation in energy related topics and include energy in broader processes of citizen participation.
- Who is involved in experimentation with sustainable energy pathways? Think of experimentation not only as a way for including citizens but also experiment with your own government settings and administrative structures

National and EU policy makers

- Who can apply for funding? Multi-actors' collaborative formats need to involve funding opportunities for multiple actors, instead of being directed to some specific actors only (such as research institutes or businesses)
- How are multi-actor formats embedded in an overall strategy for energy transitions? Participatory multi-actor formats benefit from making their aims and their embeddedness in an overall strategy transparent
- How long does it take? Including multiple actors takes time. It might help to integrate different formats with different speed and provide the timeframes suitable for each format. This should include the possibility for long-term funding to build up good participatory processes.

SIE-field-actors

- What do you mean? Provide clear definitions of the participatory concepts you are working on and make the aims of participatory processes transparent
- Who are you collaborating with? It might help to collaborate with different actors from different fields (e.g. research, businesses) at different stages of the experimentation process

8 Recommendations for our city partners, national and EU policy makers and SIE practitioners

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9 Annex 1

Methodology

Starting point for investigating the SIE-field was contact to researchers, who were engaged in research activities with close relation to the SIE-field. Especially, interviewing researchers with long year experiences in energy related research activities allowed to gain a first overview over the SIE-field and deciding whom to contact for further in-depth interviews. Overall, we were able to conduct 8 in-depth interviews, half of them with researchers engaged in different activities related to the SIE-field under study. Two interviews were conducted with members of policy making institutions, one operating on the European level, one on the national level. Due to the COVID-19 pandemic, it was difficult to get closer contact to SIE-initiatives e.g. through visiting meetings. We conducted two interviews with members of SIE-initiatives. However, the case study would have further benefited from observing meetings of initiatives with the possibility to observe varying opinions within one initiative.

The sampling strategy followed a snowball approach. The first interview was conducted with a researcher working on the SIE-field under study. This was followed by an interview with a policy maker, who has long time experience with working in the SIE-field. These two initial interviews helped to explore the field and to identify relevant SIE-initiatives and SIE-field actors for further interviews. The interviews furthermore helped to identify important documents that were reviewed for this case study. Overall we reviewed about 6 policy documents more in-depth, most of them related to policy lines for funding (such as BMWi and BMBF funding programs for energy research). The search for academic literature that we reviewed for this report also started from the suggestion of researchers interviewed. Especially academic networks such as the network 'Reallabore der Nachhaltigkeit' (as mentioned above) provided literature suggestions on their websites. These suggestions were then the entry point to explore academic literature on the field development (see detailed list of reviewed documents below). Furthermore, the approach is inspired by the fruitful exchange with the SONNET researchers working on the SIE-field in the Netherlands and Poland.

The SIE under study is increasingly researched in different research fields such as sustainability transitions research, urban development, innovation studies, energy research and policy studies. Taking into account the time constraints of this study (1,5 months), I had to focus on identifying overall changes and their interrelations. Due to the time restrictions, it was not possible to research all debates in the different research fields mentioned in-depth. National funding programmes and policies therefore served as the baseline for identifying changes, which were then traced back to the

actors engaged and their aims. The timelines were developed in the process of conducting the research and served in the last three interviews as a starting point for discussing the SIE-field-development. Therefore, the interviews were shown the timeline and then asked about their opinions concerning changes in the SIE-field.

List of interviewees

Code interview	Empirical description of case	Type of actor according to SONNET	Date of interview	Duration of interview	Interviewer
DE_PIE_1	Researcher involved in projects on Living Labs in Germany	SIE-field actor, Researcher	22/10/2020	54 min	Maria Stadler
DE_PIE_2	Member of Programming Initiative (European level)	SIE-field actor	06/11/2020	89 min	Maria Stadler
DE_PIE_3	Member of SIE-initiative, engaged in different Lab formats on the local level	Member of SIE-initiative	10/11/2020	67 min	Maria Stadler
DE_PIE_4	Researcher involved in energy related research projects, including 'Reallabor'-formats	SIE-field actor, Researcher	18/11/2020	32 min	Maria Stadler
DE_PIE_5	Member of SIE-initiative, engaged in a Lab format on the regional level	Member of SIE-initiative	30/11/2020	65 min	Maria Stadler
DE_PIE_6	Researcher involved in transdisciplinary research related to sustainability	SIE-field actor, Researcher	02/12/2020	75 min	Maria Stadler
DE_PIE_7	Researcher involved in projects in projects on regulatory sandboxes	SIE-field actor, Researcher	03/12/2020	76 min	Maria Stadler
DE_PIE_8	Member of project management agency (National level)	SIE-field actor	04/12/2020	61 min	Maria Stadler

List of meetings and events attended

Due to the corona pandemic, it was not possible to attend meetings personally. However, two online events could be attended. One more event was an older recorded webinar that was available online.

Event name	Event organiser	Type of event	Date of event	Who attended
Wie kann ein digitales Web-Tool Sachsen helfen, nachhaltiger zu werden?	SEBIT, Zukunftsstadt Dresden	Online-Workshop	26/11/2020	Maria Stadler
post-projectification – new normal in urban experimentation	IST conference session	Conference	20/08/2020	Maria Stadler
urban lunch talks #7 – from Test to Success	JPI urban Europe	Webinar (recorded)	08/10/2020	Maria Stadler

List of Documents reviewed

Author name	Document name	Document type	Year
Ballon, Pieter; Schuurman, Dimitri	Living labs: concepts, tools and cases	conference contribution	2015
Bauknecht, Dierk; Bischoff, Thore Sören; Bizer, Kilian; Führ, Martin; Gailhofer, Peter; Heyen, Dirk Arne et al.	Exploring the pathways: Regulatory experiments for sustainable development – An interdisciplinary approach	Journal article	2020
Bischoff, Thore Sören; Leyen, Kaja von der; Winkler-Portmann, Simon; Bauknecht, Dierk	Regulatory experimentation as a tool to generate learning processes and govern innovation. An analysis of 26 international cases	Journal article	2020
BMBF	Zukunftsstadt. Strategische Forschungs- und Innovationsagenda	Policy document	2015
BMUB	LEIPZIG CHARTA. zur nachhaltigen europäischen Stadt.	Policy document	2007
BMWi	7. Energieforschungsprogramm der Bundesregierung	Policy document	2018
BMWi	Reallabore als Testräume für Innovation und Regulierung. Innovation ermöglichen und Regulierung weiterentwickeln.	Policy document	2018
BMWi	Freiräume für Innovationen. Das Handbuch für Reallabore	Policy document	2019

Bylund, Jonas	Joint programming for urban transformations: the making of the JPI Urban Europe Strategic Research and Innovation Agenda.	Journal article	2020
Defila, Rico; Di Giulio, Antonietta	Transdisziplinär und transformativ forschen. Eine Methodensammlung.	book	2018
Defila, Rico; Di Giulio, Antonietta	Wissenschaftspolitische Empfehlungen zum Forschungs-und Förderformat Reallabor	Policy brief	2019
Erdmann, Lorenz; von Geibler, Justus; Dönitz, Ewa; Stadler, Karin; Zern, Rubina	Living Labs für eine Green Economy 2030. Langfassung mit Roadmaps in den Konsumfeldern Wohnen, Einkaufen und Mobilität. Ergebnis des Arbeitspakets 7 (AP 7.4) im INNOLAB Projekt: „Living Labs in der Green Economy: Realweltliche Innovationsräume für Nutzerintegration und Nachhaltigkeit	Report	2018
Horizon Europe	Draft Work programme 2021-2022	Policy document	2020
JPI Urban Europe	The knowledge hub for urban transitions	Leaflet	(unknown)
McCrory, Gavin; Schöpke, Niko; Holmén, Johan; Holmberg, John	Sustainability-oriented labs in real-world contexts: An exploratory review	Journal article	2020
Parodi, Oliver; Beecroft, Richard; Albiez, Marius; Quint, Alexander; Seebacher, Andreas; Tamm, Kaidi; Waitz, Colette	Von „Aktionsforschung“ bis „Zielkonflikte“ – Schlüsselbegriffe der Reallaborforschung	Journal article	2016
Schneidewind, Uwe	Urbane Reallabore - ein Blick in die aktuelle Forschungswerkstatt	Article	2014
Scholl; Christian, Ablasser; Gerhard, Eriksen; Mette Agger, Baerten; Nik, Blok; Johanna, Clark et al.	Guidelines for Urban Labs	Report	2017
Schuurman, Dimitri; Marez, Lieven de; Ballon, Pieter	Living Labs: a systematic literature review	Journal article	2015
Wagner, Felix; Miller, Eric	The Background and History of Real-World Laboratory Funding in Baden-Württemberg	Journal article	2018
WBGU	Welt im Wandel. Gesellschaftsvertrag für eine Große Transformation	Report	2011

10 Annex 2

Detailed SIE-field timeline

Phases, Milestones in the development of research and innovation policy after 1945, identified by Polt et al. (in press)

1980s	Innovation - Policy Trend	Innovation policies focus on key technologies	(Polt et al. in press, p. 32)
1990s	Innovation -Policy Trend	territorial diffusion-oriented system approach in innovation policies	(Polt et al. in press, p. 32)
2000s	Innovation -Policy Trend	sectoral system approach	(Polt et al. in press, p. 32)
2010s	Innovation -Policy Trend	Mission oriented innovation policies, social innovation	(Polt et al. in press, p. 32)

Phases of the German electricity transition (1986 – 2016), identified by Geels (2020)

1986 -1998	Energy - Policy Trend (GER)	'Niche innovations were nurtured in the context of a stable regimes'; wine turbines and PV supported after the 1986 Chernobyl shock	(Geels 2020, pp. 14–15)
1998 - 2009	Energy - Policy Trend (GER)	Red-Green coalition government: decision to phase out nuclear energy, renewable energy act (EEG, 2000)	(Geels 2020, pp. 15–16)
2009 - 2016	Energy - Policy Trend (GER)	Diffusion of renewable energy (feed-in-tariffs, declining RET prices), Fukushima and financial crisis as further landscape shocks	(Geels 2020, pp. 17–18)
2017 on	Energy - Policy Trend (GER)	government efforts to slow RET expansion and support utilities	(Geels 2020, p. 18)

Energy- and climate related policy events (national)

1990	Policy event	Federal Cabinet adopts its first emissions reduction target: 25 to 30 percent fewer CO ₂ emissions by 2005, compared to 1987 levels	(Wettengel 2020)
1991	Policy event	New legislation introduces feed-in tariffs for renewable power	(Wettengel 2020)
2000	Policy event	Renewable Energy Sources Act: generation of renewable electricity encouraged through feed-in-tariffs	(Agora Energiewende 2015)
2002	Policy event	Decision on nuclear phase out (nuclear consensus)	(Agora Energiewende 2015)

2007	Policy event	German climate and energy policy package (greenhouse gas reduction 40% compared to the levels of 1990)	(BMU 2007)
2010	Policy event	Energy concept of the German government (for an environmentally friendly, reliable and affordable energy supply)	(BMWi 2010)
2011	Policy event	Nuclear phase out Law and announcement to close all of German nuclear power plants by December 2022	(BGBl 2011 I 43 S. 1704-1705)
2014	Policy event	Renewable Energy Sources Act (EEG 2.0): from specified feed-in tariffs to system of tendering	(BGBl 2014 I 33 S. 1066-1147)
2016	Policy event	Smart metering and the Energy Transition Digitisation Act	(BGBl 2016 I 43 S. 2034-2064)
2017	Policy event	Renewables reform The switch from set feed-in tariffs to auctions for renewables enters into force	(BGBl 2017 I 49 S. 2532-2539)
2019	Policy event	Climate action law Germany's first climate law makes emissions reduction legally binding	(BGBl 2019 I 48 S. 2513-2521)

Energy- and climate related policy events (international)

1997	Policy event	Kyoto Protocol: requires to cut CO2 emissions	(Wettengel 2020)
2007	Policy event	Leipzig Charter (on sustainable urban development goals)	(BMUB 2007)
2015	Policy event	Paris Agreement - UN Framework Convention on Climate Change with long-term temperature goal	(United Nations 2015a)
2015	Policy event	Agenda 2030 - Sustainable Development Goals (SDGs)	(United Nations 2015b)
2020	Policy Event	EU funding initiative on Energy citizenship and transition super labs	

Field events (mentioned by interviewees and identified via Desktop research)

2006	Field Event	Frist attempts on EU level: EU commission declares support of Living Labs, ENOLL was established (see: https://enoll.org/)	(Schuurman et al. 2015)
2008 / 2009	Field Event	Design study by the European Commission shaped the term Living Lab: Design Study for the LIVING LAB Research Infrastructure, to research human interaction with, and stimulate the adoption of, sustainable, smart and healthy innovations around the home (see: https://cordis.europa.eu/project/id/212498)	(Liedtke et al. 2012) Interview DE_PIE_1

2010	Field Event	joint programming initiative (JPI) Urban Europe was established, Nearly half of the 73 JPI Urban Europe funded projects apply urban living labs approaches (see: https://jpi-urbaneurope.eu/)	(JPI Urban Europe)
2013	Field Event	Baden-Württemberg Ministry of Science, Research and Arts announced a new funding line for real-world labs entitled BaWü Labs, the first worldwide of its kind and scale (see: https://mwk.baden-wuerttemberg.de/de/forschung/forschungspolitik/wissenschaft-fuer-nachhaltigkeit/reallabore/)	(Wagner and Miller 2018)
2014	Field Event	ITA (innovation and technology analysis) research program, forum and congress (see: https://www.bmbf.de/de/innovations-und-technikanalysen-ita-937.html)	(BMBF 2017)
2015	Field Event	Initiative by the Federal Ministry of Education and Research (BMBF) and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) to establish the Innovation platform 'Zukunftsstadt' (future city). The initiative includes the 'experimental implementation of promising concepts in urban real world laboratories' (see: https://www.bmbf.de/de/zukunftsstadt-566.html)	(BMBF 2015)
2018	Field Event	BMW Strategy and funding for real world laboratories, including (see: https://www.bmwi.de/Redaktion/DE/Dossier/reallabore-testraeume-fuer-innovation-und-regulierung.html)	(BMW 2018b, 2019b)
2019	Field Event	The Karlsruhe Institute of Technology, Wuppertal Institute, Leuphana University Lüneburg and Ecornet have launch the "Network Real Laboratories for Sustainability" (see: https://www.reallabor-netzwerk.de/news/)	
2019	Field Event	Network 'Reallabore' by the federal Ministry for Economic Affairs and Energy established and first meeting in Berlin (see: https://www.bmwi.de/Redaktion/DE/Veranstaltungsarchiv/20190828-netzwerktreffen-reallabore.html)	

Projects and initiatives (identified via Desktop research)

2006-2013	Projekt / Initiative	IBA Hamburg puts a focus on participatory urban development processes and sustainability (see: https://www.iba-hamburg.de/en/)	Interview DE_PIE_2
2008	Project / Initiative	Since acquiring the property in 2008, EUREF AG has been developing the city district around the "Gasometer" (Gasholder) into a real-life	

		laboratory for the shift to renewable energy. (Zukunftsorte Berlin – urban development projects, Gründung der EURF AG) (see: https://euref.de/en/euref-campus_en/)	
2009	Initiative	Nexthamburg (since 2012: non-profit recognized association); Pilot project of the national urban development policy funded by the Federal Ministry of Transport, Building and Urban Development from 2009 to the beginning of 2012. Aims for open Civic Innovation (see: https://nexthamburg.de/)	(McCrorry et al. 2020)
2010	Project	InnovationCity Ruhr, Labor Bottrop: the “Labor Bottrop” demonstrates what a climate-friendly urban redevelopment can look like, taking into account the safeguarding of the industrial site (see: https://www.innovationcity-bottrop.de/index.php?id=3)	
2011	Project	Quartier Zukunft – Labor Stadt (see: https://www.itas.kit.edu/projekte_paro11_quazu.php)	Interview DE_PIE_1
2011	Project	Effizienzhaus Plus in Berlin, Fasanenstraße, (see: https://www.bmi.bund.de/DE/themen/bauen-wohnen/bauen/energieeffizientes-bauen-sanieren/effizienzhaus-plus/effizienzhaus-plus-node.html)	Interview DE_PIE_1
2015-2019	Project	Living Lab Walldorf: community of electricity producers and consumers who exchange experiences and energy with one another. (see: http://www.living-lab-walldorf.de/projekt/)	
2017 - 2020	Project	Start of the project SINTEG: “In the funding programme "Smart Energy Showcase - Digital Agenda for the Energy Transition" (SINTEG), transferable model solutions for a secure, economical and environmentally friendly energy supply with temporarily 100% electricity generation from renewable energies are developed and demonstrated in large-scale model regions” (zeitlich befristeten „Experimentieroptionen“, SINTEG als Reallabor) (see: https://www.sinteg.de/en/)	Interview DE_PIE_4
2017	Initiative	dynamis was founded in 2017 by the innogy Foundation for Energy and Society, the Institute for Advanced Sustainability Studies (IASS) and the 100 percent renewable foundation.; dynamis deals in a transdisciplinary way with the social dimension of the energy transition and issues that have to be tested in labs	https://www.dynamis-online.de/ueber-uns/

2019-2021	Project	Project RERaGI aims for testing and evaluating regulatory options in fields with high technological or social innovation dynamics. (see: https://reragi.wordpress.com/reragi-englisch/)	
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Broader societal Trends

2000s	societal trend	In the end of the 00s, the term Living Lab first appeared; the term Reallabor developed later mainly in the German context	Interview DE_PIE_1
2019	societal trend	Climate change for the first time as number one political topic	(Agora Energiewende 2020)

Environmental or societal shocks

2008-2009	Shock	Financial-economic crisis.	
2011	Shock	Fukushima nuclear catastrophe	
2015-2016	Shock	European migrant crisis	
2020	shock	Corona Pandemic	

SONNET – SOCIAL INNOVATION IN ENERGY TRANSITIONS

Co-creating a rich understanding of the diversity, processes, contributions, success and future potentials of social innovation in the energy sector

GA#: 837498 / Funding type: RIA

Research report on Cooperative Organisational Models for Renewable Energy in Germany



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About SONNET: SONNET is a research project that aims to develop an understanding of diversity, processes, contributions and future potential of social innovation in the energy sector. It is co-funded by the European Commission and runs for three years, from 2019-2022. The SONNET consortium consists of 12 partners across Europe, including academics and city administrations. For more information, please visit our website: <https://sonnet-energy.eu>

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12th July 2021

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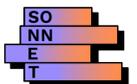
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1 FORWARD

SONNET (Social Innovation in Energy Transitions) brings diverse groups together to make sense of how social innovation can bring about a more sustainable energy sector in Europe. The project aims to co-create a rich understanding of the diversity, processes, contributions, successes and future potentials of social innovation in the energy sector (SIE). We define SIE as combination of ideas, objects and/ or actions that change social relations and involve new ways of doing, thinking and/ or organising energy. As part of this work, we make use of an embedded case study approach to build a better understanding of the development of diverse SIE-fields (e.g. participatory incubation and experimentation, framings against specific energy pathways, local electricity exchange) over time. Our research questions that frame the case study work are:

- How do SIEs and SIE-fields emerge, develop and institutionalise over time?
- How do SIE-field-actors and other field-actors interact with the 'outside' institutional environment and thereby co-shape the SIE-field over time?
- What are the enabling and impeding factors for SIE-field-actors and other field-actors to conduct institutional work and change the 'outside' institutional environment?

A SIE-field is an arena/space that includes a specific SIE as well as SIE-field-actors working on it and other field-actors enabling and/or impeding it. In this arena/ space these actors take one another and their actions into account and have a shared (but not necessarily consensual) understanding of a SIE and of their relationship to other actors. They recognise (but not necessarily follow) shared norms, beliefs and rules. SIE-fields are often not homogenous but are composed of actors with diverse and contradictory aims and interests. An example: The UK cooperative energy field includes SIE-initiatives and SIE-field-actors (e.g. Brighton Energy Co-op, Cooperative UK, Community Energy England, UK Government, City of Brighton), who have a shared understanding of an SIE, which exists as 'organising under cooperative principles to generate renewable energy'.

The structure of this report is as follows. Section 2 provides a summary of the SIE-field relevant for this report and lists some key insights. Section 3 outlines the boundaries of the SIE-field and shows how it has been studied in the country context. Section 4 shows a visual development of the SIE-field. Section 5 tells the historical development of the SIE-field over time, including analytical/ interpretive reflections from the SONNET researchers and quotes from the actors involved in the field developments. Section 6 outlines key research findings, providing answers to the three research questions. Section 7 outlines recommendations for policymakers based on the findings. After the list

of references (section 8) the final section 9 outlines the methodological approach and includes a more detailed timeline of the SIE-field and its actors.

The following boxes are used within the report:

Conceptual work

Introduction to SIE-initiative

2 Cooperative organisational models for renewable energy in Germany

In SONNET, we investigate the development of the SIE-field (and its initiatives) called renewable energy cooperatives (REC) - in Germany, but also in Switzerland and France. With RECs, we refer to **organisational models through which citizens jointly own means of and participate in renewable energy production**. Primarily, RECs aim to finance and operate renewable energy power plants but can also have other goals such as to sensitize local actors to the potential of local renewable energy and energy savings.

To determine what constitutes a **cooperative organisational model**, we rely on the cooperative principles provided by the European federation of renewable energy cooperatives (REScoop) and by the International Cooperative Alliance (ICA) respectively. These principles include **i) concern for community, ii) voluntary and open membership, iii) democratic governance of the undertaking, and iv) autonomy and independence**. At the organisational level, the cooperative principles can be implemented through a legal cooperative statute. However, what principles are represented in a cooperative statute varies from one country to another. Also, organisations with other statutes can adopt cooperative principles without having a cooperative status. To explore the boundaries of the REC field in each of the investigated countries, we started with organisations adhering to the cooperative principles and identified empirically in which arena the majority of them are embedded.

In Germany cooperative organisational models who adhere to the cooperative principles can be distinguished from other organisations by their legal form. The main attributes of member orientation, the identity principle and the democratic principle have been guaranteed by the **German Cooperative Law (GenG)** since 1889 (in GenG §1-§172). Those principles assure that cooperatives pursue the interests of their members through three means: (1) a communal business, (2) a combination of two opposing roles, e.g., the landlord and the renter, and (3) voting rights, where every member of the cooperative has one vote independent of the amount of his/her share (Klagge et al., 2016). Those principles are fundamental characteristics of energy cooperatives and play an important role for the selection of the cooperative model. Furthermore, since the registration in the German cooperative register is mandatory for all cooperatives (§10 §11 GenG) it is ensured that all energy cooperatives are comprehensively registered. Within these principles, however, cooperative organisational models with the legal status of a cooperative **can differ considerably concerning their activities, geographical scale and size**.

In the following, we **focus on cooperatives as the main organisational model** for citizen participation in renewable energy in Germany. However, it should be noted that other legal

organisational forms like associations (e.V.), limited liability companies (GmbH), partnerships under the civil code (GbR), or public limited companies (AG) exists in the field of renewable energies and may partially comply with the criteria mentioned above. Even if there might be similarities in many aspects between cooperative models and other legal forms, in this report, we only focus on cooperative models and therefore do not consider other legal forms of citizen participation in renewable energy.

Finally, the development of the SIE-field has been **fundamentally influenced by national energy policies**, as will be shown in this report. More precisely, the various changes in these policies influenced the structuration of the field and led to further adaptation processes. For brevity reasons we will not always speak of “cooperative organisational models for renewable energy in Germany” but “energy cooperatives” in short.

Key insights

For the SONNET project, the SIE-field of cooperative organisational models for renewable energy in Germany is particularly interesting because it reveals several important issues for social innovation in energy transitions. In particular, it illustrates that:

- The **socially innovative character** of energy cooperatives in Germany is not mainly to be found in the organisational model itself but rather in **its application, the reasons for its application and the resulting activities and implications**. The application of the cooperative model in the context of renewable energy to enable citizens participation in the energy transition and the resulting decentralisation of the energy system constitute one part of the socially innovative character of energy cooperatives in Germany. Furthermore, the resulting pioneer activities through which energy cooperatives induce further changes in the energy system are the main aspects of their socially innovative character.
- Moreover, the use of the cooperative organisational model led to the **evolution of a newly organised network** which is starting to have an impact on the established energy system, through the political representation of cooperatives and the alternative opportunity to generate electricity.
- The **main influential factors** for the development of the SIE-field under study are the **regulatory framework conditions on the national level**, namely German energy policy. In particular, the introduction of the feed-in tariffs for renewable energies within the Renewable

Energy Sources Act (EEG) served as the main enabling condition for the vast increase of energy cooperatives in Germany. Likewise, the decrease of feed-in tariffs and further policy changes (such as the implementation of an auction model, see Box 'policies and policy making', p. 22) hindered the further rise of newly established energy cooperatives. Nonetheless, the impact of the sub-national level, i.e. the federal states in Germany, on the development of the SIE-field is not negligible, since they can financially support the structuration of the field, through the provision of subsidies for regional intermediaries.

- Even though the initial beneficial conditions for the expansion of energy cooperatives are reduced, the SIE-field has the **potential to further develop through processes of diversification and professionalisation** (with respect to project planning and administrative processes), thus leading to further socially innovative developments.

3 Introduction to Cooperative Organisational Models for Renewable Energy in Germany

Energy cooperatives are not a new phenomenon per se in Germany since they already existed in the 20th century. In the early 1900s, their main task was to provide the rural population of Germany with electricity since it was not profitable enough for national energy providers to invest in energy grids. However, of the 6,000 electricity cooperatives existing in 1930, only 44 were still operating in 2015 (Debor, 2018). Nevertheless, since the beginning of the early 2000s, a new wave of energy cooperatives evolved with the focus on the generation of renewable energies. More precisely, 92% of all 10551 energy cooperatives registered in 2015 were established from 2006 onwards, thus the currently active energy cooperatives can be considered as a new phenomenon in Germany (Debor, 2018).

Energy cooperatives are the largest part of citizen energy in Germany (Kahla et al., 2017). According to the data basis of Kahla et al. 2017 energy cooperatives have a share of 54.6% in comparison to limited liability companies with 6.2 % and limited partnerships with a limited liability company as general partner with 36.6%. During the last 20 years, the increase of newly founded energy cooperatives, as well as the rising numbers of new members, indicate their increased popularity. In the academic literature Kahla et al. 2017 explain the growth of public attention for energy cooperatives by their positive public perception and increased popularity during the financial and climate crisis. This is accompanied by their democratic governance structure which enables citizens to participate in the energy transition – in contrast to investment-oriented companies. The transformation of the insolvent Prokon company group into an energy cooperative (2015) is an example of the trend of investor-oriented companies to change their organisational model into energy cooperatives because of their positive image (Kahla et al., 2017).

Key changes in the SIE-field over time

One of the central research questions and empirical foci within the SONNET case studies is to understand the development of the SIE and its SIE-field over time (Hielscher et al. 2020, pp. 15–18). We, therefore, take a ‘process perspective’ and investigate change through focusing on the emergence of the field and the activities of SIE-actors shaping them (Wittmayer et al. 2020b,

¹ The numbers of energy cooperatives per year vary depending on which data bank the authors use.

p. 33). In doing so, we look at external shocks, internal field events and key changes in the development of the SIE-field and its relationship with the 'outside' institutional environment (Wittmayer et al. 2020b, pp. 29–30). Moreover, we appreciate that changes in the SIE-field also concern changed narratives and societal trends that enable or impede the development of the SIE and its SIE-field.

For the SIE-field under study three fundamental key changes demarcate the development of the field in particular.

Firstly, the implementation of the Renewable Energy Source Act in the year 2000: Its introduction of the guaranteed feed-in tariffs (alongside other provisions) enabled an immense increase in energy cooperatives in Germany, particularly due to the secure long term investment opportunities for energy cooperatives. The accompanying feature of this first key change in the SIE-institutional environment and consequentially the SIE field is the amendment of the German cooperative law in 2006 which facilitated the establishment of energy cooperatives as well as the administrative procedures for smaller cooperatives. Both policy changes were the main enabling conditions for the enormous increase of newly established energy cooperatives from 2006 onwards.

The amendments of the previously very supportive energy policies characterises the second key change. The amendments of the Renewable Energy Sources Act of 2012 and 2014 led to the gradual decrease of the attractiveness of the main business model of energy cooperatives which relied on the remuneration through supportive feed-in tariffs. The decreasing margins for investments in renewable energies due to lower feed-in tariffs, their later substitution through tenders, paired with new restrictions on plant sizes, the regulations about own consumption and the new requirement to pay the EEG surcharge for it, as well as the 'breathing lid' contributed to a decrease in the number of newly founded energy cooperatives. At the same time, these impeding conditions evoked the diversification of business areas and models of existing energy cooperatives.

Finally, as a reaction to the previous key changes, the actors in the SIE-field under study started to increase their cooperation and established regional as well as national intermediaries, such as the LANEG Rheinland-Pfalz (regional) or the Bündnis Bürgerenergie e.V. (national). The resulting enhanced degree of organisation in the SIE-field can be described as the third key change. Its impact on the energy transition remains to be seen.

Energy cooperatives in Germany comprise around 850 cooperatives with around 200.000 members in 2019 (DGRV 2020, p. 9). The majority was founded within the last 10 years and invested roughly 1.7

billion euro into renewable energies (Genossenschaften in Deutschland, 2020a). Since the membership is often already possible with less than a hundred euros, energy cooperatives enable citizen participation on a large scale. Their focus on regionality and participation furthermore has supported increasing acceptance levels in renewable energies in the general public (Genossenschaften in Deutschland a, 2020; Herbes et al., 2017; Viardot, 2013; Sagebiel et al., 2014; Engerer, 2014). Until today energy cooperatives are active in different fields and can be differentiated by the way they are engaging with energy (Brinkmann and Schulz, 2011). The following table summarizes their main fields of activity. Note that some energy cooperatives engage in more than one of those fields.

Table 1: Types of energy cooperatives according to their activities

Type of energy cooperative	Tasks regarding energy
Service Organisation Cooperative (‘Dienstleistungsgenossenschaften’)	<ul style="list-style-type: none"> • consultation of their members • purchase of energy • acquisition of new tasks for the cooperative • provision of sustainable energy for their members
Energy consumer cooperatives (‘Energieverbraucher-genossenschaften’)	<ul style="list-style-type: none"> • mostly involved in the trading and the distribution of energy to the user
Producer cooperatives (‘Energieerzeugergeno-senschaften’)	<ul style="list-style-type: none"> • produce their energy or heat through photovoltaics, wind or water
➔ biggest group of energy cooperatives	

According to the data analysis of Kahla et al. (2017), the majority of energy cooperatives engages in photovoltaic energy production. The second most frequent field of activity is local heat networks followed by wind energy (and to a much smaller extent) hydrodynamic power and solar heat. For the former, the generation of electricity through photovoltaics fed into the public network and the therefore obtained remuneration for the feed-in tariffs constituted their main business model. In 2014 the revenues of almost 80% of all regional energy cooperatives and more than 80% of the supra-regional energy cooperatives depended on the feed-in tariff policy (Herbes et al., 2017).

Another distinguishing characteristic of energy cooperatives is their geographical scope. Regional cooperatives mainly focus on sites in their rural district and only allow membership for the population

of their region. Supra-regional energy cooperatives on the other hand also include sites outside of their rural districts as well as members from different areas. In addition, they tend to be bigger in terms of membership and amount of investment, and typically offer more varied activities regarding the energy production and marketing as well as activities beyond that (except for energy cooperatives who are involved in the heat sector) (Klagge et al., 2016). However, in the German case, the importance of the regional orientation in terms of membership as well as for the location of sites lost relevance. As Klagge et al. (2016) elaborate, in 2014 half of the energy cooperatives were not exclusively regional oriented anymore and the number of cooperatives with a supranational orientation in terms of membership and site locality increased to one fifth in total. Finally, the most populous federal states in Germany host the biggest amount of energy cooperatives (Bavaria, Baden-Württemberg, Niedersachsen and Nordrhein-Westphalia). However, when looking at the numbers of energy cooperatives in relation to the population of the federal states the outcome differs: in this case, Thuringia follows Bavaria as the federal state with the second biggest amount of energy cooperatives (Kahla et al. 2017).

The SIE-field under study is furthermore characterised by an immense range in the size and activity spectrum of energy cooperatives. To better illustrate this range, we selected **two different SIE-initiatives for more in-depth examination**. As first initiative we chose a middle-sized cooperative, namely the initiative Solix Energie² with 120 members and several regional activities (see box p.29). In contrast, as second SIE-initiative we selected a very big cooperative, namely Elektrizitätswerke Schönau³ (EWS) which has a supra-regional activity scope, various business fields and around 9,000 members nationwide. Besides its function as a cooperative EWS is a key actor for the field of energy cooperatives, amongst others e.g. through its supporting measures for single cooperatives, its function as a role-model and its various cooperation with other actors in the field (see box p.31).

Despite their various differences, energy cooperatives tend to share fundamental characteristics regarding their aims and motivations. The overarching main goal is often to contribute to the energy transition by means of active participation of citizens. By financing, constructing and managing renewable energy sites energy cooperatives enable citizens to directly part take in the energy transition. The democratic structures of the cooperative model usually contributes to the participation opportunities for citizens and thereby replaces the previous role of the passive consumer by the active “prosumer” (see Interview DE_EC_05). Through the increased participation of citizens energy cooperatives support the democratisation of the energy system. Another common

² Solix Energie: <https://www.solix-energie.de/>

³ Elektrizitätswerke Schönau <https://www.ews-schoenau.de/>

characteristic among energy cooperatives is their regional orientation and their aspirations to contribute to the regional development through their activities. Those ideational aims often have priority over financial motives (Klagge et al., 2016). A further unifying characteristic of energy cooperatives seems to be their specific application of the cooperative model, which can be described as a social innovation.

As described above, energy cooperatives are not a new phenomenon in Germany. Their purpose as well as their aims however significantly changed since their emergence. In contrast to these older cooperatives, energy cooperatives today aim to introduce an alternative to the already existing goods (electricity) for ideational reasons. According to Klagge et al. (2016), the ideational motivation to participate in the energy transition is a more important aspect for members of energy cooperatives than the payment of revenues (Klagge et al., 2016).

Following up on this, the use of the cooperative model in the field of energy differs significantly from other cooperatives. Usually, the cooperative model is used in the way that members obtain economic advantages through their membership e.g. cheaper goods or cheaper rents. What is specific about cooperatives in general is, that cooperatives are supposed to promote their members economically. The cooperative promotion purpose (“Genossenschaftlicher Förderzweck”) is paramount and not the payment of revenues (Genossenschaften in Deutschland, 2020b). That is different for energy cooperatives. Herein members hand in their capital and obtain financial revenues for their membership instead of material economic advantages (see Interview DE_EC_01 and 5).

Another aspect of social innovation are the pioneering activities of energy cooperatives: Energy cooperatives can lead to social innovation in that they have the time to show other market players new business models. While some activities might be too risky for established actors like energy providers, energy cooperatives can be so positively convinced of their ideas that they experiment or look into alternative ways of doing, thinking and organising. Sometimes regardless of the time it takes. One example would be the introduction of the functionality of metres to a conventional energy provider (see Interview DE_EC_04). Thus, energy cooperatives are creating SIE's with their activities. This stands in opposition to the statement that many cooperatives suffer from financial and time resources and therewith represents the oppositional perception of energy cooperatives capacities (see further in the box “contestation”).

Klagge et al. 2016 support those findings. The authors describe the innovative part of energy cooperatives today in the way they enable citizens to participate in the energy transition through the participation possibilities in renewable energy sites. Through the engagement of the new extra player

besides conventional energy suppliers the actor constellation of the German energy system changed (Klagge et al., 2016).

An additional aspect of social innovation could be seen in the focus on regionality. Many energy cooperatives and their representatives emphasise the importance of regional development. For the “local energy transition” it is important that the revenues remain in the region, even though that might only be the amount worth “for a visit in a regional restaurant”, it still leads to ties with the regional services and the feeling of connectivity (DE_EC_03). This behaviour is socially innovative in that it represents a new way of doing (dealing with) energy in opposition to central energy providers where the profits do not benefit the region and are rather centrally accumulated.

SIE changing social relations

In the context of the SONNET project, social innovation in energy (SIE) is defined as a ‘combination of ideas, objects and/or actions that change social relations and involve new ways of doing, thinking and/or organising energy’ (Wittmayer et al. 2020b, p. 4). One identified type of SIE is the ‘cooperative organisational model for renewable energy’. Energy cooperatives and their activities influence social relations in several ways.

First of all, the introduction of the cooperative model in the renewable energy sector changed the role of citizens in the energy system. The cooperative model enables citizens to actively engage in the energy transition thus not only passively consume energy mostly of the big four or municipal utilities but to participate actively in the generation of energy in various small units (cooperatives) – and thereby become Prosumers (see Interview DE_EC_04).

The majority of energy cooperatives used to rely on voluntary work. Since the changed policies complicated the conditions for energy cooperatives they started to professionalise more which might restructure the working conditions and related relationships within energy cooperatives. In addition to that, the establishment of several regional intermediaries as well as national intermediaries changed the relations between single energy cooperatives and representatives of politics, administration and other networks:

“The noticeability of energy cooperatives changed. Municipalities know what energy cooperatives are, which wasn’t always the case before. Also other actors are more aware of the work energy cooperatives do...” (Interview DE_EC_05)

Therewith the work of intermediaries – regional intermediaries of energy cooperatives as well as national associations - leads to more potential cooperation partners for energy cooperatives and subsequently to an expansion of their social relations. The work of intermediaries also influences the relations between energy cooperatives by strengthening the exchange and relations among cooperatives.

Furthermore, the organisation of the cooperatives and the therewith related participation creates a feeling of togetherness among cooperative members (see Interview DE_EC_03). This leads to closer bonds between their members and potentially influences the relationship between members and the cooperative itself (and the therewith represented aims and ideals) as well.

Finally, the expansion of energy cooperatives led to the foundation of several other cooperative forms i.e. community-supported agricultures (“solidarische Landwirtschaften”), mobility associations, village stores or communal living forms who made use of the cooperative organisational model. Energy cooperatives thus influenced the field through their role as trendsetters and changed social relations by the further dispersion of the cooperative model (see Interview DE_EC_05).

The specific aims of cooperatives have to be seen against the background of the German energy system. Despite the liberalisation of the electricity market the biggest share of electricity generation capacity is still owned by four big energy providers (from 2009: 80% to 2018: 57%) (Bundesnetzagentur, 2020). In addition to that, even though the share of non-renewable energy sources is continuously decreasing the German electricity mix still consists of 53.9 % non-renewables in 2019 (Fraunhofer ISE, 2020). This seems to serve as a constant motivation for energy cooperatives to further propel the energy transition and to create an independent counter-model to the prevalent energy system (see Interviews DE_EC_04, DE_EC_05 and DE_EC_06).

The rising environmental awareness of the German society⁴ and societal trends in favour of a more sustainable lifestyle are additional positive influences for the establishment of the field (see Interview DE_EC_05). Those trends led to a heightened curiosity about the resources and mechanisms behind energy production and an increased interest in renewable energies. The general trend among

⁴ The German federal environmental agency conducted a survey about the environmental awareness of the German society every second year. An evaluation of the results showed a weak but continuous increase of the environmental awareness from 1996-2016, despite significant deviations in some years (UBA, 2019).

citizens to self-organise and to get involved in the creation and management of public goods created further momentum for the engagement in energy cooperatives (Debor, 2018).

Diversity, Contestations and relations between actors

SONNET is interested in understanding interactions between SIE-field actors and/or other field-actors. These relations can be formal or informal, take different forms (e.g. formal alliances, networks, collaborations) and might differ in their quality (e.g. conflicting, competitive, collaborative or exchange-oriented relations; Wittmayer et al. 2020b, p. 14) as well as in their content (e.g. concentrating on learning, networking, lobbying etc.). Furthermore, field contestations between SIE-field-actors and/ or other field-actors are of interest as they can 'unsettle' the existing 'outside' institutional environment (Hielscher et al. 2020, p.19). Contestations are debates among relevant actors over SIE-field structures and processes such as disagreements about common aims or approaches to lobbying policymakers. Contestations and relations can indicate how institutionalised (or not) the SIE-field is (e.g. are there formal networks).

Diversity

The field of energy cooperatives is characterised by high levels of diversity, with energy cooperatives differing considerably regarding their size, field of activity and geographical scale. Moreover, the diversity is reinforced by the variety of relevant actors for the field ranging from municipalities to research institutes and different federations. Another source of diversity concerns the motivation for EC. While the majority of interviewees has been solely focussed on the ideational motivation, some interviewees of the SIE-field displayed more economical explanations for specific developments. This indicates the heterogenous approaches and views of SIE-field members and could be influential for the further development of the SIE-field under study.

Contestations

Contestations in the field of energy cooperatives mainly occur regarding the policies opposed to renewable energies at the national level which restrict energy cooperatives in their procedures as well as regarding opposing views of big utilities. However, the current status of energy cooperatives is perceived differently by SIE-initiative members and their intermediaries. While cooperative members were said to describe themselves as very active despite the changed conditions (for example regarding the two interviewed SIE-initiatives), intermediary organisation

representatives tend to nourish the narrative of the problematic situation cooperatives are in today (see Interviews DE_EC_01, DE_EC_02, DE_EC_03 and DE_EC_07). This might be a result of their different positions in the field and resulting point of views on the situation of energy cooperatives or due to their different goals (the more regional orientation of the cooperative vs. the aims of structural changes of the intermediaries).

In addition to contestations around national energy policy, the field is shaped by the ongoing dispute between wind energy opponents and wind energy advocates -among them energy cooperatives and their intermediaries (see Interview DE_EC_05).

Other contestations occur between intermediaries and other SIE-field actors regarding the goals of energy cooperatives and the different measures to achieve them. This dispute also reveals a fundamental underlying cause of contestation which is that several SIE- field and other field actors tend to marginalise the effects and potentials of citizen energy. Debates about the right way to achieve hundred per cent renewables or the energy transition, in general, do not only take place within the SIE-field or between the SIE-field and other field actors but also within intermediary organisations.

Relations

The field of energy cooperatives is characterised by strong personal ties and cooperation between board members of energy cooperatives, members of intermediary organisations and other relevant organisations. Those personal relations often occur as “Personalunion” meaning that the same person is a member of several boards of relevance for energy cooperatives. Those double roles lead to synergy effects and make it easier to coordinate and shift tasks between important organisations.

“The ‘Personalunion’ is system immanent! Without that the whole thing wouldn’t work. That also accounts for the boards of cooperatives.” (Interview DE_EC_06)

As cooperative representatives know each other through the participation in the same board or the attendance of the same events they also know with whom they want to cooperate in the future. One interviewee described it precisely as “it all depends on your network” (Interview DE_EC_06). Those personal ties do not just exist among the different organisations but can also reach into regional politics. As a result, processes of cooperation are often initially characterised by informal agreements which later lead into formal procedures and agreements.

It appears that another influential characteristic of energy cooperatives is the high commitment of single cooperative board members. The interviews indicate its importance as a prerequisite for

the creation of the intermediary organisations of the field (see Interviews DE_EC_03, DE_EC_04 and DE_EC_08).

Another representative facet of energy cooperatives is the relationship with municipalities. Meister et al. 2020 focussed on the linkages between energy cooperatives and municipalities and emphasised the important role of municipalities for energy cooperatives and vice versa. The numerous cooperation between cooperatives and municipalities are another example of the importance of cooperation for the SIE-field.

“Municipal utilities are always a good partner.” (Interview DE_EC_08)

Nevertheless, the support of municipalities is not guaranteed automatically and the perception about their role is contested.

“Municipalities can be an impeding as well as an enabling factor for energy cooperatives.” (Interview DE_EC_05)

Overall, it appears that these high levels of cooperation are not only an individual attribute but a significant characteristic of the SIE-field which shaped its emergence and development.

After an initial lack of energy cooperative specific political representation and following worsened policy conditions for their activities the field of energy cooperatives started to structure itself from 2010 onwards, among others by forming regional intermediaries. In this report we consider organisations and associations which represent the interests of energy cooperatives or fulfil other tasks for energy cooperatives as intermediaries. Regional intermediaries offered energy cooperatives a way to engage in regional politics, cooperate with different actors and represent their interests at the regional level. Of the eight regional intermediaries we could account for in this case study, four were interviewed for further analysis. However, since the regional intermediaries did not fill the gap of the missing national representation of energy cooperatives in national energy politics, and existing industry associations like the federation for renewable energies did not cover the specific needs of energy cooperatives, the field formed additional national intermediaries.

The national intermediaries can be differentiated regarding the field of activities they fulfil for energy cooperatives and in terms of their scope (representation of only energy cooperatives or also other forms of citizen energy). ‘Netzwerk Energiewende Jetzt e.V.’⁵ and ‘Bürgerwerke e.G.’⁶ both fulfil

⁵ Netzwerk Energiewende Jetzt e.V. – see: <http://www.energiegenossenschaften-gruenden.de/>

⁶ Bürgerwerke e.G. – see: <https://buergerwerke.de/>

specific cooperative related tasks in the field of energy cooperatives while the main tasks of the 'section for energy cooperatives at the DGRV (German Cooperative and Raiffeisen Confederation)'⁷ and the 'Bündnis Bürgerenergie e.V.'⁸ include a focus on the political representation. The two differ in that the section for energy cooperatives at the DGRV only represents the interests of energy cooperatives while the Bündnis Bürgerenergie e.V. represents the interests of citizen energy in general (thus also implies other organisational models than just cooperatives).

The first intermediary on the national level was the 'Netzwerk Energiewende Jetzt e.V.' which was established in 2010 by energy cooperative board members. Besides their versatile supporting measure for energy cooperatives, one of their most influential support measures was the four-month lasting project developer training for energy cooperatives which contributed to the increase of newly founded energy cooperatives (Energiewende Jetzt e.V., 2014).

The establishment of the 'Bürgerwerke' in 2013 as an additional national operating actor demarcated another turning point in the SIE field. Through its function as a cooperative electricity supplier, it allowed energy cooperatives to sell their energy independent of the feed-in tariff and further facilitated the existence of energy cooperatives by offering several services for the field. The activities of the Bürgerwerke thereby additionally illustrate the starting field development towards professionalism. The section for energy cooperatives at the DGRV was also founded in 2013 by the different member federations of the DGRV in Berlin and represents the interests of energy cooperatives in Brussels and Berlin. The second national intermediary based in Berlin 'Bündnis Bürgerenergie e.V.' was founded in 2014 by several regional intermediaries and other actors of the renewable energy field. Besides other activities, it has its focus on the representation of interests for citizen energy in general in Berlin and Brussels. In order to enforce the interests of energy cooperatives 'Bündnis Bürgerenergie e.V.', the DGRV section as well as the 'Netzwerk Energiewende Jetzt e.V.' are in continuous exchange and cooperate regularly. Crucial for the establishment of the field of national intermediaries is furthermore the overlap of the founding members of 'Energiewende Jetzt e.V.' and 'Bürgerwerke e.V.' which also led to the foundation of the organisation 'Bürgerenergie Hoch 3'⁹ and will be further elaborated on in chapter five.

For their effective work regional as well as national intermediaries rely on the **cooperation** with each other and relevant organisations in the field of renewable energies and environmental protection.

⁷ DGRV, section for energy cooperatives – see: <https://www.dgrv.de/bundesgeschäftsstelle-energiegenossenschaften/>

⁸ Bündnis Bürgerenergie e.V. – see: <https://www.buendnis-buergerenergie.de/>

⁹ Bürgerenergie Hoch 3' – see: <https://www.beh3.de/>

Those actors include foundations like the 100% Renewable Foundation (“100 Prozent erneuerbar Stiftung”), research institutes like the German Institute for Economic Research (DIW), federations like the Federation of Cooperatives (“Genossenschaftsverband”), the German Federation for Environment and Nature Conservation (BUND) and various project developers for the implementation of their projects. Other key actors in the field are the two large and professionalised energy cooperatives Greenpeace Energy and Elektrizitätswerke Schönau.

In addition, cooperatives cooperate with municipal utilities, other energy providers, farmers, banks, other cooperatives and municipalities (Klagge et al., 2016). The importance of municipality support for energy cooperatives is also shown by Meister et al. 2020, particularly regarding the provision of roof space, land, and help in the planning and permit procedure. As initially described cooperation partners are crucial for the development of the SIE-field under study, since they enable energy cooperatives to assemble their projects.

4 Timeline of cooperative organisational models for renewable energy in Germany

Figure 1 shows a visualisation of the innovation timeline of the field 'cooperative organisational models for renewable energy in Germany'. The timeline runs from 1998 till 2020 and is divided into four phases. For each of these, we differentiate developments on the following six levels:

- The top-level shows the main societal trends in Germany of relevance to the SIE field, such as a trend towards citizen participation or the youth climate movement.
- Thereafter, the relevant policy developments at the European level are depicted, followed by the relevant energy policy developments within German energy policy.
- This is followed by the fourth level displaying the development of intermediary organisations within the field operating on the national level.
- The fifth level shows the development of regional intermediaries and regional cooperative electricity suppliers. Finally, the lowest level illustrates the amount of newly founded energy cooperatives per year.

Additionally, the yellow arrows in the top layer of the visualisation represent the different phases of the timeline:

- I) policy foundations for the establishment of the field (1998-2006)
- II) boom phase of energy cooperatives and first structuration processes (2007-2011)
- III) successive abolishment of policy support and institutionalisation processes of the field (2012-2016) and
- IV) continuous stagnation of foundations of energy cooperatives and the further diversification of business models (2017-2020)

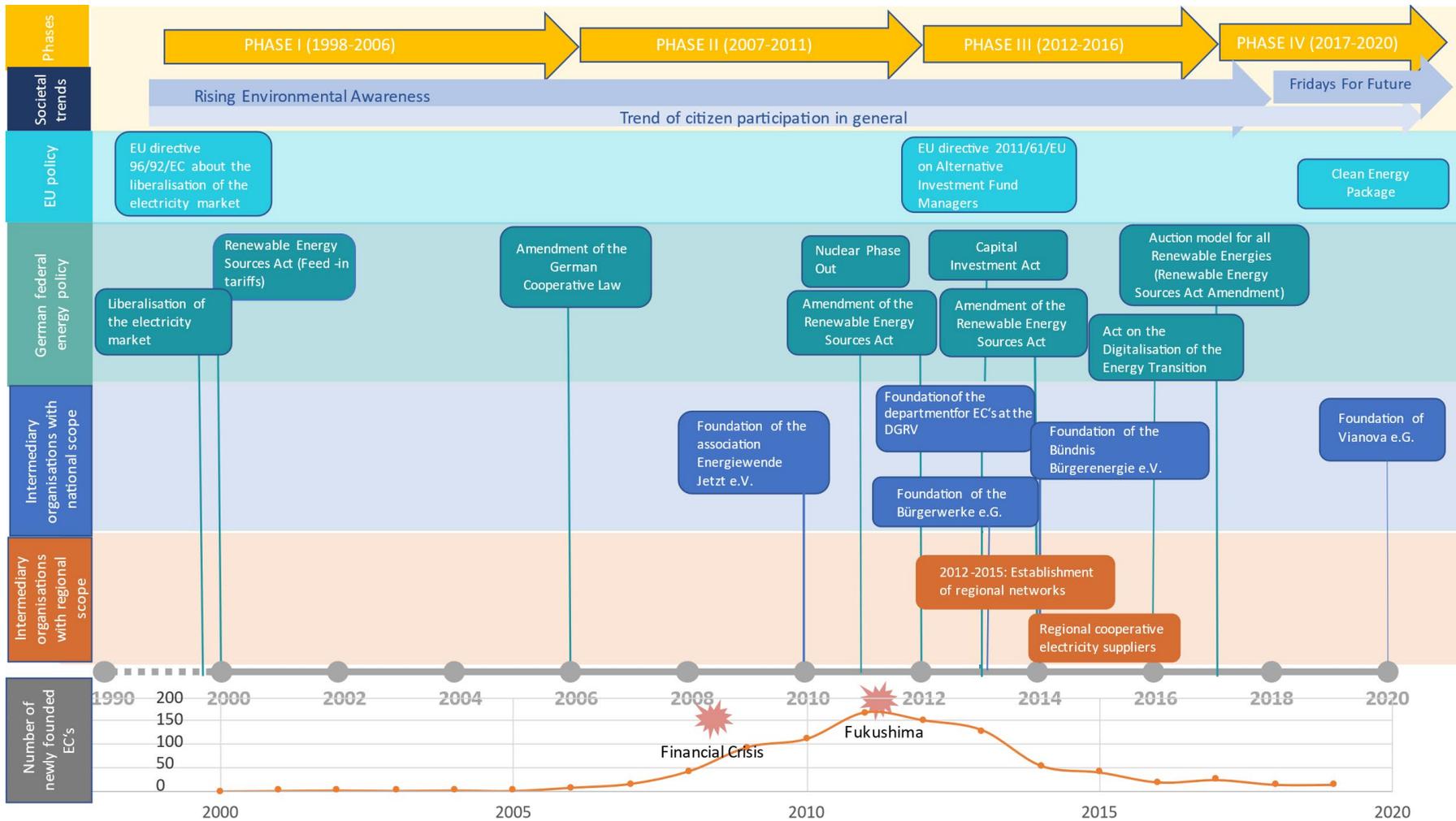


Figure 1 Visualisation of the innovation timeline

*DGRV: German Cooperative and Raiffeisen Confederation

5 Emergence and development of cooperative organisational models for renewable energy in Germany over time

What follows is a description of the innovation history of the SIE-field cooperative organisational models for renewable energy in Germany. It is structured into four phases which are described in detail below:

- I) Policy foundations for the establishment of the field (1998-2006),
- II) Boom phase of energy cooperatives and first structuration processes (2007-2011),
- III) Successive abolishment of policy support and institutionalisation processes of the field (2012-2016) and
- IV) Continuous stagnation of foundations of energy cooperatives and the further diversification of business models (2017-2020)

Phase I) 1998-2006: Policy foundations for the establishment of the field

The foundations for the field of energy cooperatives in Germany since 2000 were set with the liberalisation of the German electricity market in 1998. Therewith Germany complied with the regulations of the 1996 EU directive about the liberalisation of the electricity market.

Consequentially this changed the organization of the German electricity market significantly: It caused the separation of distribution and grid operation (unbundling) and guaranteed open grid access. In addition to that, it induced the abolition of area monopolies and thereby led to a diversity of energy providers (Meister et al., 2020). The previously regional monopolies were replaced with a system in which several market players were able to enter the market and thus also included smaller players like energy cooperatives. What helped smaller players enter the market was the rising environmental awareness of the German society (DE_EC_03), which led to an increased interest in renewable energies and consequentially ways to engage with them e.g. through citizen initiatives.

Policies and policy making

One important cross-cutting theme addressed in SONNET is the socio-political aspect and the conditions of social innovation in energy. This case study, therefore, aims for identifying important policy events and policy-making processes (Wittmayer et al. 2020b, p. 43). This includes asking about broader political debates, the role of different government levels involved,

particular policy strategies and instruments used and how they enable or impede the development of SIEs. In highlighting such issues, we are in particular interested in identifying enabling or impeding socio-political issues and how they influence social innovation processes.

The developments of the SIE-field under study are strongly tied to the German policies around the energy transition in general and renewable energies in particular. That is, policies of paramount relevance are implemented on the national level, but are often the result of previously adopted European policies. In contrast, regional policies do not feature in the list of the most influential policies for cooperative organisational models for renewable energies in Germany, as can be seen in the table below. Of the various EEG amendments only the ones most relevant for the field development are mentioned.

1996, 1998	Liberalisation of the German electricity market based on EU regulation	EU DIR 96/92/EG, BGBl. I 1998 S.730
2000	Renewable Energy Sources Act (EEG): introduction of technology-specific feed-in-tariffs guaranteed for 20 years, unbundling, priority grid access for renewables	BGBl. 2000. I 13 S. 305-309
2002	Agreement about the nuclear phase-out till 2022	BGBl. I 2002 S.1351
2006	Amendment of the German Cooperative Law (facilitated conditions for the establishment of new cooperatives, administrative relief and lightened conditions for capital procurement for cooperatives)	BGBl. I 2006 S. 2230
2007	German climate and energy policy package (greenhouse gas reduction 40% compared to the levels of 1990)	Energie- und Klimaprogramm (BMU 2007)
2010	Energy concept ("Energiekonzept") of the German government (targets for renewable energy development, energy efficiency and climate protection for 2020, but nuclear phase-out postponed to 2036)	Energiekonzept 2010 (BMWI 2010)
2011	Nuclear phase-out law (announcement to close all German nuclear power plants by December 2022)	BGBl. 2011 I 43 S. 1704-1705
2011	Revised energy concept ("political road map for energy")	(BMWI 2011)
2011	EU directive 2011/61/EU on Alternative Investment Fund Managers (Resulting introduction of the Capital Investment Act (2013) led to uncertainty for energy cooperatives)	EU DIR 2011/61/EU
2012	EEG Amendment (i.a reduction of feed-in tariffs)	BGBl. I 2012 S. 1754
2013	EU commission: treaty violation proceedings against Germany's feed-in tariffs	
2013	German Capital Investment Act (Kapitalanlagengesetzbuch, CIA)	BGBl. I S. 1981

2014	REA Amendment (introduction of tender procedures for photovoltaics, as a replacement for the secured feed-in tariffs, further amendments of the feed-in tariff)	BGBl. I 2014 S. 1066
2015	Updates on the energy road map from 2011	
2016	Energy Transition Digitisation Act (Introduction of smart metering)	BGBl. 2016 I 43 S. 2034-2064
2017	EEG Amendment: introducing tender procedures for all renewable energies (exceptions e.g. for photovoltaic and wind energy systems with an installed capacity below 750kW and biomass systems below 150 kW .	BGBl. I 2016 S. 2258
2019	Clean energy package (EU): Citizen energy (energy communities) is clearly defined and its importance acknowledged; obligation to implement policies till 2021)	European Commission 2019

The most important policies which had a crucial effect on energy cooperatives were the introduction and some of the various amendments of the Renewable Energy Sources Act (EEG). The favourable conditions which came in effect with the introduction of the EEG in 2000 (particularly the guaranteed feed-in tariffs and therewith a relatively secure investment opportunity for energy cooperatives) led to a vast increase of newly founded energy cooperatives. The favourable conditions were further enhanced by the amendment of the German Cooperative law in 2006 which facilitated the conditions to initiate cooperatives in general.

The amendments of the Renewable Energy Sources Act in 2012 and 2014, partly in response to significantly reduced technology costs, led to the successive decrease of feed-in tariffs, in particular for solar PV. As the majority of energy cooperatives largely relied on a business model comprising these feed-in tariffs, the amendments had a significant influence on the foundation of new cooperatives (Herbes et al., 2017), since reductions overcompensated for reduced technology costs. Finally, the EEG amendment of 2017 implemented an auction model for all renewable energies to replace the hitherto existing feed-in tariff model. Those changes complicated the already hardened conditions for the SIE-field (e.g. through the restrictions on plant sizes, the regulation about own consumption, or the breathing lid). In the following years, the number of newly established energy cooperatives decreased.

Another crucial policy change was the introduction of the EU directive 2011/61/EU on Alternative Investment Fund Managers which subsequently led to the implementation of the German Capital Investment Act. However, till 2015 it remained unclear whether energy cooperatives would be included or not. This sense of uncertainty got amplified by the ongoing discussions of the German government about the potential retrospective adaptations of the feed-in tariffs and

the postponed EEG reform (till a new government was formed) in 2013 (Rogge and Schleich, 2018).

The EEG is embedded into a broader energy transition policy mix in Germany which is also characterised by the nuclear phase-out, among other policies (other policies not explicitly listed here but also influential for the SIE-field are policies about the energy economy in general, some of which are further elaborated upon in the “outside institution” box). Together, this policy mix influences the general conditions for renewable energies and thereby impacts the field of energy cooperatives as well. For example, Meister et al. 2018 describe the German nuclear phase-out policy as one of the key drivers for the development of energy cooperatives in addition to the liberalisation of the electricity market and the introduction of the EEG.

The amendment of the EEG with its switch to auctioning, as well as the “Mieterstromgesetz”, can be seen as further examples of the importance of regulative institutions for the development of energy cooperatives. The “Mieterstromgesetz” in particular illustrates that even new business models can easily get restricted again which can lead to ongoing adaptation processes. Arguably, therefore, such policy and institutional changes provide strong reasons for SIE actors to further engage in energy policy-making processes.

Finally, the clean energy package of the European Union from the year 2019 raised the hope of energy cooperative representatives that the importance of citizen energy will finally be acknowledged. Since it specifically addresses the importance of citizen energy and energy communities and has to be implemented at the national level in 2021 it could introduce another positive development phase for energy cooperatives. The empirical findings at hand thus show the dependency of the SIE-field on national policies, and that these have acted as an enabling as well as impeding factor for the emergence and development of the field. (German national policies are often driven by preceding EU regulations which is demonstrated by the liberalisation of the German electricity market (based on EU DIR 96/02/EC) or the introduction of the capital investment act (based on EU DIR 2011/61/EU). The treaty violation proceedings against the German feed-in tariffs by the European commission further illustrate the influence of the European Union on national policies.

A fundamental step in the first phase was the implementation of the Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz -EEG) in 2000, a measure by the German coalitions government (social democrats and green party) to promote renewable energies. The most important features of the act were the introduction of feed-in tariffs, priority grid access for renewable energies and the Renewable Energy Sources Act (EEG) surcharge. The technology-specific feed-in tariffs are a

payment for renewable electricity producers per kilowatt-hour (kWh) and were guaranteed for 20 years, thereby leading to investment security and the entry of smaller players into the electricity market.¹⁰ The priority of the grid access guarantees electricity from renewable energy sources, such as wind, solar or biomass, the access to the grid and prioritizes these renewable energies ahead of conventional power. Finally, the EEG-surcharge was implemented to finance the feed-in tariffs. This surcharge is paid by all electricity consumers, but exceptions exist for electricity-intensive industries and renewable energy operators who consume their own electricity. The surcharge depends on the wholesale market price for electricity, implying that the reduction of electricity prices due to the merit order effect arising from greater shares of renewables leads to a higher surcharge (Appun, 2014). Of all these changes, the introduction of the guaranteed feed-in tariffs was crucial for the development of energy cooperatives, as it allowed them to build up their main business model based on the remuneration of the feed-in tariffs.

The second prerequisite for the establishment of the SIE-field under study are the changes subsequent to the amendment of the German Cooperative Law in 2006 (BGBl. I 2006 S.1911, Klagge and Meister, 2018). Among others, those amendments included a reduction of members necessary for the foundation of a cooperative and the necessity of only one board member for small cooperatives (<20). In addition to that, smaller cooperatives (financial statement < 1 million) were released of audits at the end of the year thus leading to enabling conditions for the establishment of new cooperatives and administrative relief for smaller cooperatives. In addition to that, the amendments of the cooperative law lightened the conditions for capital procurement for cooperatives. More precisely, it allowed the formation of non-cash capital contributions and - of particular importance for energy cooperatives - the admission of members that joined the cooperative as 'investing members'. Investing members are members of the cooperative without making use of their services and goods, thereby contributing to broadening the opportunities for cooperatives to generate proprietary capital (Genossenschaften in Deutschland e, 2020). Those changes led to a better capital endowment for energy cooperatives and made it more attractive for individuals to invest and thereby contribute to the energy transition in a bottom-up manner (Deutscher Bundestag, 2013; Volz, 2012). Those two fundamental policy changes were described by all interviewees of this study as indispensable enabling conditions for the successive increase of newly founded energy cooperatives in the following years. Klagge and Meister (2018) support those findings

¹⁰ Larger players / technologies were initially exempt from this regulation, including, among others systems with electricity generated by hydro-electric power plants, systems powered by gas from landfill and sewage systems with a capacity larger than five megawatts, or biomass installations with an installed capacity larger than 20 megawatts.

by referring to those policy changes as the main reasons for the immense increase of energy cooperatives since 2006. Indeed, before 2006 only very few cooperatives were newly established (one till four per year) indicating the importance of the amendment of the cooperative act for the further evolvement of the field.

'Outside' institutional environment shaping the development of the SIE-field

SONNET aims to explore the interactions and relations between actors working on a SIE and the broader institutional context in which the SIE is nested in (Wittmayer et al. 2020b, p. 7). An empirical focus lies on the development of SIE-fields. Following Fligstein and Adam's field definition (Fligstein and McAdam 2011), an SIE-field within the SONNET project is understood as 'an arena/space that includes a specific SIE as well as SIE-field-actors working on it and other field-actors enabling and/or impeding it. In this space these actors take one another and their actions into account and have a shared (but not necessarily consensual) understanding of a SIE and of their relationship to other actors. They recognise (but not necessarily follow) shared norms, beliefs and rules. SIE-fields are often not homogenous but are composed of actors with diverse and contradictory aims and interests' (Hielscher et al. 2020, p. 17)

While the field is constituted by SIE-actors and field-actors activities, it is also influenced by the outside institutional environment, which can interact, shape, enable or impede the development of the SIE. The institutional environment is thereby constituted by formal as well as informal institutions (Hielscher et al. 2020, p.19). 'The SIE-field itself constitutes an environment (= SIE-field institutional environment) but also is nested with the larger encompassing institutional environment (= outside institutional environment). The SIE-field and its institutional environment consist of institutions and actors who interact with each other. The 'outside' institutional environment consists of institutions that can 'penetrate' (i.e. shape/influence/interact with) the SIE-field.'

The electricity market

In the German case, energy cooperatives are embedded in the German energy system which has major implications for the development of the field. The liberalisation of the electricity market in 1998 led to the separation of distribution and grid operation (unbundling), the abolition of area monopolies, free grid access, free choice of energy providers for citizens and a rising diversity of energy providers (Meister et al., 2020). Those conditions were fundamental for energy cooperatives as they enabled them to enter the electricity market. Today more than 1,000 energy providers constitute the German electricity market. Even though the four big electricity

providers still have the majority of the market, their share is constantly decreasing (from 2009: 80% to 2018: 57%) (Bundesnetzagentur, 2020).

Besides that, the developments of the energy industry act (Energiewirtschaftsgesetz, EnWG) were of importance for the development of energy cooperatives involved in grid operation and energy distribution (not for photovoltaic or wind cooperatives since it did not affect their operational work to the same extent). Changes in the energy industry act typically lead to changed processes for energy cooperatives. Another example would be the metering point operation law (Messstellenbetriebsgesetz, MsbG) implemented through the digitalisation of the energy transition law in 2016 (Gesetz zur Digitalisierung der Energiewende, GDEW). Another influential factor is the price trading mechanisms at the energy spot market. Those mechanisms impact the perception of renewable energies since the price for electricity (which through the merit order effect goes down with higher shares of renewables) determines the amount of the EEG-surcharge. Ironically, this reduction in electricity prices through renewables leads to higher EEG-surcharges which in turn leads to more negative perceptions of renewable energies as “expensive for everyone” (Interview DE_EC_05), and thus also influences the perception of energy cooperatives.

Influence of the financial market

Another influential outside institutional condition is the development of the financial market. Since the interest rates are currently (2020) very low, in comparison to bank savings it is often more attractive to invest in an energy cooperative where investors get at least a small revenue for their investment. That development made it easier for cooperatives to collect money (see Interview DE_EC_03). Interestingly, the financial crisis is seen as an enabling factor due to the low interest rate and higher interests for the cooperative shares. That is in contrast to the usually mentioned ideational motivation to engage in energy cooperatives.

Germany's federal structure and the special role of municipalities

The organisation of the state as a federal state plays a crucial role for the development of energy cooperatives in Germany. Even though the majority of energy policy is decided on the national level the federal states have means to influence the conditions of energy cooperatives as well. One example is the very strict rule about the distances between wind energy plants and residential houses (“10 H Abstandsregel”) which hinders further wind-energy plans in Bavaria (Bavarian building law, GVBI 2014, S. 478). It stipulates a minimal distance between wind energy plants and residential buildings of 10 times the height of the wind energy plant itself. This measure leaves almost no areas in Bavaria for the installation of wind energy plants. Nevertheless, municipalities can allow exceptions. Another example is that federal ministries of the federal

states have the power to support the regional energy cooperative networks financially, which enables them to hire professional staff. A third example is that the federal state structure allows for municipalities to play an important role for energy cooperatives. According to their status as a municipality, they have the freedom and ability to cooperate with energy cooperatives or to become a member of them.

The following interview quotations summarize the importance of municipalities for the activities of energy cooperatives and thereby their crucial role for the development of the field.

“It is important that the City Councillor is in favour of what the cooperative is doing. If the City Councillor is against you, you have no chance.” (interview DE_EC_06)

“You cannot install the best technique if you don’t have political approval. It is dependent on the municipality and the political board [...] if you can build something or not it doesn’t matter if it is photovoltaics or wind... it is dependent on the municipal policy... If there is someone who wants it you can do it and if not you will starve.” (Interview DE_EC_08)

Phase II) 2007-2011: Boom phase of energy cooperatives and first structuration processes

During this phase, the number of newly founded energy cooperatives increased enormously. The security of their investment guaranteed by the feed-in tariffs for 20 years and the facilitated conditions for cooperatives led to a boom of newly established energy cooperatives. Starting from only 16 energy cooperatives in 2007 the number grew up to 167 energy cooperatives in 2011 – until today this is the biggest increase of newly founded energy cooperatives (DGRV, 2020). In addition, energy cooperatives did not only grow in terms of their total number, but also in terms of their membership and investment capital, as shown by analysis conducted for the period 2010-2013 (Klagge et al., 2016). This increase in number, membership and capital equipped energy cooperatives with the capacity to further invest into new projects.

Interestingly the international financial crisis supported this development, as it led to decreasing interest rates and thus made the acquisition of cooperative shares more attractive.

“You can also see it today that the interest levels at the market are effectively zero. To collect capital is no problem at the moment... Banks are currently not a competitor because one gets so little interest rates. With your cooperative, you offer at least a dividend of 2-3 %...” (Interview DE_EC_03)

These developments constituted another incentive to participate in an energy cooperative. Consequentially the engagement of new members led to the further growth of energy cooperatives. Another effect of the financial crisis was the higher intactness of cooperative banks compared to other banks which led to an even better reputation of the cooperative model (DE_EC_04) and thereby the positive image of energy cooperatives. In the same way, cooperative banks could further proceed in cooperating with energy cooperatives and with their work as an important initiating actor for the establishment of new energy cooperatives (Volz, 2012; Klagge and Meister, 2018). These developments additionally contributed to the continuous increase of newly founded energy cooperatives in that period.

Example 1: SOLIX ENERGIE cooperative

Solix Energie¹¹ represents one of the smaller energy cooperatives in Germany. The cooperative started with nine founding members in 2011 and today counts about 120 members (not exclusively from their region) and possesses an investment capacity of 1.2 million euro.

The foundation process of the cooperative illustrates the influence of other field developments at the time. The cooperative was founded after the participation of five of their founders in a training by the network "Energiewende Jetzt e.V.". According to the founding member, the workshop introduced them to strategies and practical insights about how to establish an energy cooperative. Before the foundation of the cooperative five of the founding members already worked together on renewable energies in the organisational form of a partnership under the Civil Code (GbR). Their decision to change the legal form was mainly driven by the fact that the legal form of a cooperative enabled members to participate equally and to include new members easily. As stated by the founding members it additionally offered them the opportunity to support their members and to be independent in their decisions about the dividends (which can be seen as an emphasis on the democratic and solidarity principle). The foundation of the cooperative was furthermore mainly driven by the aim to become an active part of the decentral energy transition and to keep the generated revenues in the region.

The organisation of work as well as the relation to other actors represents typical characteristics of energy cooperatives in Germany. Everyone engaged in the cooperative is working voluntarily, as it is the case for the majority of energy cooperatives (Klagge and Meister, 2018). Solix Energie has very strong ties with local municipalities as well as the association of municipalities with

¹¹ See: <https://www.solix-energie.de/>

whom they cooperate to implement their projects. Another characteristic - which is very frequent in the field of energy cooperatives as well - is the "Personalunion", meaning that members of the board of Solix Energie are also board members of other relevant organisations for the field: like many other energy cooperatives Solix Energie is a member of several regional and national federations but not actively participating in them (i.a. for financial reasons, since their voluntary working board members do not have the time capacities for it). Nevertheless, Solix Energie emphasises the importance of the work of those supra-regional organisations, even though they are not able to solve all obstacles Solix Energie is facing at the regional level. For that reason, Solix Energie rather focuses on necessary actors in their region to operate their projects. Thus, the majority of cooperation takes place with regional actors with whom they plan projects together. Besides that, contact with other organisations takes place through events. This is also the place where Solix Energie represents how they are dealing with their current projects and therewith influences other actors. The importance of events for collaboration processes of cooperatives and related actors has been also stated by several other interviewees. *"It all depends on your network"*. (Interview DE_EC_01)

Due to the policy changes on the national level the cooperative had to broaden its business model. Solix Energie started with a business model based on photovoltaics in cooperation with the community (on four community buildings roofs). As a reaction to the EEG amendments of 2012 and 2014 and the resulting decreased remunerations for their prospective generated electricity, Solix Energie adapted their business model and built their first wind energy plant in 2016. In addition to that, the cooperative launched its first electric car in 2019.

Solix Energie is therewith a good example of an initiative whose foundation was directly influenced by other field-members (workshop participation) and a diversification process (their adaptation of the business model with the wind wheel 2016 in response to previous policy changes) – two significant current change processes in the field of cooperative organisational models in Germany. In addition to that, the wind wheel is built on the ground of the municipality to guarantee that the rent Solix Energie has to pay remains in the region. With that the establishment of the wind wheel serves as a good example of the cooperation patterns between energy cooperatives and local municipalities and the implementation of their ideational goal to support their region.

Example 2: Elektrizitätswerke Schönau (EWS)

EWS¹² represents one of the very big energy cooperatives in Germany. As of 2020, the cooperative counts 9,000 members and employs about 200 permanent staff within the cooperative and their subsidiaries.

EWS has its roots in an anti-nuclear citizen initiative. After the reactor catastrophe of Tschernobyl in 1986 the initiative strove for climate-friendly energy supply without nuclear energy. The activities of the initiative led to the foundation of the EWS limited liability company owned by the 'Netzkauf Schönau partnership under the civil code' which involved 650 citizens. In 1997 EWS became the green electricity energy provider in Schönau and started to offer their green electricity nationwide after the liberalisation of the German electricity market in 1998.

The transformation of the partnership under the civil code into a cooperative took place in 2009. According to EWS, the cooperative model facilitated the admission of members, enabled the participation of each member and guaranteed independence from other actors (since one member cannot accumulate several shares). In addition to that, the cooperative model was chosen to "equip the EWS for the future and to bring up additional capital for their growth, increase of employees and new activities." (EWS, 2020) This is in accordance with the in the box "diversity, contestations and relations between actors" described twofold line of reasoning for the selection of the cooperative mode: on the one hand for practical and economic reasons on the other hand to implement the ideal of citizen participation.

According to EWS, their main aim is to enable citizen participation in energy distribution and production. To achieve that, the cooperative sourced out all operating activities and is holding the shares of its associated operative companies. Those limited liability companies are involved in the sectors of photovoltaics, wind parks, hydro energy, heat networks, biogas and electricity marketing. Thus, the cooperative itself has no end-customer but is responsible for the controlling, personal- and billing management of its subsidiaries.

When compared to the first example the EWS example highlights the great variety of energy cooperatives in Germany. On the one hand through its different fields of activity which represent the activity fields of German cooperatives, on the other hand through its size, organisational structure and history. It furthermore reveals the importance of existing previous citizen organisations engaged in renewable energies for the establishment of the new energy cooperatives. Interestingly also EWS previously existed in the organisational form of a 'partnership under the civil code' (as well as Solix Energy) and changed its organisational model after the amendment of the German cooperative law (2006), indicating the importance of the

¹² See: <https://www.ews-schoenau.de/>

German cooperative law amendments for the development of the field. Besides that, the EWS can be seen as an example of successful professionalisation processes.

Even though EWS is not a representative example of an “average” energy cooperative in Germany it has an important role for the field of energy cooperatives since it possesses the resources to support single cooperatives and other relevant actors in the field. In addition to that they serve as a role model for energy cooperatives and citizen participation in the renewable energy sector in general. Moreover, they encourage and support citizens to start their own energy production, thereby manifesting their aim to enable citizens to become producer of their energy.

Another characteristic of this phase (and the following phases) is the general trend among citizens in Germany to self-organise and to get involved in the creation and management of public goods (Debor, 2018). Maron and Maron (2012) furthermore classify the increase of energy cooperatives as a part of the general new foundation boom of citizen-led initiatives concerning infrastructure. This trend is also illustrated by other societal developments in Germany, like the foundation of a citizen-led initiative in reaction to a disputed city construction project in a major German city (“Stuttgart 21”).

The aftermath of the Fukushima catastrophe in 2011 was recognisable in the field of energy cooperatives as well. The following policies about the reinstated nuclear phase-out by 2022 and the immediate shutdown of the seven oldest German nuclear sites led to an increase in customers for energy cooperatives involved in the distribution of electricity (see InterviewDE_EC_03).

An important evolving actor of that period is the association “Energiewende Jetzt e.V.” founded in 2010 by members of already existing cooperatives and prospective board members of national organisations for energy cooperatives. The previously described importance of personal ties in the SIE-field under study is illustrated by a phrase of the founding members of the association: “

“The form of coordination at the moment is ‘Personenidentität’ (the same person for different roles) and the shared offices in Heidelberg. [...] someone who is an employee at „Bürgerwerke“ is at the same time board member of the association Energiewende Jetzt e.V. and they arrange things with each other.” (Interview DE_EC_03)

The main goals of the association are to support energy cooperatives in terms of foundations and enhancements, to help with the development of new business models or entry into sectors other than only related to energy generation (e.g. via electric cars), to support their competencies and to increase the cooperation and networking between actors in citizen energy. One of their main tasks

with a considerable influence on the field is the four-month lasting training to become a project developer for energy cooperatives. Therein participants learn how to initiate energy cooperatives and to support them in their foundation processes. The project developers trained till 2014 founded more than 40 energy cooperatives, one of them Solix Energie (Energiewende Jetzt e.V., 2015). In addition to that, the association offers workshops and conferences, network meetings, practical examples of new business models as well as regular news via their newsletter and social media channels.

The association therewith functions as an important information and exchange platform for energy cooperatives at that time and enabled them to benefit from already made experiences of other energy cooperatives nationwide. The significance of their workshops for the establishment of new cooperatives was stated by interviewee number 1.

“The training was very important and contributed a lot to the expansion of energy cooperatives around that time.” (DE_EC_01)

The association thereby created a way to directly disperse already proven knowledge and contributed to the increase of newly established energy cooperatives. Moreover, the constant work of the association set the foundations for continuous networking processes and the further structuration of the field.

Phase III) 2012-2016: Successive abolishment of policy support and institutionalisation processes of the field

After the boom phase between 2006 and 2012, the field of energy cooperatives experienced worsened conditions due to the decreasing support of policies for renewables and a resulting decline of newly founded cooperatives. As a reaction, the SIE-field actors established new organisations and changed their business models.

Policy Changes

This period is characterised by the successive weakening of the previously implemented policy support measurements for renewable energies by the conservative-liberal coalition in 2012 and by the ‘grand coalition’ (christian democratic party and social democratic party) in 2014. Two policy changes, in particular hindered the further expansion of energy cooperatives. It started with the amendments of the EEG in 2012 and 2014, which were largely driven by the aim to reduce the costs of the subsidies, the expansion of renewables, spiked photovoltaic installations and the dispute with

the European commission whether the feed-in tariff model was compliant with the European abatement law (Hoppmann et al., 2014; Gawel and Lehmann, 2014). The amendments led to decreasing feed-in tariffs, the introduction of the breathing lid (till the amendment 2014 optional) direct marketing of renewable energy a pilot for the auction model (to be tested for free field solar PV) (Leiren and Reimer, 2018). As a consequence, the risks for energy cooperatives as investors of renewable energy sites increased (Engerer, 2014). The largest part of energy cooperatives in Germany were built around photovoltaic systems next to wind and other technologies. The generation of electricity through photovoltaics fed into the public network, and the therefore obtained remuneration for the feed-in tariffs constituted their main business model. In 2014 the revenues of almost 80% of all regional energy cooperatives and more than 80% of the supra-regional energy cooperatives depended on the feed-in tariff policy (Herbes et al., 2017). Thus, the decrease in feed-in tariffs made new investments to implement their mostly used business model not profitable anymore. Subsequently, the number of newly founded energy cooperatives dropped tremendously from 2012 onwards from 150 new foundations in 2012 to only 54 new foundations in 2014 (DGRV, see fig.1).

Another negative outcome of the EEG amendments for energy cooperatives are the rules for the EEG-surcharge. Since the amendment of 2014 the EEG-surcharge has to be paid for own consumption as well (Klagge et al., 2016). To get exempted from the surcharge the operator of the site and the consumer of the energy have to be the same and only one person. Since this does not apply to energy cooperatives they have to pay the EEG-surcharge. In addition to that the size of installations energy cooperatives target does not fall under the exemption clause. This mechanism additionally indicates the observed power imbalance between energy cooperatives and energy-intensive industries since they are exempted from the EEG-surcharge (see Interview DE_EC_05).

Power and power relations (power to + power over + power with)

Shifting power relations is often considered as an important aspect, which defines social innovation processes (Wittmayer et al. 2020b, p. 47). The term 'power' thereby refers to actors capacities to mobilise resources and institutions (Avelino 2017). In the context of this case study, we aim to analyse which power relations are enabling or impeding SIEs and how they do so (Wittmayer et al. 2020b, p. 48). It is important to distinguish between different types of power. Actors might have power to e.g to do certain things and push their interests (e.g. political power, economic power, innovative power), power over others or power with other to achieve collective goals (Wittmayer et al. 2020b, p. 48).

Power over

In the case of energy cooperatives in Germany, one aspect of the 'power over' concept might be the influence of big energy suppliers. According to the interviewees, big energy suppliers are more able to focus on lobbying due to their financial resources. They could thereby influence politics to a larger extent than the representatives of energy cooperatives. Furthermore, they could invest more in advertisement and thereby gain attention in the general population which might possibly help them to maintain the status quo. This power dynamic is perceived as an impeding factor by energy cooperatives.

"We aim to always find new business models and to develop them before politicians sense that as a threat for the bigger companies and try to stop those developments"
(Interview DE_EC_06)

Another narrative energy cooperatives emphasise is the power of German politics and their ability to restrict new business models and the expansion of renewable energy in general, thus representing their influence on ('power over') the activities of energy cooperatives. The perception of being less powerful than others is reinforced by the resource problems of energy cooperatives. Restricted time and financial resources of their voluntarily working staff result in fewer investments in PR and lobbying compared to other actors. Energy cooperatives awareness of power imbalances regarding national energy policy is accompanied by the awareness of worldwide energy-related power relations resulting in the aim to become independent of the gas and oil import of not democratic countries.

An important source of power for energy cooperatives is their knowledge. Through the joint expert knowledge of their members and the accumulated knowledge through the representation and participation of members in several federations and related organisations, energy cooperatives and their intermediary organisations possess a great amount of theoretical as well as practical knowledge. Those knowledge resources enable them to generate new ideas, new business models and to profoundly evaluate the effect of regulatory influences. It became clear that some organisations/cooperatives/intermediaries have an advantage over others through their multifaceted representation in several federations, engagement in politics and membership in regional intermediaries at the same time. This results in power differences between different energy cooperatives and illustrates the 'power over' as well as the 'power to' types.

"[...] we wouldn't know that it is this legal reason, if we wouldn't be in this constellation of actors, you can't compare that to a normal energy cooperative." (Interview DE_EC_08)

Power with

The establishment of intermediaries led to a change of power relations in the field of energy cooperatives. Through their bundled representation by federal-state networks or nationwide acting intermediaries, they could represent the interests of energy cooperatives and reach a wider audience, which illustrates the 'power with' characteristic.

"[...] they don't listen to me because I'm Mr... they listen to me because I am the board member of the federal state network for energy cooperatives." (Interview DE_EC_08)

Another aspect of the power with characteristic is the financial support of the federal states for the regional intermediaries (e.g. in Bavaria, Rhineland-Palatinate, Hesse and Thuringia). Furthermore, the representation of energy cooperatives on the European level by the national intermediaries as well as the cooperation between national intermediaries and the European federation for energy cooperatives (REScoop) constitutes an additional facet of the 'power with' aspect.

Power to and further power relations

Intermediaries furthermore function as an instrument to gain knowledge. Due to their access to different actor groups, the knowledge of their multifunctional board members and their widespread representation of board members in a variety of different organisations and federation they are able to accumulate and harness a variety of knowledge. Intermediaries also support the cooperation between several single energy cooperatives leading to bigger projects and therewith a bigger scope of the participation sphere of energy cooperatives. In addition to that, the establishment of intermediaries reinforces the ability of energy cooperatives to influence others through their work. Either by serving as an example of successful citizen energy or by sharing information and their point of views at several events in and outside of their field, thus serving as an example of power to and power with (Interview DE_EC_01).

Another facet of power imbalances might be the membership constellation in energy cooperatives. So far is very unevenly distributed between male and female as well as between highly educated (in terms of a university degree) members and members without a higher education degree. The majority of energy cooperative members as well as their representatives are male and highly educated. This could be an indication of conscious or unconscious selection criteria or hurdles for new members and thereby represent another power imbalance.

The investment insecurity for energy cooperatives got amplified by the discussions about the German Capital Investment Act (CIA). The CIA was adopted in 2013 and introduced regulations for

organisations involved in the management and collection of capital. It was uncertain whether energy cooperatives would also be affected by them or not and consequentially led to a stagnation of new investments and less frequent new foundations of energy cooperatives. Another consequence was the reduced investment in projects energy cooperatives could not operate themselves; leaving many financial resources of energy cooperatives open (investment backlog) (Herbes et al., 2017).

The act on the digitalisation of the energy transition further contributed to the already difficult conditions for energy cooperatives. The therein included “Messstellenbetriebsgesetz” stipulated the clear separation of grid operation and energy distribution, and thus made two companies necessary instead of one. Those changes impacted the work of energy cooperatives who are involved in the grid operation (Interview DE_EC_02).

It was also during this phase that the developments of the solar industry sector had a non-neglectable influence on energy cooperatives. The decrease of the costs for photovoltaic technology and the thereby increased margins for solar installations plus further policy support (such as the provision of low-interest loans by the 100,000 roofs programme), led to a spike in photovoltaic installations (in 2003 the 15-fold installed capacity compared to the amount from 1999) (Hoppmann et al., 2014). As the annual reduction of feed-in tariff remuneration (of 5 % p.a.) did not compensate the continuously decreasing technology costs the margins for photovoltaic installations peaked while the costs for all electricity consumers (through the EEG-surcharge) increased significantly, too. At that point, the German government interfered and started to decrease feed-in tariffs from 2009 onwards, starting with the replacement of the 5% depression of feed-in tariffs per year by a dynamic depression (Hoppmann et al.2014). Some interviewees argued that these decreases in feed-in tariffs were outweighing these technology cost reductions:

“The price shock of the photovoltaic sector... you can say that the module prices for photovoltaics did not get lowered as much as the feed-in tariff got reduced... there was a miscalculation for a time...” (Interview DE_EC_06)

According to one interviewee, the decreased feed-in tariff calculations did not take into account the still increasing costs for the remaining parts of the photovoltaics installation like the personnel or the construction costs (see Interview DE_EC_05), thus, leaving the energy cooperatives with increased investment costs while the previously guaranteed investment remunerations decreased.

At the same time, partially as a consequence of the harder conditions, this period is characterised by increased networking activities between cooperatives leading to newly established organisations for

the SIE-field. In the following section, we outline the emergence of the most important intermediary organisation, which emerged first on the regional level, then on the national level.

Adaptation processes to the deteriorated policy conditions

A) At the regional level: the foundation of regional intermediaries

The reasons for the foundations of regional intermediaries from 2012 onwards are multifaceted. Since the favourable policy support changed and impeded the work of the majority of energy cooperatives it became progressively important to represent energy cooperative's interests in the realm of regional and German politics.

"[...] we asserted that a single cooperative does not really have a voice concerning politics. That was the starting point where we said, we want an umbrella organisation which represents the voices of energy cooperatives in our federal-state." (Interview DE_EC_07)

Another factor for the foundation of regional intermediaries was the lack of information from the auditing associations. Every cooperative has to be a member of an auditing association to get assessed once per year. By 2012 energy cooperatives were still a new phenomenon to them which led to the necessity for energy cooperatives to organise themselves.

"[...] Auditing associations also offer a lot of information and events. But at the time it was not really specific for energy cooperatives. And energy cooperatives are also a bit different from other cooperatives." (Interview DE_EC_05)

In addition to that, regional intermediaries offered energy cooperatives a way to be recognised by different actors and to get included into regional matters and politics, hence offered cooperative members a way to participate even more in the energy transition – one of the main motivation of their members.

Today the regional intermediaries are in touch with local politicians and attend events in the name of energy cooperatives, they get involved in regional decision-making processes and therewith impact the development of energy cooperatives in their region. Their boards are advising energy cooperatives and prospective cooperative initiator's, equipping them with information, initiate network or information events and engage in the current discussions in the form of press releases and political statements. They furthermore inform their members via newsletters and their active

social media presence thus leading to a more informed and connected group of energy cooperatives. They furthermore provide energy cooperatives with information besides the conventional audit association or, like in the Bavarian case, founded their audit association. Moreover, regional intermediaries function as a network and communication platform between cooperatives and potential project developers. Their successful activities also have to be related to their specific working mode which is characterised by the immense personal commitment of their board members who – in most cases work voluntarily- and the previously described “double roles” (see box relations and contestations) which provides the boards with additional information and a resulting improved capacity to act and engage.

Their status as a recognised actor in the field of energy cooperatives gets more acknowledged as several regional state networks receive financial promotion by federal-state ministries. The federal-state networks have thereby the financial resources to commission studies, hire (at least to some extent - as a “helping hand”) staff and engage in more activities. Nonetheless, the regional state networks emphasise their independence despite the financial support of the federal states.

B) At the national level

The lack of particular representation of energy cooperatives (besides the representation in overarching general renewable energy or cooperative related organisations) at the national level further increased the urge of cooperatives to form overarching organisations.

The formation of regional representatives on the federal state level marks the first step for the establishment of representative organisations at the national level. Through the enhanced cooperation structures and the exchange between the different regional intermediaries, national organisations were formed in cooperation with other relevant organisations for renewable energies.

Section for energy cooperatives at the German Cooperative and Raiffeisen Confederation

The foundation of the section for energy cooperatives at the German Cooperative and Raiffeisen Confederation in 2013 (DGRV, Germany's umbrella organisation for cooperatives) by its member federations was a milestone for the development of energy cooperatives. From that moment on the interests of energy cooperatives were represented on a national level towards the media, general public and politics. Moreover, their interests were represented through an already well established and experienced federation, therewith additionally indicating the relevance of the newly established field towards a broader audience. The energy cooperative department at the DGRV functions as the

contact person for the public and represents the interests of energy cooperatives on the national as well as on the European level.

Yearly surveys about the status of energy cooperatives, as well as press releases and regular statements inform the general public and the field about the status quo of energy cooperatives. Twice a year the section for energy cooperatives meets the boards of the regional intermediaries to get informed about the current status and the concerns of energy cooperatives nationwide. A fundamental difference to the regional intermediaries is that the DGRV subsection has permanent personal funded by the contributions of their member federations (Interview DE_EC_09). They might therewith possess more resources and time capacities to focus on the political representation than regional intermediaries or cooperatives themselves.

Bündnis Bürgerenergie e.V.

In contrast to the section for energy cooperatives at the DGRV the Bündnis Bürgerenergie e.V. (BBEn) does not solely represent the interests of energy cooperatives but of citizen energy in general, thus also implies other organisational forms than only cooperatives. It has been established through the cooperation of several regional intermediaries and other actors of the renewable energy field out of the necessity that already existing umbrella organisations like the federation for renewable energies did not specifically address the particular interest of citizen energy. The association unifies locally, regionally and nationally active networks, includes associations, companies and private persons and counts over 200 members accumulating around 500,000 “energy citizens” nationwide (as of 2020). Besides its function as a networking platform for citizen energy actors, BBEn focuses on the political representation of interests at the national level. They engage actively in political debates by directly addressing members of parliament, by publications, by commissioning of statements and by the organisation of events. Current examples include a discussion paper in cooperation with Greenpeace Energy, modelling work with the 100% renewables foundation and Elektrizitätswerke Schönau (https://www.buendnis-buergerenergie.de/fileadmin/nkmdn_Lokale_Strommaerkte.pdf) and a study together with the German Institute for Economic Research (DIW) on the advantages of a decentral energy transition. This illustrates the range of different cooperation partners and activities of the association. It furthermore depicts its versatile approaches to reach its goals and to further spotlight the importance of citizen energy in the realm of politics and the general public. Their organisational structure includes a council of citizens which consists of engaged cooperative members active in science, politics and further citizen energy projects and thereby equips the association with various knowledge resources.

To sum up the above mentioned intermediary organisations that explicitly target energy cooperatives, the variety of new established intermediary organisations led to several changed conditions for energy cooperatives. Through the foundation of intermediaries, energy cooperatives could engage with different actors and organisations which single cooperatives could not have been in touch with – they thereby broadened the range of potential activities and project partners. It furthermore led to a much broader representation of cooperatives on the local, regional and national level hence enabled cooperatives to have their political concerns and interests represented. Their function as a platform to network and the active support of their members led to the further organisation and structuration of the SIE-field under study.

Other influential actors evolving during that time are the “Bürgerwerke” (an umbrella cooperative) and the “BürgerenergieHoch3” (a limited liability company limited liability company). Besides the intermediary organisations already mentioned, Bürgerwerke and BürgerenergieHoch3 fulfil additional tasks next to political representation and networking for the SIE-field under study.

Bürgerwerke e.G.

The foundation of the Bürgerwerke (2013) marks another crucial step for energy cooperatives since it offers them a way to sell their energy independent from feed-in tariffs. Energy cooperatives sell their energy to the Bürgerwerke who in turn sells their energy to end customers. The remaining profits after taxes, administration costs, EEG-surcharge and grid charges are distributed among the member cooperatives. They are the largest umbrella cooperative of energy cooperatives in Germany and furthermore offer energy cooperatives to take over tasks like electricity marketing, accounting and other energy supply tasks. Energy cooperatives on the other hand save costs, have lower risks to deal with and can intensify their focus on their projects in the region. In addition to that, the Bürgerwerke offer energy cooperatives a platform to exchange their experiences with different business models, advice energy cooperatives about new business models and regularly offer matching workshops. They therewith contribute to a broader expansion of new business models. The strong ties of the Bürgerwerke with other overarching network organisations like the BBEn, and Energiewende Jetzt e.V. and their wide coverage led to an even wider application of their business model.

Interestingly, the foundation of the Bürgerwerke is related to the at the time negative prospects of energy cooperatives since they were not able to work economically with their so far used business models. The different crises (climate crisis, the crisis of the established business model) were described as enabling conditions for the development of their organisations.

“The desperation of energy cooperatives and the rising question whether there would be still an economic market for them led to the idea to found an umbrella company, independent from third parties where existing competencies could be bundled.” (Interview DE_EC_03)

The foundation of the Bürgerwerke in the federal state of Baden-Württemberg set an example in the field of energy cooperatives and resulted in the foundation of similar organisational constructs at the regional level in several federal-states in the following years. The foundation of the regional cooperative electricity suppliers took place in cooperation with the regional intermediaries for energy cooperatives, thus represents the importance of the previously created intermediary organisations for the further development of the SIE-field under study. The regional cooperative electricity suppliers partially cooperate with the Bürgerwerke and encourage their members to become part of the umbrella organisation and thereby increase the spread of the new business model and the relevance of the Bürgerwerke as a new organisation. In addition to that, the bundling of competencies and outsourcing of business sectors, like the distribution of electricity through the foundation of the Bürgerwerke exemplifies the starting professionalisation of the field.

BürgerenergieHoch3 (BEH3): Project developer for energy cooperatives

Another new emerging actor during that phase is the project development limited liability company Bürger Energie Hoch 3 in 2013. Among others, their services include project planning as well as the installation of PV-panels. What is particular about them is that their founder stems from the energy cooperative field. The project developer is thus familiar with the particular problems and expectations of energy cooperatives and able to work accordingly. The trust of energy cooperatives is another characteristic of the newly created actor.

“The foundation of the Bürgerwerke and the BEH3 led to increased motivation for energy cooperatives. Energy cooperatives know if they have a project idea someone will take care of it and stick to it. It will not take several meetings and potentially result in stagnancy as it was previously sometimes the case.” (Interview DE_EC_03)

The two previously described organisations (Bürgerwerke and BEH3) have been established by partially the same actor constellations of the energy cooperative field as the Energiewende Jetzt e.V. association (EWJ). Besides that, their organisational format has been chosen consciously according to the tasks they would take over for energy cooperatives in the future. Thus, the organisations do not compete but rather complement each other. It therewith represents again the importance of

interconnectedness and strong personal ties between particular important actors, and their strong personal commitment for the development of the field of energy cooperatives. Furthermore, it is a good example of the importance of the know-how of the board members in addition to their will to initiate and improve the conditions for their further existence. Hence the establishment of the Energiewende Jetzt e.V., Bürgerwerke and BEH3 can be seen as an enabling factor for the further existence of already established energy cooperatives.

New business models

Since the business model based on FIT remuneration of electricity generation became unattractive, new business models were created to develop energy cooperatives further. The establishment of cooperative electricity suppliers (Bürgerwerke) is only one example of a new business model in the field of energy cooperatives. Further diversification processes and new business models were created in reaction to the previously described changed basic conditions for energy cooperatives.

“Currently there is a trend in the direction to more complex business ideas because the standard energy cooperatives used in the past is not possible anymore. To finance photovoltaics through the remuneration for feed-in tariffs gets more and more difficult.”
(Interview DE_EC_06)

In those processes, the know-how of the members is important to generate those ideas. Among others, such new business models include the introduction of e-car sharing (energy cooperatives offer e-cars) and direct marketing of electricity. Since energy cooperatives are not able to fully use their electricity (the legal regulations about the “Personenidentität” – meaning that the operator of the site has to be the same person as the consumer of the electricity- prevents them from doing that). Models like the “Pachtmodell” (energy cooperatives lease a PV-panel to a company who uses the electricity themselves), or “Mieterstrommodell” (where energy cooperatives build a PV-panel on an apartment building and sell their electricity to renters of that building) were established to bypass the current legal regulations.

“With the decrease of the feed-in tariffs, it became more and more necessary that energy cooperatives started those own-consumption models... Own-consumption... I do not like to say that because energy cooperatives built the sites they don't consume the energy. Instead, the project partner is making use of the energy. Anyways, energy cooperatives had to develop more and more into this direction because it was more economically feasible.”
(Interview DE_EC_05)

To conclude, the newly established business models and strategies to diversify business areas are an attempt of energy cooperatives to reorganise themselves to still be able to work economically after the phase-out of the feed-in tariffs and the introduction of the auction model. Moreover, it is seen as a way to further develop and implies the establishment of new structures for cooperatives to work with. The introduction of the new business models requests energy cooperatives to partially engage with new actors, apply new relationship modes and engage with new themes. In addition to that, the increased complexity of those business models - due to the regulations around the EEG-surcharge, own consumption, the breathing lid and restrictions about plant sizes - leads to the necessity for energy cooperatives to further look into ways to professionalise even more. Their previously used mode of work which was mainly based on voluntary work and already had apparent deficits (a lack of time and financial resources) became therewith even more obsolete. It is planned to replace it by permanent employee structures and thereby relieve the so far voluntary working board members to be able to focus more on operative activities.

Regulative, normative and/ or cultural cognitive institutions

SONNET draws on Scott's conceptualisation of institutions, which consist of regulative, normative and cultural-cognitive elements (Scott 2014). Regulative institutions include laws, rules, standards and policies while normative institutions describe social norms, duties, and value systems (Wittmayer et al. 2020b, p. 21). The third type of institutions is referred to as cultural-cognitive institutions such as shared expectations and common beliefs (Wittmayer et al. 2020b, p. 22). In SONNET, we assume that SIE have the potential to transform existing institutions while they will also maintain parts of existing institutions (Wittmayer et al. 2020b, p. 20). We are therefore interested in understanding existing regulative, normative and cultural-cognitive elements that shape the SIE and its SIE-field.

As regulative institutions are mainly treated in the analytical box "policies and policy making" this box focusses on normative as well as cultural cognitive institutions.

The "very good image of cooperatives" as an organisational model was often mentioned as an argument for decisionmaking by several SIE-field actors (Interview DE_EC_02 and 3). Its distribution in diverse other fundamental parts of society like the housing sector, agriculture, banking or grocery retail sector is another indication of how well established the cooperative model is in the German society. That in addition to the positive perception of cooperatives and the existing legal framework for cooperatives indicate that the cooperative model per se is an established regulatory- as well as normative institution in Germany. This contradicts the opinion

of another SIE-field actor who describes the lacking trust of the population in citizen-led energy cooperatives and their ability to accomplish the energy transition. That suggests that the trust in other – not citizen-led - institutions is another important cultural-cognitive institution hindering the development of the SIE-field.

Besides that, the cooperative model represents certain values itself. Democratic values - through their one member one vote policy, solidarity - through their purpose of the member support - and cooperation are only a few to be named here. The cooperative model is likewise influenced by normative and cultural-cognitive institutions as well. By adopting the organisational model of the cooperative energy cooperatives automatically contribute to maintaining those values. The importance of democratic values can be found in two ways. On the one hand within the cooperative model itself, which is structured according to democratic principles. On the other hand, through the expectations and beliefs of energy cooperatives and their representatives that citizens participation is a fundamental step towards the energy transition.

Other predominant values among energy cooperatives and their representatives are the values of independence and autonomy. The reasoning for decentral energy production was often related to becoming independent of big gas and oil industries and in particular to become independent from gas and oil delivering countries without democratic governments. It is therewith another example of the importance of values and shared beliefs for the emergence of the SIE-field.

„[...]we would rather have energy from our own country than from dictatorship countries.“ (Interview DE_EC_06)

The development of energy cooperatives is influenced by societal trends in favour of sustainable investment and a critical stance towards economic growth as well as the solidarity and sharing economy – which we count as cultural-cognitive institution. These trends manifests themselves in the degrowth movement, circular economy projects and various exchange platforms. Those movements and advocates of those movements share similar values of environmental awareness, solidarity, cooperation and the importance of the common good. Among others, they aim to prevent further climate change and contribute to the energy transition. Those commonly shared values and goals make energy cooperatives more attractive for a broader audience that is already engaged in similar activities. The shared common beliefs are therewith further maintained and contribute to a wider expansion of the field.

What is also interesting to see is that shared values between SIE-initiative actors, SIE-field and other field actors like environmental protection or the support of the region lead to opposing activities. One of the main arguments of initiatives against wind energy is that wind power

stations are destroying the landscape and destruct the natural habitats for animals. Those arguments show environmental protection is an important shared value in the SIE-field, nevertheless, the approaches to achieve it differ quite drastically between wind energy opponents and advocates. This illustrates the preliminarily described characteristic of SIE-fields in general.

An example of the change of regulatory institutions can be seen in the adaptation procedures of conventional energy organisations. One federation recently implemented a business section for citizen energy which according to the interviewee *“is only a trend thing and not meant a hundred per cent serious”* (Interview DE_EC_04). Nevertheless, the inclusion of a previously rather niche topic into a conventional, established organisation shows a change of the perception of the importance of citizens in the energy sector (therewith a change of the cultural-cognitive institutions) and as a consequence a change in an established institution (which could evoke further regulatory or cultural-cognitive institutional changes).

Phase IV) 2017-2020: Continuous stagnation of foundations of energy cooperatives and the further diversification of business models

The amendment of the EEG in 2017 marks another policy drawback for energy cooperatives. The previously tested pilot version of the auction model was thereby stipulated for the majority of renewable energy systems and led to a final replacement of the previous feed-in tariff model for the promotion of renewable energies. More precisely, the amendment was stipulated for photovoltaic and wind energy systems with a capacity of more than 750 kW and biomass systems with a capacity of more than 150 kW. Exceptions were made for systems generating electricity from hydropower, landfill, sewage- or mine gas and geothermal energy as well as specific pilot wind energy systems up to a capacity of 125 MW (Agora Energiewende, 2016). Despite the special regulations for onshore wind energy for citizen energy¹³ the numbers of bids reflect the difficulties energy cooperatives had with the new regulation: Of the 2643 offers in total (from 2015 onwards) only 18 offers were made by energy cooperatives and from 780 auction awards since 2015, just three were awarded to energy cooperatives (Genossenschaftsverband, 2020). In addition to that, the auction policy of “the lowest offer gets the award” is not in favour of energy cooperatives either. The therewith further worsened

¹³ Facilitated access to the auctions for wind energy and, depending on the outcome of the auction, the highest market premium. See further in Agora Energiewende, 2016, p.11.

conditions for their old business model led to continuous diversification processes. The discussions about the inclusion of systems with a capacity below 750 kW into the tender procedure constituted a potential drawback since this would restrict the potential installation capacities for energy cooperatives (since the middle -sized segment is crucial for their business model) (see Interview DE_EC_05).

With the introduction of the auction model, the uncertainties of energy cooperatives increased. Unlike as with the feed-in model, the revenues for their electricity were not certain anymore since it is uncertain whether a bid would win and thereby a certain revenue guaranteed or not. To be able to participate in an auction a bidder has to make an offer and therewith already invest capital in advance before it is clear whether the promotion will be awarded or not. Energy cooperatives therewith risk losing capital of their members which would be used for the project planning of the offer. Unlike energy cooperatives, bigger project companies can plan several projects at the same time thus can distribute their risks better.

“The auction model makes it difficult for energy cooperatives as they are not as big as the big energy suppliers and therewith can’t offer as much certainty.” (Interview DE_EC_04)

This policy change illustrates the often perceived power imbalance between energy cooperatives and bigger players in German energy policy making in this and the previous time period (see power box).

On the other hand, the introduction of the auction model led to more cooperation between single cooperatives. In order to distribute their risks and have a chance to receive awards energy cooperatives joined forces with other energy cooperatives to make offers about several projects at once (DE_EC_02).

According to the interviewees the new regulations around the „Mieterstromgesetz“(2017) constitute another restricting factor energy cooperatives had to deal with in this phase. Even though the interviewee perceived the measure as a potential support for their business model its actual application with its administrative as well as financial hurdles made the model for cooperatives less profitable. The planned support measures were not compensating the increased costs for its implementation on a larger scales (see Interview DE_EC_05) and led to ongoing adaptation processes.

A promising prospect for energy cooperatives in Germany is the Clean Energy Package (2019) of the European Union. In its directive “on common rules for the internal electricity market,” it

acknowledges the important role citizens and energy communities play in the energy transition. Moreover, it stipulates their members to integrate them and their activities into the national energy and climate plans and enable their further participation in their electricity systems (EU, 2020). The representatives of energy cooperatives see those policies as the result of the successful work of the national intermediaries and European representation of energy cooperatives (RESCoop, the European federation for renewable energy cooperatives). This further indicates the importance of intermediaries and their activities on multiple governance levels, so that if conditions turn bad on one level, lobbying efforts can continue on another level. In this case, cooperation on the European level may have been instrument for the future development of the SIE-field. However, since these policy changes on the European level have not been implemented on the national level until now, their consequences for energy cooperatives in Germany cannot be assessed yet.

Another significant field development of that phase is the progressing growth of electromobility. The already emerged trend of electromobility projects further dispersed and led to the foundation of the umbrella cooperative Vianova eG (2020). The cooperative was founded by several energy cooperatives while the regional energy cooperative network functioned as a supporting platform and offered the cooperatives technical and practical help to found the new umbrella cooperative. Hence the foundation of the Vianova eG can be seen as a further example of how the recently established regional intermediaries are enabling cooperatives to further develop and thereby contribute to the further evolution of the SIE-field.

Main functions of the Vianova eG are the support of organisations who engage in e-carsharing, the bundling of competencies, infrastructures, IT systems as well as services and back-office activities to improve the economic efficiency as well as the competitive capacity of their members (Vianova, 2020). Energy cooperatives therewith go one step further in the direction of professionalisation as they use economic strategies like outsourcing and bundling of competencies to work more efficiently.

In the German case, the Fridays for Future movement constitutes another influential factor for energy cooperatives in the fourth phase. Even though it is contested among members of the SIE-field how much impact the movement had, the majority agreed that it impacted energy cooperatives to a certain extend. One of the major outcomes, besides the raising of awareness in the general public about climate change and therewith also for renewable energy-related topics, is the increase of younger people interested in the field of citizen energy and ways to engage in the generation of renewable energies. The extremely hot summers in recent years reinforced those developments even more. More generally, several cooperatives recorded an increase of new members since the

movement began and some started to cooperate with members of the Fridays for Future as well as the scientist and parents for future movements.

“The clean energy package and Fridays for Future are important as ideational support but are not represented in politics so far.” (Interview DE_EC_04)

Institutional work conducted by SIE-field actors and other field-actors

SONNET investigates how SIE-initiatives, SIE-field-actors and other field-actors ‘perform institutional work – meaning they engage in creating, maintaining and transforming institutions to be able to work on, enable and/or impede SIE developments’ (Hielscher et al. 2020, p. 20). This analytical focus emphasizes that institutional changes are actively influenced by actors within the field (Wittmayer et al. 2020b, p. 31). The term ‘institutional work’ refers to these activities of creating, maintaining and transforming institutions and can include diverse types of institutional work, such as material, relational and symbolic work.

Institutional work in the field of energy cooperatives takes place in three ways. Firstly, through the structuration of the field itself and the creation of new organisations. With the intention to connect existing cooperatives, to bundle and share their knowledge and to introduce their concerns to a broader audience several energy cooperatives in several federal states started to join forces and created regional intermediaries for energy cooperatives. Today those networks organise events for energy cooperatives, offer them a place to network, and represent their interests in regional politics towards administrative organisations or other public actors. The formation of those regional intermediaries led to more acknowledgement of energy cooperatives in the regions and the representation of their interests in different councils.

“[...]that wouldn’t be possible for a single cooperative. It enables us to introduce aspects of citizen participation and cooperatives into those councils as well.” (DE_EC_05)

Several of those regional intermediaries and like-minded organisations founded the “Bündnis Bürgerenergie e.V.”, a nationwide acting network to support energy cooperatives and citizen energy participants and represents their interest at a national level. Thus, institutional work led to the creation of newly established organisations on the regional and on the national level. (Other important newly established organisations are further elaborated upon in section 5 - phase 2.)

The work of intermediaries themselves is the second important type of institutional work within the field under study. Particularly national intermediaries (besides the Bündnis Bürgerenergie e.V. also the section for energy cooperatives at the DGRV) work on press releases, organise collective statement about prospective laws and try to influence politics through lobbying, the publication of reports and similar activities. They thereby aim to influence existing or emerging new laws and change existing regulative institutions. An example of successful institutional work is the influence of the Bündnis Bürgerenergie e.V. and the DGRV section in the decision making process about the recent EEG amendment in 2020. The duty for tender offers should have been lowered from 750 kW to 100 kW, which would have affected energy cooperatives and their business models significantly. Even though they did not reach their intended goal, the final result was the decline from 750 to only 500 kW – which indicates the partial influence of their work. Through the transfer of know-how, training and workshop for already existing cooperatives and prospective cooperatives intermediaries additionally contribute to maintaining existing structures in the field. The representation in Brussel and the cooperation with the European federation for energy cooperatives (REScoop) is another example of the second type of institutional work in the SIE-field.

The third form of institutional work addresses normative, as well as cultural-cognitive institutions. By serving as an example of successful energy cooperatives, energy cooperatives influence the view of the general public on citizen energy and their related goals (DE_EC_01). A more direct way of changing cultural-cognitive as well as normative institutions is the result of the constant work by energy cooperatives to provide the public with information about their ongoing work, the reasons for it and individual regional topics in general. Those measures are accompanied by the continuous spread of petitions on their websites and their social media channels. The additional aim of intermediaries to act as advisors for and to spread information about their goals also contributes to a change of normative and cultural-cognitive institutions. Finally, the support and commissioning of studies by bigger cooperatives and intermediaries to confirm their personal experiences with scientific results is an additional contribution to that form of institutional work.

“The association wants to make the knowledge of energy cooperatives accessible to everyone and encourage other people to also engage cooperatively.” (DE_EC_07)

Today the numbers of newly founded energy cooperatives are nearly at the same level as they have been before the immense increase during the boom phase (14 new foundations in 2019, 8 in 2006). Nevertheless, the numbers of Kahla et al. (2017) show that the energy cooperatives deleted from the cooperative register do not compensate for the newly established once hence the total amount of

energy cooperatives is still increasing (till 2016). This development has continued till today according to the numbers of the DGRV.

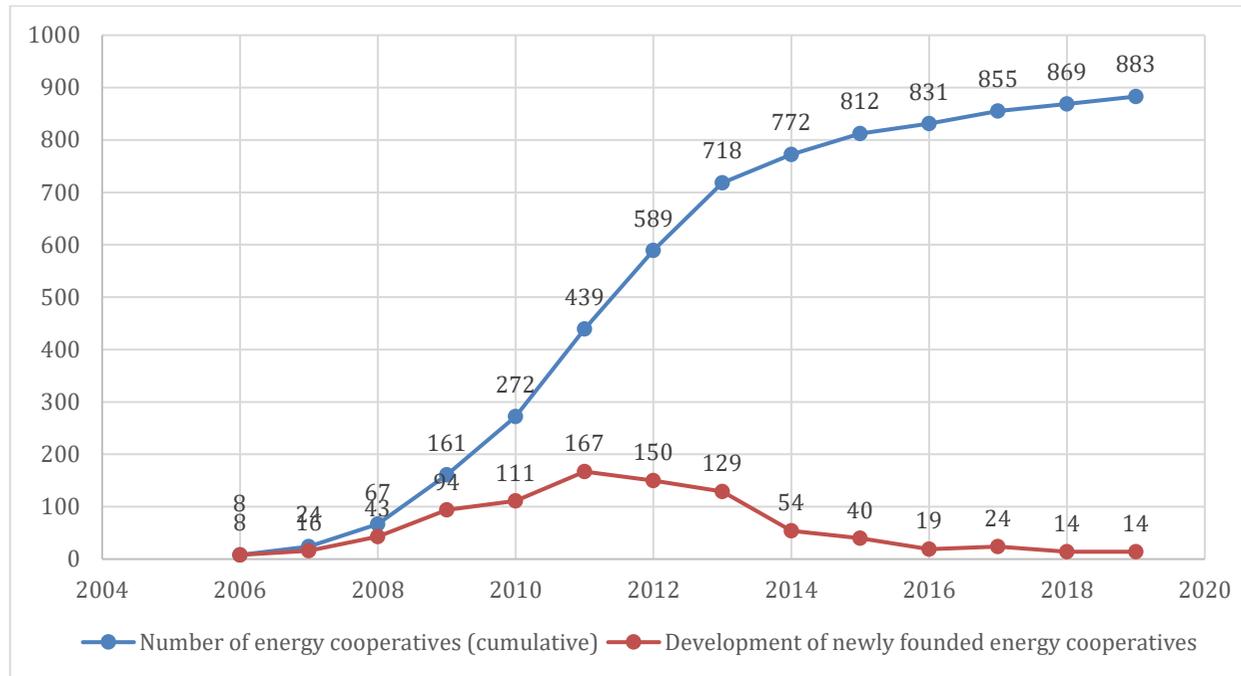


Figure 2. Number of energy cooperatives in Germany (cumulative and newly founded per year)

(Source of numbers: DGRV, 2020, own depiction)

However, even though newly founded energy cooperatives are decreasing, both interviewed cooperatives reported increasing membership development. This development is also represented by the yearly survey of the DGRV which shows that the total number of members increased during the last years, from 130.000 members in 2014 (DGRV 2015, p.10) to around 200.000 member in 2019 (DGRV 2020, p. 9). This points out the relevance of and citizen interest in energy cooperatives despite the decreasing development of new cooperatives.

Outlook

Other topics that energy cooperatives currently are faced with as a potential influence on the field in the future are e.g. the successor question. Since older energy cooperative members are about to leave the cooperatives and the succession of young people does not equal out this development so far, energy cooperatives fear a decrease of active members. This trend might change through the increased interest by the Fridays for Future movement, but the overall effect cannot be assessed yet. Besides that, the forthcoming changes of the EEG in 2021- with its changes of the exception clause for the tender procedure- constitutes a potential source for future developments in the field. Moreover, the aspirations of energy cooperative members to consume their energy and the creation of new projects to invest their capital represent additional topics which might potentially further influence the field.

“I see that with nearly every cooperative, that their members would like to invest, the money is there, but there are no projects which would be worthwhile to invest in.” (Interview DE_EC_05)

6 Summary, synthesis and conclusions

6.1 How do SIEs and SIE-fields emerge, develop and institutionalise over time?

In SONNET we define social innovation in energy (SIE) as a ‘combination of ideas, objects and/ or actions that change social relations and involve new ways of doing, thinking and/ or organising energy’ (Wittmayer et al. 2020b, p. 4). One type of SIE is the ‘cooperative organisational model for renewable energy’, in short, ‘energy cooperatives’. In the embedded case study at hand, we analysed the identified SIE and the field the SIE is embedded in over the last 20 years. In the German case, the social innovation is not mainly to be found in the cooperative model itself but rather in its application, the reasons for its application and the resulting activities and implications.

Energy cooperatives in Germany are not per se a new phenomenon since they existed already in the 20th century to provide the rural population with electricity. At that time, their main aim was to provide citizens with a commodity that would have not been accessible otherwise. That differs from energy cooperatives today, where the generation of electricity from renewable energies does not fulfil the economic needs of the single cooperative members. Thereby, the motivation to participate in an energy cooperative is not mainly driven by the personal economic advantage the participation would imply but by the ideational motivation to actively contribute to the increase of renewable energy production. Thus, energy cooperatives enable citizens to actively take part in the energy transition by financing, constructing and managing renewable energy sites. Another aspect of social innovation can be seen in the pioneering activities through which energy cooperatives inspire other actors and induce further changes in the energy system. The SIE is thereby the result of the ideational motivation and the aspiration to be more active as an individual and not only consume electricity but to become active in its production thus acting as a ‘prosumer’.

Our analysis describes an innovation timeline for the emergence and development of the SIE-field of energy cooperatives in Germany which can be divided into four phases. The first phase from 1998 till 2006, can be characterised as the “policy foundation phase” wherein the fundamental policy conditions for the establishment of the field have been implemented. The liberalisation of the German electricity market as well as the introduction of the Renewable Energy Sources Act, with the introduction of technology-specific feed-in tariffs and priority to the grid access for renewables, constitute the main policy foundations for the establishment of the field. The second prerequisite for the establishment of the field was the amendment of the German cooperative law which facilitated the conditions to initiate cooperatives and caused administrative relief for smaller cooperatives. Those policy changes in addition to the increased environmental awareness and the general trend

of citizen participation led to the second phase. Starting from 2007 onwards and propelled by the investment security guaranteed by the feed-in tariffs for 20 years the numbers of newly established energy cooperatives increased remarkably and finally spiked in 2011. The shock of the financial crisis, as well as the nuclear catastrophe of the Fukushima accident, were described as additional boosters of the steep increase of newly established cooperatives during the second phase. The third phase is characterised by a change of the favourable policy conditions for renewables through the amendments of the Renewable Energy Sources Act in 2012 and 2014 and increased uncertainties of the SIE-field in response to the introduction of the Capital Investment Act at the one hand and increased networking activities of the SIE-field on the other hand. Those networking activities led to the creation of regional intermediaries well as several different national intermediaries which from then on guaranteed the political representation of energy cooperatives and contributed to enabling the continuation of existing energy cooperatives despite the changed conditions. At the same time, the number of newly established energy cooperatives started to drop, a trend which continued in the fourth phase from 2017 on. In addition, economic calculations by policy consultants and published by the economics ministry suggested that it would be more cost-effective to abstain from self-consumption, arguing that it would not lead to systemic benefits (Winkler et al., 2016). The implementation of the auction model in 2017 for the majority of renewable energy systems (for exceptions see p.44) replaces the previous feed-in tariff model on which the main business model of energy cooperatives relied on. Through the continuous work of national as well as regional intermediaries, new business models emerged and dispersed. As a consequence, the field started to diversify its business models and the first signs of professionalisation evolved. It is also during that phase that the Fridays For Future movement creates further momentum for environmental awareness and increased participation in energy cooperatives despite the stagnation of newly established energy cooperatives.

Overall, the development of the field can be divided into three main movements. At first an expansion of energy cooperatives induced by favourable policy conditions for renewable energies in general and facilitated conditions for cooperatives. Second, partially in reaction to changed policy conditions and the need for political representation, increased networking activities between cooperatives and other SIE-field actors and the structuration of the field through the establishment of regional and national intermediaries. And finally, third, diversification processes of business models and a starting professionalisation of the field also partially as a reaction to changed policy conditions while the establishment of new cooperatives further stagnated.

6.2 How do SIE-field-actors and other field-actors interact with the 'outside' institutional environment and thereby co-shape the SIE-field over time?

While the SIE-field is constituted by SIE-actors and field-actors activities, it is also influenced by the outside institutional environment, which can interact, shape, enable or impede the development of the SIE.

The 'outside' institutional environment shapes the field of energy cooperatives in several ways. First of all, energy policies at the federal level and European policies. As briefly outlined in 6.1. the liberalisation of the German electricity market, the implementation and amendments of the Renewable Energy Sources Act as well as the amendments of the German Cooperative law were highly relevant for the establishment of the SIE-field in Germany. Those influential national policies are often driven by previous European policy decisions such as the EU directive on the liberalisation of the electricity market and illustrate the importance of European policies for the development of the field. The representation of energy cooperatives in Berlin and Brussels is one example of how the SIE-field actively interacts with this specific outside institutional environment.

Other important field developments are a result of the institutional embeddedness of energy cooperatives in the German federal system. Due to the partial independence of the federal states, they possess the means to financially support regional intermediaries or to interfere with federal state-bound regulations as the example of the Bavarian building law ("10H Abstandsregel") illustrates. The latter is an example of an impeding factor for the field development since the regulation hinders the realisation of new wind energy systems for energy cooperatives. On the other hand, it can be argued, that impeding factors of the outside institutional environment influence the further development of the field in that energy cooperatives need to adapt to the changed conditions and thereby create new ways of doing and thinking energy. The diversification of business models partially as a response to the changed policy conditions can be seen as a further indication for this development. Besides that, the German federal system is furthermore a prerequisite for the specific role municipalities play as a cooperation partner for energy cooperatives.

The German electricity market as well as the financial market constitute two other relevant factors of the outside institutional environments that influenced the emergence of the field under study. Energy cooperatives are embedded in the German energy system which influenced the development of the field in different ways: One aspect is the resulting changes in the energy system subsequent to the liberalisation of the energy market. Those changes form a precondition for the establishment of the field since they enabled smaller players such as energy cooperatives to enter

the electricity market. In contrast, the price trading mechanisms on the energy spot market constitute an impeding factor for the development of the field, since the high EEG-surcharge contributes to the negative perception of renewables as 'expensive energy sources for everyone'. (The electricity price, which goes down with higher shares of renewable through the merit order effect, determines the amount of the EEG-surcharge. Ironically, this reduction in electricity prices through renewables leads to higher EEG-surcharges.)

Finally, the financial market is described as another enabling outside institutional factor for the field establishment during the last 20 years. The comparably good situation of cooperative banks after the financial crisis led to the approval of the positive connotations with the cooperative model in general and potentially increased the trust in the organisational model for other purposes as well. Furthermore, the currently (2020) low-interest rates led to an increase in capital investment into energy cooperatives leading to an increased potential for further project developments and increased activities of the field.

6.3 What are the enabling and impeding factors for SIE-field-actors and other field-actors to conduct institutional work and change the 'outside' institutional environment?

In SONNET we describe 'institutional work' as activities of SIE-field-actors and other field-actors which aim to create, maintain and transform institutions in order to influence SIE developments. In the SIE-field of energy cooperatives in Germany institutional work mainly takes place in three ways.

Firstly, through the structuration of the field itself and the subsequent creation of new organisations such as regional and national intermediaries. Intending to connect existing cooperatives, to bundle and share their knowledge and to introduce their concerns to a broader audience several energy cooperatives in several federal states started to join forces and created regional intermediaries for energy cooperatives. This was followed by the creation of national intermediaries which represent the interests of energy cooperatives in Berlin and Brussels. Hence, with the aim to enforce energy cooperatives interests the field started to structure itself and institutionalised parts of its procedures.

The resulting work of intermediaries constitutes the second important type of institutional work within the field under study. Through joint advocacy and the representation of interests in energy policy making processes, representatives of energy cooperatives try to influence existing or emerging laws and change existing regulative institutions.

The third type of institutional work addresses normative and cultural-cognitive institutions. By serving as a role model for other energy cooperatives and a successful example of citizen energy, energy cooperatives can influence the general public's view on citizen energy and their related goals. The process can take place consciously or as a side effect of their daily work since the daily work of energy cooperatives often includes the provision of information about current projects to the general public. The support and commissioning of scientific studies as well as the continuous spread of petitions are other forms that contribute to that type of institutional work.

The institutional work of energy cooperatives is hindered by various impeding factors. First of all, SIE-field internal factors. Those include e.g. the widespread dependency on voluntary working members which is partially a result of lacking financial resources. On the one hand, voluntary work can be seen as an advantage as it enables energy cooperatives to experiment and try new things independent of the time resources it takes. On the other hand, it can be seen as a disadvantage at the same time as it can also cause restricted time capacities and restrict energy cooperatives activities. The lack of financial resources further contributes to a lack of restricted capacities to invest in professional PR strategies or other business sectors which can not always be fulfilled in the same professional way by cooperative members, it thus hinders the professionalisation of the field. This would enhance the degree of awareness of energy cooperatives and their work which is not always given at the moment and constitutes an impeding factor for the current institutional work of energy cooperatives. This leads to SIE-field external hindering factors for energy cooperatives. Since the majority of incumbents of the energy system is not in favour of a decentral energy transition their lobbying interests are in opposition to the interests of energy cooperatives. Their size, financial resources as well as their status in the prevalent energy system equip them with the resources to hinder further institutional work of energy cooperatives. Another hindering factor for the institutional work for energy cooperatives might be the sceptical view towards citizen-led initiatives of parts of the general public and the trust in public institutions for the management of energy. This counteracts the intended change of the normative and cultural-cognitive institutions by energy cooperatives.

This hindering factor gets amplified by a general lack of awareness about the role of citizen energy for the renewable energy production in the general public as well as among politicians which is described as a hindering factor for the work of intermediaries in the field.

In contrast, enabling field internal factors for energy cooperatives are versatile as well. First of all, energy cooperatives and their representatives possess accumulated knowledge resources through their members and their engagement in different organisations. This is accompanied by the high levels of motivation and personal commitment of their members which leads to engagement

beyond the cooperative work and e.g. the creation of intermediary organisations. In addition to that, the high levels of interconnectivity in the field of energy cooperatives, e.g. through the engagement of intermediary board members in several other boards constitute additional enabling conditions for the institutional work of the SIE-field under study. The resulting synergy effects as well as the widespread cooperation with other relevant organisations of the renewable energy field further advances those developments.

An external enabling factor for energy cooperatives institutional work can be seen in the financial support of the federal state ministries for regional intermediaries. It equips them with the financial resources to invest in their work as political representatives and advisors of the field. The long tradition of the cooperative model in Germany forms another enabling condition for the institutional work of the SIE-field. On the one hand, it leads to more acceptance of energy cooperatives and their related goals, on the other hand, it facilitates the political interest representation of energy cooperatives since related organisations (like the German Cooperative and Raiffeisen confederation, DGRV) have been already established and facilitated the foundation of a national intermediary for energy cooperatives. The establishment of regional and national intermediaries constitutes another enabling factor for the institutional work of the field since they enable energy cooperatives to represent their interests in the realm of politics.

7 Recommendations for our city partners, national and EU policy makers and SIE practitioners

SONNET city partners

- Cities can support energy cooperatives by providing them with roofs or other open spaces so that energy cooperatives can install their renewable energy sites there. In addition to that cities can purchase electricity from cooperatives.
- Cities can encourage more cooperation between municipal utilities and energy cooperatives.
- In addition to that, cities can make use of their responsibility for energy-related topics (as they are considered a common good) and adapt their strategy towards renewable energies in general and therewith also improve the conditions for energy cooperatives.
- Cities or municipalities can become a member of the energy cooperative, therewith (through their equity) support the cooperative and potentially raise more awareness for energy cooperatives.

National and EU policy makers

- To support the work of energy cooperatives it is necessary to take into account the organisational specifics of energy cooperatives for the creation of policy instruments (exemption clauses for smaller players, in general, might not fit energy cooperatives).
- In order to create specific policy instruments, it might be valuable to get into a conversation with representatives of energy cooperatives.
- It might be worth it to take into account the potential of citizen energy for future renewable energy production capacity calculations.

SIE-field-actors

- Continue the vast cooperation and networking processes with other actors as well as the political representation on the regional as well as the national level. Who might be other potential cooperation partners?
- Could the accumulated capital which can at the moment not be invested into new renewable energy sites be perhaps invested somewhere else worthy? Possibly to hire staff for a limited amount of time to organise accounting etc.

- Would it be worth it to invest more in PR strategies, to increase the recognisability of energy cooperatives and their related work? This might lead to more recognition in the general public as well as in other spheres.

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Annex 1

Methodology

As a preparation for the case study at hand the conceptual underpinnings of SONNET have been studied. In order to get a first insight into the field of energy cooperatives in Germany the most recent research literature of the field has been reviewed. This served as a starting point to get a first overview of the main developments, particularly concerning the policy changes, of the field. This was followed by desktop research in which relevant actors for the field of energy cooperatives could be partially discovered and examined. This served as a starting point for the selection of interviews. The following interview selection was based on the already conducted interviews and the aim to include regional as well as national intermediaries to potentially get an overview of the field developments. It has to be noted that for the study at hand only interviewees in favour of the decentral energy transition and citizen energy, in general, have been interviewed. Additional insights from an opposing point of view are not reflected here. Thus, the focus of the study at hand is the perspective of energy cooperative supporters.

The interviews have been done sequentially. Nonetheless, during the processes of writing up the report, it became clear, that further interviews with more specific questions would further enhance the insights of the report.

List of interviewees

For the SIE-field under study eight interview partners from SIE-initiatives, regional as well as national intermediaries have been interviewed. The interviews were conducted from September till early December 2020. The total duration of the interviews was 11.21 hours.

Code interview	Empirical description of case	Type of actor according to SONNET	Date of interview	Duration of interview	Interviewer
DE_EC_01	Energy cooperative	SIE-initiative	10.11.2020	1:50	Jasmin Heidary
DE_EC_02	Energy cooperative	SIE-initiative	09.12.2020	0:57	Jasmin Heidary
DE_EC_03	National intermediary for energy cooperatives	SIE-field actor	7.10.2020	0:57	Jasmin Heidary

DE_EC_04	National intermediary for energy cooperatives	SIE-field actor	26.10.2020	1:15	Jasmin Heidary
DE_EC_05	Regional intermediary for energy cooperatives	SIE-field actor	24.10.2020	1:34	Jasmin Heidary
DE_EC_06	Regional intermediary for energy cooperatives	SIE-field actor	16.09.2020	1:28	Jasmin Heidary
DE_EC_07	Regional intermediary for energy cooperatives	SIE-field actor	23.09.2020	1:34	Jasmin Heidary
DE_EC_08	Regional intermediary for energy cooperatives	SIE-field actor	02.10.2020	1:38	Jasmin Heidary
DE_EC_09	National intermediary for energy cooperatives	SIE-field actor	18.02.2020	E-Mail exchange	Jasmin Heidary

List of meetings and events attended

Due to the corona pandemic, it was not possible to attend meetings personally. However, one online event could be attended.

Event name	Event organiser	Type of event	Date of event	Who attended
7. Fachtagung Bürgerenergie und Energiegenossenschaften NRW	Energy agency NRW	Online webinar	28.10.2020	Jasmin Heidary

Annex 2

Detailed SIE-field timeline

The events in the timeline were chosen based on the interviews, the desktop as well as the literature research based on their relevance for the field development.

DATE	TYPE OF EVENT	DESCRIPTION OF EVENT	QUOTE & SOURCE
PHASE I: Policy foundations for the establishment of the field (1998-2006)			
2000s	Trend	Rising environmental awareness	UBA (2019)
1996	SIE-field event	EU directive on the liberalisation of the electricity market	EU DIR 96/92/ EC
1998	SIE-field event	Liberalisation of the German electricity market	(Meister et al. 2020)
2000	Policy event	Introduction of the Renewable Energy Sources Act: introduction of technology-specific feed-in-tariffs guaranteed for 20 years, unbundling and priority grid access for renewables	BGBl 2000. I 13 S. 305-309
2006	Policy event	Amendment of the German cooperative law: (facilitated conditions for the establishment of new cooperatives, administrative relief and lightened conditions for capital procurement for cooperatives)	BGBl. I 2006 S. 2230
PHASE II: Boom phase of energy cooperatives and first structuration of the field (2007-2011)			
2000s	Trend	Trend of citizen participation in general	Debor (2018), Maron and Maron (2012)

2007	SIE-field event	Number of newly founded energy cooperatives per year starts to increase	(DGRV, 2020)
2008	Shock	Financial crisis	
2010	SIE-field event	Foundation of Energiewende Jetzt e.V.	DE_EC_01, 03, 05
2011	Shock	Fukushima nuclear catastrophe	
2011	Policy event	Nuclear phase-out law (announcement to close all German nuclear power plants by December 2022)	(Agora Energiewende, 2015)
2011	SIE-field event	Number of newly founded energy cooperatives per year peaks	(DGRV, 2020)
2011	EU-policy event	EU Directive on alternative investment fund managers	(Herbes et al., 2017)
PHASE III: Successive abolishment of policy support and institutionalisation processes of the field (2012-2016)			
2012	Policy event	Amendment of the EEG (i.a reduction of the feed-in tariffs)	BGBI. I 2012 S. 1754
2012-2015	SIE-field	Establishment of regional intermediaries	DE_EC_04, 05, 06
2013	Policy event	Introduction of the capital investment act (CIA)	(Herbes et al., 2017)
2013	SIE-field event	Foundation of the section for energy cooperatives at the DGRV	DE_EC_04, 05, 07
2013	SIE-field event	Foundation of the Bürgerwerke e.G.	DE_EC_03, 04, 07
2014	Policy-event	Amendment of the EEG (introduction of tender procedures for photovoltaics, as a replacement for	BGBI. I 2014 S. 1066

		the secured feed-in tariffs, further amendments of the feed-in tariff)	
2014-2015	SIE-field event	Foundation of regional cooperative electricity suppliers	DE_EC_07, 08
2014	SIE-field event	Foundation of the Bündnis Bürgerenergie e.V.	DE_EC_03, 04, 05
2016	Policy event	Act on the digitalisation of the energy transition (Introduction of smart metering)	BGBl. 2016 I 43 S. 2034-2064.
PHASE IV: Continuous stagnation of foundations of energy cooperatives and the further diversification of business models (2017-2020)			
2018	Trend	Fridays for future (increased interest in renewable energies and energy cooperatives)	DE_EC_02, 04, 05
2017	Policy event	EEG 2017: introduction of the auction model for the majority of renewable energy sources (exceptions i.a. for wind and solar energy systems below 750kW)	BGBl. I 2016 S. 2258.
2019	EU policy event	Clean energy package: Definition of citizen energy communities and acknowledgement of their importance for the energy system.	European Commission (2020)
2020	SIE-field	Foundation of Vianova e.G.	DE_EC_04, 05, 07

SONNET – SOCIAL INNOVATION IN ENERGY TRANSITIONS

Co-creating a rich understanding of the diversity, processes, contributions, success and future potentials of social innovation in the energy sector

GA#: 837498 / Funding type: RIA

Research report on city level competitions for sustainable energy in Germany



Cover photo: © Andreas Henn / City of Mannheim

About SONNET:

SONNET is a research project that aims to develop an understanding of diversity, processes, contributions and future potential of social innovation in the energy sector. It is co-funded by the European Commission and runs for three years, from 2019-2022. The SONNET consortium consists of 12 partners across Europe, including academics and city administrations. For more information, please visit our website: <https://sonnet-energy.eu>

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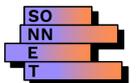
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1 Forward

SONNET (Social Innovation in Energy Transitions) brings diverse groups together to make sense of how social innovation can bring about a more sustainable energy sector in Europe. The project aims to co-create a rich understanding of the diversity, processes, contributions, successes and future potentials of social innovation in the energy sector (SIE). We define SIE as a combination of ideas, objects and/or actions that change social relations and involve new ways of doing, thinking and/or organising energy. As part of this work, we make use of an embedded case study approach to build a better understanding of the development of diverse SIE-fields (e.g. participatory incubation and experimentation, framings against specific energy pathways, local electricity exchange) over time. Our research questions that frame the case study work are:

- How do SIEs and SIE-fields emerge, develop and institutionalise over time?
- How do SIE-field-actors and other field-actors interact with the 'outside' institutional environment and thereby co-shape the SIE-field over time?
- What are the enabling and impeding factors for SIE-field-actors and other field-actors to conduct institutional work and change the 'outside' institutional environment?

A SIE-field is an arena/space that includes a specific SIE as well as SIE-field-actors working on it and other field-actors enabling and/or impeding it. In this arena/ space these actors take one another and their actions into account and have a shared (but not necessarily consensual) understanding of a SIE and of their relationship to other actors. They recognise (but not necessarily follow) shared norms, beliefs and rules. SIE-fields are often not homogenous but are composed of actors with diverse and contradictory aims and interests. An example: The UK cooperative energy field includes SIE-initiatives and SIE-field-actors (e.g. Brighton Energy Co-op, Cooperative UK, Community Energy England, UK Government, City of Brighton), who have a shared understanding of an SIE, which exists as 'organising under cooperative principles to generate renewable energy'.

The structure of this report is as follows. Section 2 provides a summary of the SIE-field relevant for this report and lists some key insights. Section 3 outlines the boundaries of the SIE-field and shows how it has been studied in the country context. Section 4 shows a visual development of the SIE-field. Section 5 tells the historical development of the SIE-field over time, including analytical/ interpretive reflections from the SONNET researchers and quotes from the actors involved in the field developments. Section 6 outlines key research findings, providing answers to the three research questions. Section 7 outlines recommendations for policymakers based on the findings. Finally,

Section 9 outlines the methodological approach and includes a more detailed timeline of the SIE-field and its actors.

The following boxes are used within the report:

Conceptual work
...

Introduction to SIE-initiative
...

2 City-level competitions for sustainable energy

Definition of SIE and SIE-field boundaries? City-level energy competitions are formats where participants strive to rank themselves, gain or win something that focus on particular local energy topics (e.g. energy savings) contributing to specific energy pathways. This specific type of SIE is therefore concentrating on novel ways of engaging in different (playful) energy competition formats. Its novelty lies in the formats of competition, which allow for new actors to engage in sustainable energy pathways. Furthermore, the formats might involve new indicators for measuring energy related behaviour. While this report concentrates on 'city-level competitions for sustainable energy' in **Germany**, the SIE will also be studied in further case studies in **France** and **Switzerland**. A concluding cross-country analysis will allow for comparing the similarities as well as differences between the situations in the three countries.

How is the SIE-field defined? In the SIE-field under study, we focus on energy competitions that happen at the city level. With the term 'city-level competitions for sustainable energy' we refer to diverse formats related to sustainable energy pathways, where participants strive to rank themselves, gain or win something. These formats can address competitions between city administration (e.g. referred to as 'between city competitions', which take place between different cities) or target changes of individual behaviour (e.g. referred to as 'within city competitions', which take place within the city between different stakeholder groups). What links these formats is their shared aim to promote and mainstream sustainable energy. Our broad understanding of competition includes next to games voluntary comparisons, rankings, benchmarking, etc. and does not necessarily mean defeating others. Participants can strive to gain an award and/ or energy label or win goods (money/prices/lower costs) but also recognition, a feeling of empowerment, opportunities for marketing or for creating political capital, and fun.

What's specific for the German case? In the case of Germany, due to strongly decentralised structures in the federal political system, cities play an active role in developing sustainable energy pathways (Deutsche Energie-Agentur GmbH 2019). However, technologies which allow for real-time energy measurements (such as smart meters or smart energy management systems) are still not very far diffused to individual households in Germany (Giest 2020). This, on the one hand, limits the possibilities of cities to establish energy focused competition formats where energy-efficient behaviour is rewarded. On the other hand, cities stress the importance of taking an integrated approach, which embeds energy related topics in their overall engagement in climate protection activities. City actors describe their understanding of energy related topics as 'entirety of all things that concern climate protection or CO2 reduction, including e.g. mobility' (see Interview DE_CLC_8).

The German case study therefore also considers competition formats with a broader focus on sustainability pathways where energy might be one topic among others. These competitions target behaviour changes towards sustainability and thereby integrate energy related topics.

Key insights:

For the SONNET project, the SIE-field of city-level competition for sustainable energy is particularly interesting because through different formats of competition between cities and within cities, it reveals a number of important issues for social innovation in energy transitions. In particular, it illustrates that:

- The SIE under study emerged out of a situation, which is described to be characterized by a 'discouraged political mood'. This refers to a situation at the beginning of the 21st century, when the political attention for sustainable energy related issues was rather low. Out of this situation, however, individual actors started developing formats to increase attention and attraction of energy related topics.
- Focusing on formats on the city level, organized by (local) city administrations, the SIE-field under study is by definition closely embedded in existing institutional structures such as the organizational and regulatory structures of city administrations or the political responsibilities in the German federal system. The SIE addresses change within existing administrative structures and aims for opening them up for new actor constellations and new forms of engagement.
- The SIE under study is impeded by technical factors, mainly the lack of smart energy infrastructures and therefore addresses broader sustainability questions, with energy being one topic among others. Cooperation on the local level and close network relationships within cities are enabling the SIE.

3 Introduction to city-level competitions for sustainable energy in Germany

This report investigates the development of the SIE-field 'city level competitions for sustainable energy' in Germany and its social innovation in the energy sector (SIE, see analytical box 'SIE changing social relations' below). The SIE-field stands for novel ways of engaging in different (playful) energy competition formats. Competition is here not limited to formats that are characterized by a strong sense of 'competitiveness' but might also include joyful 'fun formats', awards or labels. What links these formats is that participants strive to rank themselves, gain or win something. To qualify for this study, the formats focus on particular local energy topics (e.g. energy savings) contributing to specific energy pathways. These energy related topics however might be embedded in formats that aim for encouraging a broader engagement in sustainability related issues.

In the German context, 'city level competitions for sustainable energy' is a rather heterogeneous field. It includes a variety of activities carried out by different actors such as city administrations, intermediaries like city networks or by civil society actors in cooperation with city administrations. The fact that the SIE-field is so far neither strongly institutionalized in Germany nor very well studied, makes it difficult to draw clear SIE-field boundaries. We therefore concentrate on activities on the city level as in Germany, cities are very active in developing energy transition pathways and thereby competing against each other (Deutsche Energie-Agentur GmbH 2019; Elmqvist et al. 2019). This means that we concentrate on competition formats in which city administrations are part of organising, participating in, leading and/or carrying out these competitions. However, the formats under study also include cooperative formats that involve different actor groups such as intermediaries like city-networks, civil society actors or private business.

SIE changing social relations

In the context of the SONNET project, social innovation in the energy sector (SIE) are defined as 'a combination of ideas, objects and/ or actions that change social relations and involve new ways of doing, thinking and/ or organising energy' (Wittmayer et al. 2020b, p. 4). In order to observe the diversity of SIE, the SONNET project first developed a typology of contrasting SIE (Wittmayer et al. 2020a). One identified type of SIE is called 'city level competitions for sustainable energy'. A main characteristic of this SIE-type is that participants strive to rank themselves, gain or win something. This specific type of SIE is therefore concentrating on novel ways of engaging in different (playful)

energy competition formats. Its novelty lies in the formats of competition, which allow for new actors to engage in sustainable energy pathways.

City level competitions for sustainable energy include new ideas insofar as formats are striving towards a more playful character. This is in contrast to former attempts, which are so far dominating the German discourse and frame energy related issues as mostly technical or political topics. This new idea of a playful way of getting engaged in energy related issues is furthermore linked to new actions in terms of new formats being developed and new actor constellations involved in these competition formats. The SIE under study is therefore changing social relations insofar as SIE-initiatives are actively trying to include new actor groups. SIE-actors are aiming for reaching out to different stakeholder groups such as citizens, city administration staff as well as private companies ('big players'). They do so by developing 'fun formats' for promoting and mainstreaming sustainable energy and for making sustainable energy a more 'fun' topic. The main change is about who is included in the 'game' and which forms of engagement the game offers: participating in a competition and having fun doing so is considered a good way of motivating people for getting engaged, of knowledge transfer and learning. New actor groups are getting engaged in developing games and competition formats. Civil society actors, private initiatives as well as city administrations are taking new forms of responsibility. Furthermore, the SIE-under study might also include new objects such as the development of digital Applications, tools or platforms that help to carry out the competition. Competitions, in the understanding of this report, are however not limited to digital settings only.

In Germany, the development of 'city level competitions' is based on the relatively strong role of local governments in Germany's federal system. This leaves municipalities space to engage in different types of activities and explore new formats that target energy related issues. However, it also increases the responsibility of local governments and the pressure to innovate on the local level. One of the main challenges for municipalities thereby is how to involve different stakeholder groups such as citizens, civil society actors, private business or city administration staff in local energy transition pathways. One novel way to do so is to develop competition formats that are often embedded in information campaigns (see Interview DE_CLC_6). Engagement in sustainable energy project thereby also helps to improve the image of cities and helps to promote 'location advantages' (Andersson 2016). In the German context, a large amount of formats therefore target competition formats or awards between different cities. City networks, foundations or federal ministries often organize these formats. Examples are the Germany sustainability award (Deutscher Nachhaltigkeitspreis) which is organized by a foundation with the same name, or the competition 'energy municipality of the month' (Energie-Kommune des Monats), which is organized by the

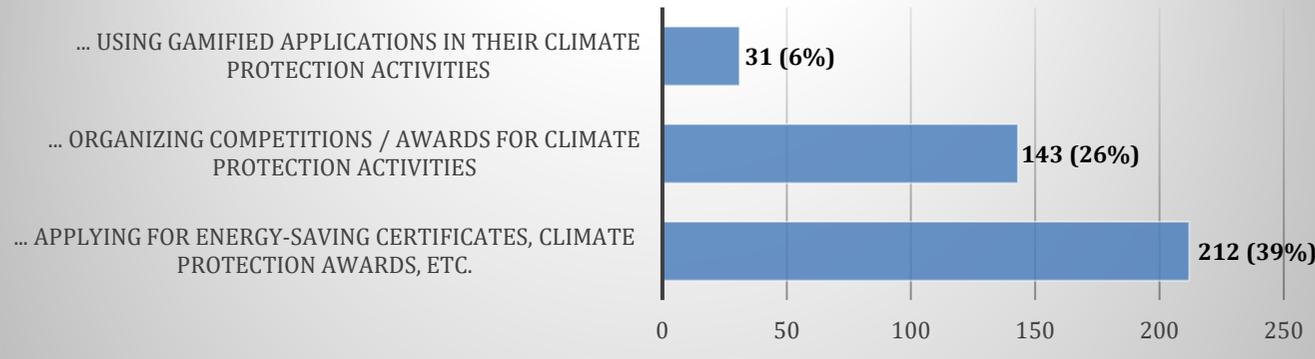
German Renewable Energies Agency. Next to these awards, also labels play an important role as competition formats in Germany with the most prominent label being the European Energy Award.

The role of cities in sustainability transitions and especially the engagement of city administrations in developing sustainable energy pathways significantly increased during the last years. This is why some academic scholars working in the field of (urban) sustainability transitions are describing this development as emergence of the 'urban century': 'the current century should rightly be labelled the urban century, where cities will require a fundamentally new holistic perspective for understanding [global] challenges [...] (Elmqvist et al. 2019). City administrations can thereby take different roles e.g. as actors, who push for change through climate emergency declarations (Rode 2019), as policy-makers that encourage urban experimentation formats (Bulkeley and Kern 2006), as intermediaries coordinating activities in a multi-governance frame (Gustafsson and Mignon 2019) or as role models in international comparisons through their city branding activities (Andersson 2016). These different roles might also lead to different forms of engagement in competitions as a means for cities to take action. City-level competitions for sustainable energy is a type of SIE that so far is not very well studied. In the context of sustainability studies, academic scholars often take a broader focus on the role of experimentation in urban sustainability transitions (Evans et al. 2018) or study a certain format of urban competition such as gamified applications (Albertarelli et al. 2018; AlSkaif et al. 2018). However, overarching studies on the role of competitions on the city level in the context of social innovation in energy transitions so far are missing.

Concerning the format of competitions, a survey conducted by Fraunhofer ISI¹ among German municipalities showed that the relevance of different competition formats highly varies between municipalities. About 39% of the municipalities stated that the city administration already applied for prizes or awards in the field of sustainable energy and climate protection activities and 25% of the municipalities indicated that the city administration organizes competitions within their municipality. In contrast, only 6% of municipalities indicated, that gamified applications play a role in their climate protection activities (own data by Fraunhofer ISI, status October 2020, N=554).

¹ The survey is part of the project NostaClimate, which examines the role of non-state actors and their interactions with state and individual actors. The project is funded by the German Federal Ministry of Education and Research (BMBF) within the second phase of the funding priority "Economics of Climate Change" (FKZ: 01LA1813). The survey was conducted among German municipalities with 5.000 to 500.000 inhabitants. In total, 550 municipalities participated in the survey.

Local governments...



Gamified applications mostly build up on smart energy technologies which allow for real-time energy measures (Albertarelli et al. 2018; AISkaif et al. 2018). These technologies are still not very far diffused to individual households in Germany and were excluded from this case study due to their small presence in Germany. The focus rather lies on two different levels of activities which correspond with two phases of development of the SIE-field: competitions between cities and competitions within cities.

Formats	Within Cities	Between Cities
Focus	Often focus on behaviour changes of different target groups	Focus on specific indicators and benchmarks, climate protection targets and measures by city administrations
Participation type	Different city administration units, individual citizens, schools, private companies	City administrations
Organiser	City administration as part of the organizer (in cooperation with other actors such as NGOs, private companies, etc.)	Federal governments, city networks, associations

Level of competition	Often rather playful character, focus on learning	Comparison and rankings between different cities
Process	Often (short-term) project-like character	Rather structured and institutionalized character
Reward	Recognition, Material prizes, financial participation in monetary savings	Recognition, monetary awards
Examples	Project fifty/fifty (energy savings at schools), CO2-Fasting-Challenge city of Nuremberg	German sustainability Award (Deutscher Nachhaltigkeitspreis), energy municipality of the month (Energiekommune des Monats)

‘Between city competitions’, taking place between cities on the national or international scale, are the first step of engagement of cities in competitions for sustainable energy. As a consequence of an increasing engagement of city administrations in sustainable energy pathways, in a second phase, cities strive to increase the awareness and engagement of citizens in these pathways. Therefore, ‘within city competitions’ are the second level which were examined for this report. Next to the participating cities, actors involved in organizing competition formats on the city level are national or regional governments and ministries, who implement programs and funding opportunities (e.g. energy consulting for municipalities) to foster local energy transition pathways. Furthermore, city networks like C40², covenant of mayors or ICLEI³ are playing a crucial role in developing these formats as their role is to offer peer-to-peer learning possibilities and comparison between cities (Frantzeskaki 2019; Smeds 2019). In addition, private companies are engaged in these competitions, e.g. as sponsors (see interview DE_CLC_7). In many cases, also research partners are involved as partners in competitions. Researchers are e.g. deciding on the winners. Therefore, new indicators are being developed which allow for measuring the success of cities in the SIE-field of sustainable energy pathways. Such indicators, on the one hand are measurable numbers such as the amount of renewable energies consumed by municipal properties or the amount of CO2 emissions reduced through local saving measures. On the other hand, indicators also include the self-evaluation of municipalities, their commitment towards the United Nations’ Sustainable Development Goals

² “C40 is a network of the world’s megacities committed to addressing climate change. C40 supports cities to collaborate effectively, share knowledge and drive meaningful, measurable and sustainable action on climate change”; See: <https://www.c40.org/>

³ “ICLEI – Local Governments for Sustainability is a global network of more than 1,750 local and regional governments committed to sustainable urban development.”; see: <https://iclei.org/en/Home.html>

(SDGs) (see Interview DE_CLC_7).

'Outside' institutional environment shaping the development of the SIE-field

SONNET looks at the interactions and relations between actors, working on a SIE and a broader institutional context in which the SIE is nested in (Wittmayer et al. 2020b, p. 7). An empirical focus lies on the development of SIE-fields. Following Fligstein and Adam's field definition (Fligstein and McAdam 2011), an SIE-field within the SONNET project is understood as 'an arena/space that includes a specific SIE as well as SIE-field-actors working on it and other field-actors enabling and/or impeding it. In this space these actors take one another and their actions into account and have a shared (but not necessarily consensual) understanding of a SIE and of their relationship to other actors. They recognise (but not necessarily follow) shared norms, beliefs and rules. SIE-fields are often not homogenous but are composed of actors with diverse and contradictory aims and interests' (Hielscher et al. 2020, p. 17). While the SIE-field is constituted by SIE-actors and SIE-field-actors' activities, it is also influenced by the outside institutional environment, which can interact, shape, enable or impede the development of the SIE. This institutional environment is constituted by formal as well as informal institutions (Hielscher et al. 2020, p. 19).

The SIE-field development of 'city level competitions' for sustainable energy is embedded in the institutional structures of city administrations and their role in the federal system in Germany. Therefore, while the actors involved in developing new formats of city level competitions for sustainable energy are changing, this change happens embedded in existing institutional structures such as administrative arrangements with its specific organizational and financial conditions. This can be an impeding factor when it comes to different organizational units within the city administration, which have to work together on developing and implementing new energy related formats and pathways. It can however also be an enabling factor because municipal self-government allows for flexibility in finding local solutions. Competition formats that take place within the city are therefore often purposefully addressing administrative structures. They are trying to encourage processes of cooperation to overcome 'silo thinking' and motivate for new forms of learning between different city administration actors as well as between city administration and civil society (see Interview DE_CLC_6).

Furthermore, interviewees point out that the development of competition formats is often taking place in specific actor-arrangements, which are influenced by certain institutional structures. One

interviewee describes this as 'danger of falling into a filter bubble' of institutionally well-recognized actors who use competitions to 'showcase' their engagement (see interview DE_CLC_4). This means, that actors who engage in competition formats and contribute to shaping these formats are already well-established actors. These actors are in power to formulate indicators or to showcase their achievements. When looking at the social innovative character of competition formats, this raises the question how 'open' these formats actually are for change. Existing power relationships might rather be reproduced than changed, e.g. by formulating indicators for 'good' pathways. As one interviewee mentions: most of the municipalities that are successful in competition formats between cities are located in western Germany while eastern German cities are still dealing with structurally less advantaged situations. This is however not taken into account sufficiently in indicators that serve to measure and rank different participating municipalities (see Interview DE_CLC_7).

Ongoing changes in the outside institutional environment concern e.g. the emergence of novel forms of collaborations between political, private and scientific actors which are encouraged through competition formats (see Interview DE_CLC_4). This is the case, when foundations, research institutes, private companies and federal ministries are joining forces to promote best practice examples – as it is the case in terms of the German sustainability award (Deutscher Nachhaltigkeitspreis). The institutional environment shaping the development of the SIE-field is therefore described by some interviewees as entanglement between top-down and bottom-up processes, meaning that different government levels (municipalities on the local level and ministries and governments on the national and state level) are interacting (see Interview DE_CLC_7).

Overall, the SIE-field is characterized by the actor's ambitions to promote and mainstream sustainable pathways, which are not limited to but include energy related changes. The main narrative of the field particularly refers to the growing responsibility of individual actors to engage in sustainable energy activities to overcome the slow progress in this field. Cities administrations are taking up this responsibility by developing energy related goals on the local level and competing for resources for and recognition of their activities. However, in order to reach local energy related targets, city administrations are forced to develop communicative formats, reach out to citizens and include them in this process. (Playful) competitions are one way to make the subject more attractive, raise awareness and mainstream engagement in sustainable energy pathways.

Diversity, contestations and relations between actors

SONNET is interested in understanding interactions between SIE-field-actors and/ or other field-actors. These relations can be formal or informal, take different forms (e.g. formal alliances, networks, collaborations) and might differ in their quality (e.g. conflicting, competitive, collaborative or exchange-oriented relations; Wittmayer et al. 2020b, p. 14) as well as in their content (e.g. concentrating on learning, networking, lobbying etc.). Furthermore, SIE-field contestations between SIE-field-actors and/ or other field-actors are of interest as they can 'unsettle' the existing 'outside' institutional environment (Hielscher et al. 2020, p. 19). Contestations are debates among relevant actors over SIE-field structures and processes such as disagreements about common aims or approaches to lobbying policymakers. Both, contestations and relations can provide an indication of how institutionalised (or not) the SIE-field is (e.g. are there formal networks).

The SIE-field 'city level competitions for sustainable energy' consists of quite heterogeneous actor groups such as city administrations, city networks, civil society actors, private businesses and their funding partners. The relationships between the participating actors thereby highly varies, depending on the form of competition. While competitions can facilitate knowledge sharing between cities, they often take a more competitive character, with each city seeking recognition and funding (see Interview DE_CLC_4). What characterizes these formats is the aim as well as the difficulty to create comparability and measurability between participating city administrations. These competition formats are strongly formalized and often organized by federal ministries or NGOs operating on the national or international level. This means that also the relation between SIE-actors and SIE-field actors are characterized by formalized application processes and professional roles. In contrast, competitions within cities are rather characterized by cooperation and the aim for shared learning between SIE-actors and SIE-field actors. This formats target a more personal involvement and commitment and are therefore less formal in character. Helping each other is considered an important part of the competition (see Interview DE_CLC_5). Awards in this case serve as incentives but are less relevant than in competitions between cities.

The SIE might help to overcome contestations within cities, especially between different administrative units. In the case of competitions between cities, these units are forced to closely work together in order to participate in competitions or apply for awards (see interview DE_CLC_4). Overall, the SIE-field development is not very strongly characterized by formal contestation. It rather

encourages knowledge exchanges through best practice examples. Different interests rather increase the diversification of the field, meaning that different formats are being developed and explored in different cities which then exist next to each other.

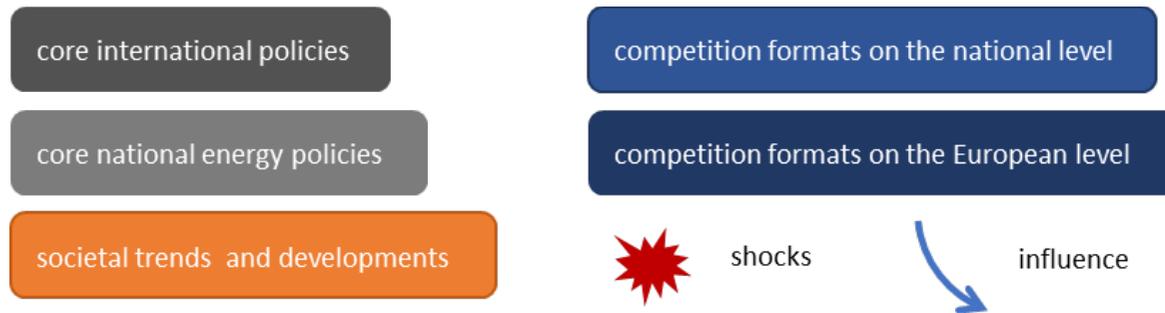
For this case study, we interviewed members of city administrations, city networks and game developers. Concerning competition formats between cities, we exemplarily studied the German sustainability award (Deutscher Nachhaltigkeitspreis), established in 2013, which honours 'pioneers of sustainability' in Germany and aims for motivating key players 'to change, to network [...] and to encourage partnerships' (internal document Deutscher Nachhaltigkeitspreis). As example of competition formats taking place within cities, we investigated the Climathon competition which first took place in 2015. In a one-day event, a Climathon aims for developing (technical) solutions for solving pre-defined local problems (challenges) in the context of climate change. The competition is part of a broader European initiative. It is however carried out by a local associate in close cooperation with the local city administration (first event in the city under study in 2019).

The innovation history outlined in this report is structured around three phases:

- **PHASE A)** describes the early phase of SIE-field development in the beginning of the 2000s and includes the years 2000 until 2007. This phase is characterized by the overall societal trend of resignation concerning the lack of political engagement for energy related issues and overall climate protection goals. City level competitions for sustainable energy during this phase occur rather as single activities than as an emerging SIE-field. This however changes around the year 2007.
- **PHASE B)** describes the emergence of new formats of city level competitions for sustainable energy between 2007 and 2015. This happened against the background of a new sense of responsibility towards environmental issues and the aim of civil society actors as well as local policy actors to raise attention towards sustainability. One important milestone for this development was the Leipzig Charta for sustainable development in 2007. Competition formats during this phase are mainly developed by institutionalized actors such as federal ministries or associations operating on a national scale.
- **PHASE C)** describes a time of increased environmental awareness starting in 2015 which is going along with efforts of civil society actors to engage in energy related topics and climate protection activities. Competition formats during this phase start to diffuse to different stakeholder settings. In order to involve a variety of actors in energy and climate protection

related issues, new playful formats are being developed, e.g. by city administrations on the local level.

The following colours and symbols are used to explain the timeline on the next page:



4 Timeline of city level competitions for sustainable energy in Germany

This is a visualisation of the innovation history of participatory incubation and experimentation in Germany. An overview of the listed events can also be found in the Appendix.

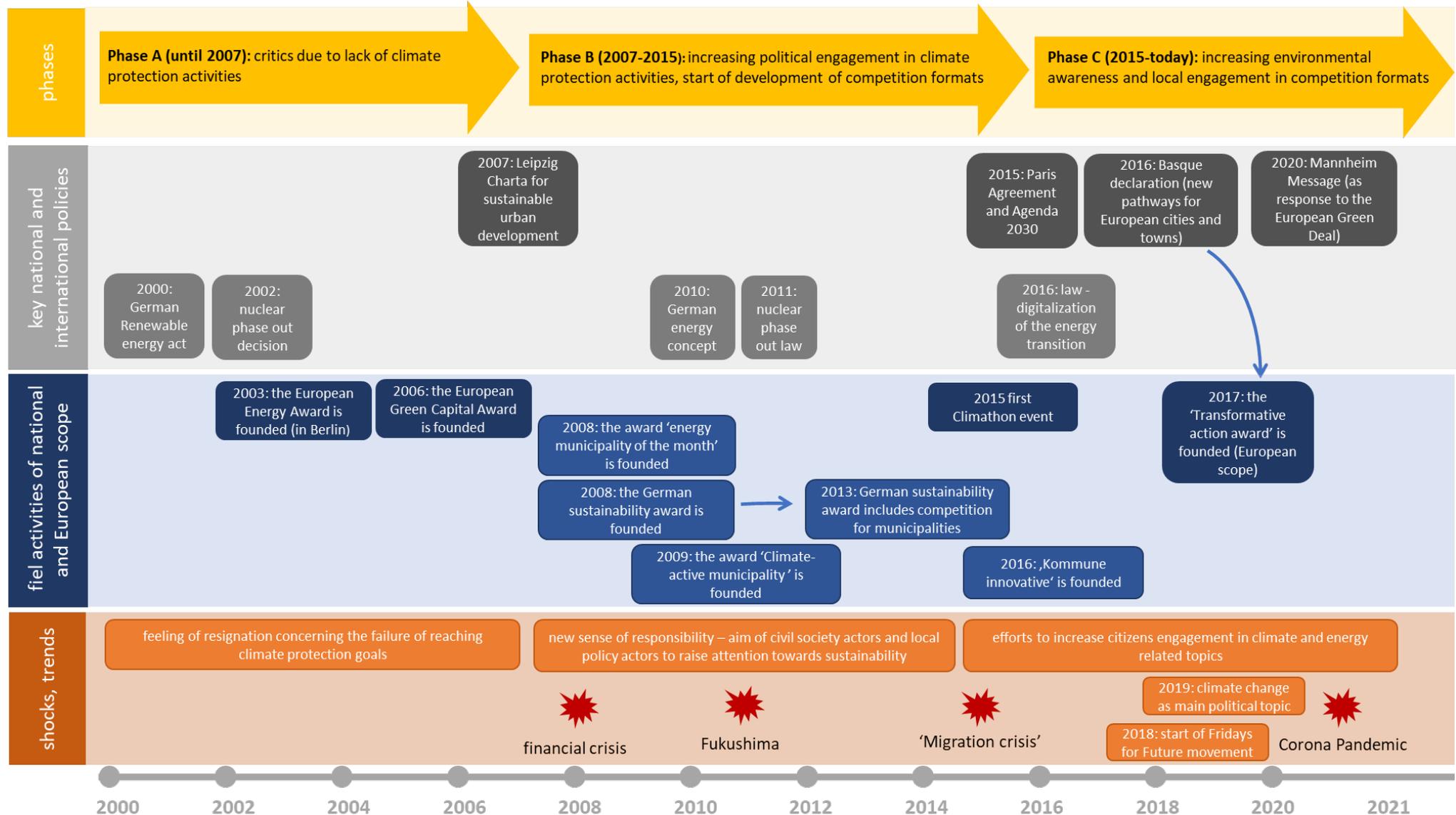


Figure 1: Timeline of City level competitions for sustainable energy in Germany

5 Emergence and development of City-level competitions for sustainable energy in Germany over time

The innovation history of the SIE-field 'City-level competitions for sustainable energy' in Germany is structured around three phases. Before describing these three phases more in detail, we shortly describe the broader contexts and trends, which laid the foundations for the emergence and development of the SIE-field 'City level competitions for sustainable energy' in Germany.

BROADER TRENDS: foundations and contexts of the SIE-field development

Based on the fieldwork and according to academic literature on cities roles in climate protection activities, we identified the following three broader trends that influenced the development of 'City level competitions for sustainable energy' in Germany. First, the changing role of cities in the 'urban century'. Second, the context of the German 'Energiewende' (energy transition) and third, the change in urban development politics in Germany.

Concerning the changing role of cities, this development first derived out of a strong economic focus (Häußermann et al. 2008) leading to a new form of entrepreneurial agency of cities (Harvey 1989). Cities, in the course of this development, started to 'act' or engage in global contexts (Sassen 2001). This post-modern development is described as an decreasing engagement of the nation state, going hand in hand with the increase and strengthening of local responsibilities (Häußermann et al. 2008). In the course of this development, the role of cities moved towards a stronger engagement in climate protection activities. One of the first starting points for this development was the Agenda 21, adopted at the United Nations Conference for Environment and Development in Rio in 1992. It increased the global awareness for the need to take action towards sustainability and identified the local level as key to address activities for sustainable change (United Nations 1992). As Wolfram (2016, p. 4) points out, the new acknowledgement of cities as nodes in global processes is accompanied with a 'broader engagement with the normative concept of sustainability' (Wolfram 2016, p. 4). Cities and local governments are thereby taking new forms of responsibility for global problems (Rode 2019). The transformation into a 'green city' in this context also serves as a form of city branding (Andersson 2016) which leads to a 'new dimension of cities' competitive positioning' (Hodson and Marvin 2010, p. 478).

Looking at the German energy system, the increasing engagement of cities is supported by the aim of decentralizing the energy system. 'Federal states and municipalities' in the course of this attempt, are described as 'new strengthened levels of energy policy' (Agora Energiewende 2017, p. 37).

Decentralization can thereby take different dimensions such as local electricity production and direct delivery as well as energy models and local heating networks (Zuber et al. 2018, p. 6). Furthermore this includes new forms of urban governance (Bulkeley and Kern 2006; Bulkeley and Castán Broto 2013) which especially takes a experimental and project-based form. These governance approaches involve 'competing (discourses) coalitions, and are structured by relations of power and strategic practices' (Bulkeley and Castán Broto 2013, p. 366).

These new forms of experimental and participatory governance are part of the change in the politics of urban planning (Gribat et al. 2017). Approaches are taking project-based and 'festivalized' formats and thereby become rather 'educational'. 'It tries to change ways of thinking and behaviour; it focuses on values, attitudes and mentalities' (Häußermann et al. 2008, p. 260; own translation). Cites, in the course of these developments, are playing 'a crucial role blurring the line between social movements and governments' (Rode 2019, p. 9).

Regulative, normative and/ or cultural cognitive institutions

SONNET draws on Scott's conceptualisation of institutions, which consist of regulative, normative and cultural-cognitive elements (Scott 2014). Regulative institutions include laws, rules, standards and policies while normative institutions describe social norms, duties, and value systems (Wittmayer et al. 2020b, p. 21). The third element is referred to as cultural-cognitive institutions such as shared expectations and common beliefs (Wittmayer et al. 2020b, p. 22). In SONNET, we assume that SIE have the potential to transform existing institutions while they will also maintain parts of existing institutions (Wittmayer et al. 2020b, p. 20). We are therefore interested in understanding existing regulative, normative and cultural-cognitive elements that shape the SIE and its SIE-field.

The formation of city level competitions for sustainable energy is influenced by normative and cultural institutions, such as the changing urban planning approaches and the role of cities in the global context as previously indicated. Regulative institutions such as laws and policies are in the course of the early SIE-field development criticized for their insufficient engagement to prevent climate change. On the other hand – and, in a rather discursive and normative sense – institutions are starting to manifest in political declarations. Especially the Leipzig Charta for sustainable development can be seen as one milestone for activities on the city level. Furthermore, concerning normative institutions, city level competitions for sustainable energies are encouraged by a new

sense of duty and responsibility of civil society actors to get engaged and motivate others to rethink their behaviour and fight the weaker self. Here competition formats, with more playful approaches, purposefully aim for developing scenarios 'outside cognitive routines' (see Interview DE_CLC_1). This means that these (playful) competition formats often target behaviour changes and encourage to change existing behavioural patterns. Concerning cultural institutions, SIE-actors are criticizing the discouraged mood of political actors, the lack of holistic concepts and the strong focus on economic aspects. SIE-actors are therefore pressuring shifts in discourse and aim for motivating others.

PHASE A: foundations for the field development and critical mood in the early 2000s due to insufficient political measures in the area of climate protection activities (2000-2007)

A feeling of frustration and slow progress is often described as the starting point for the development of city competition formats. Interviewees e.g. mention an overall discouraged mood at the beginning of the 2000s: *"The 2000s started out very, very discouraged. Somehow, everyone thought: My God, we have just missed the Millennium Development Goals. How is all of this supposed to continue? Climate change is advancing. We overuse our resources. We experience increasing social problems and so on and so on. It was a very discouraged mood [...]"* (Interview DE_CLC_7). On the city level, especially the slow progress within city administrations and in coordination between different administrative units is described as a key problem: *"Energetic renovation of urban properties can often take years. It's really frustrating. It's just not like in the free economy, it that doesn't happen that quickly. It is really difficult"* (Interview DE_CLC_6). Also civil society actors are claiming that they are missing a clear political goal and therefore describe a discouragement situation: *"I am missing the narrative from above: There is a goal and we know how to achieve it. And we know what measures need to be taken. But it's this mood of, oh, we only do what is absolutely necessary"* (Interview DE_CLC_5).

Out of this overall feeling of political discouragement, civil society initiatives started to develop a new sense of responsibility: *"[...] It was a very discouraged mood. And then some got up and decided: Okay, we have to do something about it now"* (Interview DE_CLC_7). This change led to the development of new competition formats later on. (Playful) competition formats especially target a new sense of motivation in opposite to the resignation described above.

Key changes over time

One of the central research questions and empirical foci within the SONNET case studies is to understand the development of the SIE and its SIE-field over time (Hielscher et al. 2020, pp. 15–18). We therefore take a 'process perspective' and investigate change through focusing on the emergence of the SIE-field and the activities of SIE-actors shaping them (Wittmayer et al. 2020b, p. 33). For example, we look at external shocks, internal field events and key changes in the development of the SIE-field and its relationship with the 'outside' institutional environment (Wittmayer et al. 2020b, pp. 29–30). Moreover, changes in the SIE-field also concern changed narratives and societal trends that enable or impede the development of the SIE and its SIE-field.

In the key of the SIE-field 'city level competitions for renewable energy', we observed two key changes over time. As a more recent influence on the SIE-field development, several interviewees named the 'Fridays for Future' movement as an important cause of change. This is especially the case because 'Fridays for Future' triggered a new sense of individual responsibility and new pressure on topics around sustainable change (see Interview DE_CLC_5 and DE_CLC_7). The social movement is thereby part of a broader socio-cultural institutional shift but also directly caused concrete activities. For one initiative, Fridays for Future was the starting point for getting engaged in a local Climathon competition – a hackathon that aims for developing solutions for climate related problems. The initiative engaged as local organizers of this competition and promoted the format in their city (see Box on page 27). For another initiative, the German sustainability award (Deutscher Nachhaltigkeitspreis), the Fridays for Future movement caused a significantly higher engagement of actors in their competition formats. The willingness of the participating municipalities to invest in activities around sustainable energy since then significantly increased (see interview DE_CLC_7).

Besides the broader development and awareness, focusing on the energy system in Germany, a decentralized approach is supplementing the increasing responsibility of single municipalities to engage in sustainable energy. Municipalities are engaging in different ways in energy transitions, however, the engagement in the context of competition, games and awards takes a highly project-based form. Changes thereby happens in phases, structured by different temporal limited projects (see interview DE_CLC_6). Even if competitions for sustainable energy are part of this development, they however do not play a major role in this broader process of change.

PHASE B: increasing political engagement in climate protection activities and start of the development of new city-level competition formats (2007-2015)

The 'vacuum situation' of lacking political engagement in climate protection activities, as described above, serves as starting point for different forms of engagement by individual actors. The local level (e.g. local governments) thereby plays a crucial role. Since the Agenda 21 in 1992, there is an increasing focus on local governments to address sustainability related activities. One further milestone in this process is the Leipzig Charta on Sustainable European Cities in 2007. This initiative by the ministers responsible for urban development in the EU Member States highlighted the role of local engagement for sustainability and the role of knowledge exchange in and between cities (BMU 2007). After 2007, also new formats emerged that aimed for encouraging cities engagement in sustainable energy. The focus of formats in this phase first of all is to encourage competitions between cities. In competitions between cities, cities are acting as participants where they promote their local sustainable energy pathways and compete for recognition and financial support. These competitions can take place on the national level such as in the case of the German Sustainability Award (Deutscher Nachhaltigkeitspreis)⁴ or in the case of the award climate active municipality (Klimaaktive Kommune)⁵. However, competitions are also taking place between cities on the European level such as the European Green Capital Award⁶ or the Transformative Action Award⁷.

These awards might largely differ in their organizational structures, their degree of formalization and stakeholders involved. As an example, the award 'Energie-Kommune des Monats' (energy-municipality of the month) is organized by the German wide operating 'renewable energy agency' (Agentur für erneuerbare Energien). This award is directed to municipalities with a high engagement in renewable energies, e.g. through investments in energy production or the development of local energy concepts. The award helps to gain recognition and identify best-practice examples. However, the event is not embedded in a larger event or a broader network of stakeholders. In contrast, the German sustainability award (Deutscher Nachhaltigkeitspreis) is organized by a large amount of cooperating partners. These partners include among others research institutes like the Wuppertal

⁴ organized by the foundation 'Stiftung Deutscher Nachhaltigkeitspreis e.V.' in cooperation with a large number of different institutions as well as federal ministries; see <https://www.nachhaltigkeitspreis.de/en/>

⁵ Organized by the German Federal ministry for the Environment, Nature Conservation and Nuclear Safety in cooperation with the German institute of Urban Affairs (difu); See: <https://www.klimaschutz.de/wettbewerb2009-2019>

⁶ Organized by the EU commission; see: <https://ec.europa.eu/environment/europeangreencapital/>

⁷ Co-organized by ICLEI – Local Governments for Sustainability, the Basque Country, the City of Aalborg, supported by the European Committee of the Regions and the European Investment Bank; see: <https://sustainablecities.eu/transformative-action-award/>

institute or the German institute for urban Affairs, which help developing indicators and designing the process of selecting winners. Further partners such as federal ministries or private business are involved as supporting partners which increases the amount of stakeholders involved in the process. Participating successfully in the competition therefore guarantees greater visibility and recognition – not only from other cities but also within the city. As one of the interviewees describes it: “*We often get the feedback from cities where they say that like, lots of citizens in our city weren't really fully aware of what we were doing, but then we won this award. And then there were like hundreds of news articles looking at our work. And it opened up a new conversation in this city*” (Interview DE_CLC_4)

Introduction to the initiative ‘Deutscher Nachhaltigkeitspreis’

In 2008, lawyer and journalist Stefan Schulze-Hausmann founded the foundation ‘German Sustainability Award’, which since then organizes the German sustainability Award. The award honours ‘*pioneers of sustainability and aims for motivating key players ‘to change, to network [...] and to encourage partnership’* (see: <https://www.nachhaltigkeitspreis.de/en/dnp/award/>). The foundation organizes different competitions for different stakeholder groups, such as competitions for design, architecture, Start-ups etc. Since 2013, also a competition for municipalities is organized. In the course of this case study, we only observed the competition for municipalities, which is organized by the foundation in close cooperation with partners from the field of research, federal ministries and private companies. The winning municipalities are selected in a twostep application process, which includes a questionnaire and self-evaluation of the participants in the first step and personal interviews with city administrations in the second step. Municipalities in three different categories, according to the size of the municipality, can win up to 30.000 € which can be invested for further projects in the field of sustainable activities. The award is presented at a festive award ceremony. This is considered as a glamorous event that offers good visibility and recognition to the winners.

Competitions between cities are mainly aiming to create comparability between cities, which position themselves in concurrence to each other. Therefore, competitions between cities require to develop indicators, which allow for comparison ‘such as green space, green entrepreneurs, consumption, waste, chemicals, transports and biodiversity’ (Andersson 2016). In the context of the German Sustainability Award, energy related indicators are included in terms of the investments in

renewable energy production and the measurement of carbon emissions (see interview DE_CLC_7). In the course of the development of competition formats and cities engagement in sustainability transitions, these indicators are however changing. As one interviewee describes it: *"This is a trend that I am watching. That we are increasingly moving away from saying: Show us the great structures that you have created. But rather move in the direction of saying: Show, what you have really already implemented and provide facts and figures about that. More in the direction of monitoring and not just about creating structures."* (Interview DE_CLC_7). While it was sufficient in earlier competitions to award city administrations for their intentions and political goals to engage in sustainable energy pathways, activities now have to be measurable in a way that they can be proved with facts and figures.

Besides the competitive element, award ceremonies and competition events also serve as networking platforms, where *"a lot of people who wouldn't meet otherwise"* (Interview DE_CLC_4) are getting together. Competitions between cities also allow for a shared sense of responsibility, shared learning and networking insofar as cities *"inspire one another"* and are *"very much guided by other cities and what they've done in the past"* (Interview DE_CLC_4). Participating in competition formats or awards brings recognition on the national or even international level: *"The activities themselves are local activities [...]. But then through participating in the award, [cities] gain European recognition"* (interview DE_CLC_4).

Policies and policy making

One important cross-cutting theme addressed in SONNET are the socio-political aspects and conditions of social innovation in energy. In SONNET, we are particularly interested in identifying enabling or impeding factors and how they influence social innovation processes. This case study therefore aims for identifying important policy events and policy making processes (Wittmayer et al. 2020b, p. 43). This includes asking about broader political debates, the role of different government levels involved in policymaking, particular policy strategies and instruments used and how they enable or impede the development of SIEs.

Cities are increasingly developing policy goals that target change towards sustainability. Competitions thereby serve as a way to promote these targets and encourage engagement, knowledge exchange and best practice learning. Competitions between cities, supported by national ministries and national associations especially highlight best practices. Thereby, they do

however also contribute to developing indicators and standards. E.g. the local production on renewable energies might be compared but also the implementation of local policies is part of the assessment, e.g. whether the municipality develop local energy and climate protection concepts. In competitions within cities, the focus is mainly on locally promoting pathways for renewable energies. Citizens might be encourage to and reward for taking their bikes to work and dispense their car for a certain time (see city of Mannheim; <https://www.klima-ma.de/spardirdeinauto.html>) or to save energy in schools (see project fifty/fifty; <https://www.fifty-fifty.eu/>).

Some interviewees state however, that policy goals and regulations are not strong enough linked to each other. City administrations would e.g. favour stricter regulations, e.g. when it comes to standards on energy efficient buildings (see Interview DE_CLC_6). Because these regulations are often missing, local administrations are under pressure to open up new fields of activities and reach sustainability targets by increasing the awareness and encourage local stakeholders to support transition pathways voluntarily. Overall, competitions fulfil a reverse function when policymakers use these formats to search for new instruments or transfer responsibilities to civil society actors.

What furthermore characterizes competitions between cities is that they are in many cases strongly embedded in and supported by existing institutional structures and organized in close cooperation with state actors (such as federal ministries). Also research institutes (e.g. German Institute of Urban Affairs which organizes the award Klimaaktive Kommune) and city networks or intermediary organizations (e.g. ICLEI – Local Governments for Sustainability) are involved as organizers. This, however might also contribute to reproducing existing power relations by these formats rather than transformed. Interviewees e.g. mention an existing gap between municipalities' engagement in competition formats between the municipalities located in former eastern German states and western German states (see Interview DE_CLC_7). Competitive cities might therefore still increase their recognition through winning awards while less competitive cities feel discouraged to participate. One interviewee describes the situation as follows: "*These kind of smaller cities that you perhaps wouldn't have heard of [...] perhaps wouldn't necessarily see themselves competing against these larger players that are kind of well known within the sustainability field.*" (Interview DE_CLC_4).

Power and power relations (power to + power over + power with)

Shifting power relations is often considered as an important aspect, which defines social innovation processes (Wittmayer et al. 2020b, p. 47). The term 'power' thereby refers to actors capacities to mobilise resources and institutions (Avelino 2017). In the context of this case study, we aim for analysing which power relations are enabling or impeding SIEs and how they do so (Wittmayer et al. 2020b, p. 48). It is important to distinguish between different types of power. Actors might have power to, for example, to do certain things and push their interests (e.g. political power, economic power, innovative power), power over others or power with other to achieve collective goals (Wittmayer et al. 2020b, p. 48).

As described above (see analytical box: SIE changing social relations), city level competitions for sustainable energy change social relations insofar, as they aim for encouraging different stakeholder groups such as citizens, different administrative units or private business to engage in energy transitions on the local level. However, the shaping of competition formats and the decision about the 'rules of the game' (**power over**) do take place within existing structures and power relations, e.g. inside the academic 'filter bubble' as described by one interviewee (see interview DE_CLC_4). This is described as participation-dilemma, when seemingly open formats rather reproduce existing power relations between top-down decision makers and the bottom-up initiatives participating in competitions, which are then judged according to these criteria or when municipalities in the eastern parts of Germany are represented less in competitions.

Even if competition formats are encouraging the development of new ideas and the engagement of different stakeholders (**power with**), the adaption of new ideas still strongly depends on political will and government support (see interview DE_CLC_4). An example for this is the Hackathon event Climathon. It aims for developing ideas for concrete problems related to climate change on the local level. The implementation of these ideas (such as local platforms to organize bike-sharing, or to measure energy consumption in local buildings or many more) however depends on formal policy-makers to decide over them and implement concrete activities (**power to**).

During this phase between 2007 and 2015, competition formats such as the German Sustainability award (Deutscher Nachhaltigkeitspreis) or the award 'climate-active municipality' (klimaaktive Kommune) are institutionalizing as important and relatively well-recognized yearly events. They challenge cities' engagement in transitions towards sustainable energy systems and thereby contribute to re-structuring inner-administrational processes. Climate activities (just as application processes for competitions between cities) require cooperation between cities' different

administrational units. Out of the need to encourage the cooperation between different inner-city apartments, competitions within city administrations are developing during the following years.

PHASE C: increasing citizen engagement in local energy transitions and development of competition formats within cities (2015-today)

With the German energy concept and the nuclear phase out decision after the Fukushima nuclear catastrophe, the years 2010 and 2011 mark a milestone for the German energy transition. Energy moved further into focus of policy agendas – on the national level as well as the local level. Linked to the nuclear phase out and the promotion of renewable energies, the local level further gained importance in the course of attempts to decentralize the energy system (Agora Energiewende 2017). Not least since the Fridays for Future movement started off in 2018, the power of citizens engagement in climate protection and sustainability transitions got visible. As one interviewee describes the situation: *“You have the feeling that there is currently really pressure on the topic. Also through the Fridays for Future movement. [...] A lot is happening there at the moment.”* (Interview DE_CLC_7).

As a consequence cities are increasingly under pressure to find new and innovative ways of addressing change in the energy system on the local level. Therefore, it is crucial for local governments to involve and motivate local stakeholders (such as city administration employees of different departments, companies, local and civil society initiatives, residents or more broadly speaking: local citizens) to get engaged in energy related activities. Playful competitions formats such as hackathons, energy saving competitions, board games or digital applications allow citizens to engage in energy related topics in an entertaining way, which makes the topic more fun. Even if energy related matters are presented in a more subtle way, competitions within cities still allow for shared learning and encourage awareness raising. The main actors involved in these activities are city administration (as organizers of competitions but also as target group and role model for inner-city change process), local civil society initiatives, citizens and companies as partners and sponsors in competitions.

One example for this development is the competition format Climathon that first took place in 2015 and was an initiative of the European Institute of Innovation and Technology (EIT) and its Knowledge and Innovation community for climate action (Climate-KIC). It introduces a Hackathon format – in which participant collaboratively work on ‘challenges’ related to hardware or software development – to the context of action against climate change. These activities are quite strongly linked to local contexts. Climathons are carried out locally in cities and organized by the local city administration in cooperation with other partners such as universities, associations, local companies and so on.

Introduction to the 'Climathon' competition, organized locally in Mannheim by the association 'Hackerstolz e.V.'

Climathon is a hackathon (a collaborative software and hardware development event) for problems related to climate change. It is an open format initiated by the European Institute of Innovation and Technology (EIT) and its Knowledge and Innovation community for climate action (Climate-KIC). The aim behind the development of this competition format is to develop (technical) solutions for solving pre-defined problems (challenges) in the context of climate change. In a one-day event, teams that consists of actors from different disciplines and backgrounds (such is informatics, experts in the field of sustainability and designers) work jointly together on developing an idea that helps to solve the challenge. The event takes place globally, in different cities around the world on the same day. However, each event is organized by a local organizing team which works closely together with the local city administration as well as with other stakeholders such as private companies and volunteers who participate in the event. The overall aim of the event is that 'together, cities and their citizens are forming a global wave of change-makers (see brochure Climathon).

For this report, we studied one local organizing initiative – the registered association Hackerstolz with about 100 members – that organized a Climathon event in Mannheim in 2019. The overall aim of the association is to support digital culture and does so, e.g. by organizing hackathons which are not limited to topics related to renewable energies. However, when a larger amount of members got engaged in sustainability debates, the association decided to organize a local Climathon event together with the City of Mannheim. During an 40 hour event, 16 local teams developed prototypes of (digital) solutions for sustainability related challenges. One energy related challenge was e.g. formulated as follows: "How quickly can power generation by rooftop solar panels be doubled?". As a result of the competition, the winning team can get support for developing their idea or found a start-up.

In contrast to competitions between cities, on the inner-city level, competitions are rather characterized by a cooperative and playful mood than by competitiveness between participants. Overall, they are described as an occasion to bring different actors together, create a sense of togetherness and stimulate learning (see Interview DE_CLC_5). Here the event is in focus, rather than the aim to win something and awards mainly serve as incentives to engage in the event. Social

relations are thereby changed by actively trying to include actors, which were formerly not part of energy discourses, e.g. by developing formats especially for schools, city administration employees or start-ups. Furthermore, the relations between city administration and citizens change in a way, that these formats allow for a new entanglement between governments and civil society actors (see Interview DE_CLC_7). While cities are experience a new form of responsibility, citizens develop a new form of confidence to engage in political questions and claim their right to have a say.

Institutional work conducted by SIE-field actors and other field-actors

SONNET investigates how SIE-initiatives, SIE-field-actors and other field-actors 'perform institutional work – meaning they engage in creating, maintaining and transforming institutions to be able to work on, enable and/or impede SIE developments' (Hielscher et al. 2020, p. 20). This analytical focus emphasises that institutional changes are actively influenced by actors within the SIE-field (Wittmayer et al. 2020b, p. 31). The term 'institutional work' refers to these activities of creating, maintaining and transforming institutions and can include diverse types of institutional work, such as material, relational and symbolic work. Examples might be attempts to influence policy makers or the general public through lobbying activities or to influence informal institutions such as norms and values.

City administrations, associations, civil society actors engaged in the SIE-field of 'city level competitions for sustainable energy' are working towards transforming institutions by developing and testing new scenarios in playful competition formats, which allow for thinking 'out of the box' (see interview DE_CLC_1). Fun formats are encouraging engagement and promoting change in a motivational way. Competition formats furthermore are allowing for dialogues between different stakeholder groups. The formats developed by SIE-actors are aiming for taking the topic of sustainable energy out of the niche, making it 'glamorous' and therefore allow for mainstreaming it (see interview DE_CLC_4). The focus of institutional work within the SIE-field under study therefore lies in activities of relational work like networking and knowledge exchange: In many cases, participating in a city-to-city competition requires new forms of cooperation on the inner-city level. Competitions serve as networking platforms, connect projects and people and inspire learning. Furthermore, participating in a competition allows for transforming the self-perception of cities. City administrations start perceiving themselves in role models and thereby also conduct symbolic institutional work, meaning that they contribute to shaping new discourses about cities

abilities to react to climate change or reframe the relationship between city administrations and citizens.

In developing new formats such as hackathons or energy saving competitions, cities are however well aware of the need to address different groups of stakeholder in more targeted formats (see Interview DE_CLC_7). Especially the slow changes in inner-city administration processes and the functioning as a role model requires involving city administration employees as a stakeholders in urban energy transitions. Energy savings, especially in in municipal properties, often date back to a lack of attention, responsibilities and incentives to encourage energy savings (Böhm et al. 2019). Furthermore, many municipalities have still not yet installed energy management systems which allow for a detailed measurement of energy consumption and show saving possibilities (see Interview DE_CLC_6). Against this background, inner-administration competitions are one way to reach out to 'hard to reach' stakeholders, who are not intrinsically motivated to engage in energy related subjects and therefore can't be reached with 'pure information' (See Interview DE_CLC_7). These competitions are part of information campaigns and aim for awareness raising as well as recognition for successful project.

The experiences of the SIE-actors indicate, that competition formats are often supported by local actors such as companies, volunteers and city administration actors: *"When we look back, we were very pleasantly surprised at how well our project was received. We got a lot of support, not only from volunteers, but also on the financial side from sponsors."* (Interview DE_CLC_5). While competitions on the city level in Germany are so far rarely taking the form of games or gamified apps, some formats by start-ups, association or local businesses are starting to explore diverse formats which aim for promoting sustainable energy as a 'fun topic' and thereby also inspire cities. E.g. the start-up 'Pitch your Green idea' developed a board game which allows to learn about sustainable organizational change process and especially stresses the importance of the fun-aspect: *"This aspect of fun is very important. It promotes learning processes and generates ideas"* (see Interview DE_CLC_1).

So far, digital competition formats are not very far diffused as competition formats on the city level and city administrations so far don't recognize themselves as the drivers of the development in the direction of gamified digital competition formats. Here, city administrations rather depend on the cooperation with start-ups and research institutes to pick up these developments. Looking at the further development of competition formats, it is likely that these pathways will play a stronger role in the future (see interview DE_CLC_2).

6 Summary, synthesis and conclusions

To conclude this report, the following section summarizes the key findings in relation to the three central research questions:

How do SIEs and SIE-fields emerge, develop and institutionalise over time?

Competitive formats between cities first emerged out of the increasing sense of responsibility of city administrations to push sustainable change. With the Agenda 21 and later, in 2007, the Leipzig Charter for sustainable urban development, the local level and especially cities were identified as important arenas to address sustainability targets. National or European associations started to develop competition formats directed towards city administrations in order to promote best practice examples. In the following years, this trend also inspired competition formats within cities, carried out by local administrations. These formats are developed to make the topic more attractive to a broader audience and include citizens.

It is however noteworthy to mention, that the SIE-field of 'city level competitions for sustainable energy' is still a highly heterogeneous and fragmented field in Germany. It consists of a larger variety of different actors such as city administrations, civil society actors, associations or private businesses. Overall, the SIE-field is not very strongly institutionalized in the sense, that actors work together to reach joint goals. However, the SIE-field is embedded in stronger administrative structures that shape the outside institutional environment. This especially concerns the positioning of cities in the federal system and their ability as well as pressure to engage in transitions towards more sustainable energy systems. City administration actors are connected to clear roles and positions from where they act on the behalf of 'their city'. Therefore, it is easier for SIE-field actors to recognize each other. As the member of a city networks, involved in organizing competitions on the national level, describes it: *"If you're long enough in that business, you know the usual suspects, you know who might apply and who might get nominated"* (Interview DE_CLC_4). It is, however, hard to draw clear boundaries between the institutional structures (formed e.g. by intermediary actors such as city networks and national or European funding programs) around city networks and the specific formats of city-level competitions. This is especially the case because city-level competitions are rather recognized as one aspect of a broader activities carried out by municipalities and does not necessarily stand on its own (yet).

How do SIE-field-actors and other field-actors interact with the 'outside' institutional environment and thereby co-shape the SIE-field over time?

As the SIE-field under study focuses on competition formats related to city actors, the SIE is by definition strongly embedded in existing structures of city administrations. In Germany, these structures are characterized by the German federal political systems that forms formal institutions, which shape the outside institutional environment of the SIE-field under study.

In some cases, this situation is described as an 'institutional bubble', meaning that it consists of actors who work along the institutional logics of e.g. of city administrations (often also referred to as 'silo thinking' in different administrative units). This rather reproduces existing power relationships than changing them. Competition formats are directly addressing the need to change social relations and include new 'players in the game'. In competitions between cities, these 'new players' are cities that just started developing activities in the field on sustainable energy transitions. In competition formats within cities, especially reaching a broader audience and encourage citizens to engage in sustainable energy transitions is in focus. The changing role of cities thereby also encourages the development of new competition formats (such as digital platforms, competitions that are carried out on social media, awards for certain activities). The situation can therefore be described as entanglement between top-down and bottom-up processes, meaning that competitions encourage exchange between (local) governments and (local) initiatives.

What are the enabling and impeding factors for SIE-field-actors and other field-actors to conduct institutional work and change the 'outside' institutional environment?

The main aspect of institutional work conducted by SIE-field-actors and other field-actors is their relational working that consists of networking and knowledge exchange. By taking part in competitions or organizing competitions, city administrations are gaining insights in best-practice activities and interact with other field-actors.

Technical as well as social factors are impeding the work of SIE-field-actors. Concerning technical aspects, mainly the lack of smart energy infrastructures, which allow for real-time energy measurement lowers the possibilities to develop energy targeted competitions. Competition formats so far are taking broader approaches, where energy in many cases is one topic among others. Concerning social aspects, some target groups are hard to reach and involve in energy related topics. City-administrations are often concerned with a strong 'silo thinking' and slow process of change. This makes it hard to encourage change within the city administration. Even if competitions are addressing this difficulty with playful formats, the engagement is sometimes rather low. Furthermore, for citizens, energy related questions feel quite technical and abstract, which makes it harder to engage them in energy related competitions.

Enabling factors influence the SIE-field under study on a local and on a global level: On the local level, supporting local partners and network relationships are often a major factor to establish the SIE locally. Here, the cooperation between city actors and local initiatives are often the key for encouraging change. On the global level, the changing discourse around the role of cities and their responsibility in developing sustainable pathways encourages the engagement in energy related competitions.

7 Recommendations for our city partners, national and EU policy makers and SIE practitioners

From the findings outlined above, the following recommendations can be given to practitioners, cities, policy-makers on the national and EU-level

SIE practitioners

- Cooperate: Looking out for possibly partners can provide funding as well as knowledge exchange. Look out for partners, which support your idea and increase your visibility.
- Put ideas into practice: While many competitions aim for collecting new ideas for energy related problems, it is often harder to implement them in practice. When developing your competition, make sure that you have resources to follow up these ideas and put them into practice.

SONNET city partners

- Measure energy behaviour: Energy measurements and energy management systems are the basis to know in which sectors or properties the involvement of users is most efficient. This allows to target more explicitly topics that can be addressed in competition formats.
- Visualize energy behaviour: Competitions are much more attractive when success gets visible. Visualizing (real-time) energy behaviour can therefore be a big motivating factor in energy saving campaigns, especially in non-residential where users can't visualize their energy consumption on the electricity bill.
- Create incentives which are really attractive: When involving target groups, think about which incentives are really attractive for this group of people. Here different groups might be addressed differently. Consider reducing the number of competitions to an amount, in which you really can and want to invest your time and resources.

National and EU policy makers

- Engage in developing narratives: While it is necessary to develop clear energy related goals, energy pathways should also include a narrative about the role of local actors in shaping change. This should not be understood in a way that socially innovative actors are filling a gap of missing engagement but involve a sense of cooperation between stakeholders from different levels.

- Think integrated about decentralization: The progressing decentralization of the energy system not only requires decentral energy production facilities. Decentralisation also involves aspects such as citizen energy, local knowledge production and decision-making.

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Wolfram, Marc (2016): The Role of Cities in Sustainability Transitions: New Perspectives for Science and Policy. In Euijune Kim, Brian H. S. Kim (Eds.): Quantitative Regional Economic and Environmental Analysis for Sustainability in Korea, vol. 25. Singapore: Springer Singapore (New Frontiers in Regional Science: Asian Perspectives), pp. 3–22.

Zuber, Fabian; Goldammer, Kathrin; Jacobs, Davin; DALE Germany (2018): Die dezentrale Energiewende in Deutschland im Kontext internationaler Entwicklungen: Statusbericht im

Rahmen des Projekts: Global Initiative for Distributed and Local Energy (DALE) - the German Perspective.

9 Annex

Methodology:

Due to the heterogeneous character of the field, the case study followed an explorative approach and aimed for exploring the most relevant SIE-actors and SIE-field actors as well as the diversity of the SIE-field. Especially the attempt to include digital competition formats taking place on the city level was not possible. An early interview with a researcher who previously worked on games design showed that gamified competitions so far are hardly taking place on the city level in Germany because city administrations in many cases are lagging behind in terms of digitalizing systems. The few existing examples took place in the course of research projects, however, none of them developed an app in German language which made it impossible to relate the findings to the national context. We focused on the two levels of competitions within and between cities.

Following the explorative approach, the studied initiatives depict the heterogeneous character of the SIE-field were selected in their contrast to each other. Two early interviews, one with the member of a city administration and one with the member of a city network, offered the contacts to SIE-initiatives, which were interviewed in the next step. One difficulty thereby was to identify initiatives with a specific energy related focus as the activities in the SIE-field are taking place in a broader context of sustainability. Time constrictions complicated follow-up interviews with other members of the already interviewed initiatives. Document research and the collection of empirical interview data took place in a parallel process with the early interviews influencing the direction of the research. The reviewed primary source documents mainly related to the initiatives under study while secondary literature complemented the city approach with studies on urban sustainability transitions. These documents were selected in order to deepen the information on different initiatives and followed a snowballing processes that followed the selection process of relevant interviewees.

Interview recordings were transcribed, using the automatic transcription service offered by Nvivo and coded with the Nvivo coding software. We therefore used a deductive coding process, which allows for cross-country analysis. The data was reflected against the theoretical background of the SONNET projects and studies on urban sustainability transitions. Next to the tight timeframe of the study, one major limit was the lack of possibilities to personally attend meetings and conduct participant observations due to the corona pandemic.

List of interviewees:

Code Interview	Role of interviewee	Date	duration of the interview
DE_CLC_1	Interview with founder of a start-up, which is developing a board game	2020-06-23	51 minutes
DE_CLC_2	Interview with a researcher who previously worked on game development	2020-06-25	Approximatly 40 min (unrecorded)
DE_CLC_3	Interview with member of a city administration	2020-06-26	46 minutes
DE_CLC_4	Interview with two members of a city network	2020-07-01	47 minutes
DE_CLC_5	Interview with local organizer of a competition within a city	2020-07-16	90 minutes
DE_CLC_6	Interview with organizer of a energy saving competition within a city administration	2020-08-05	75 minutes
DE_CLC_7	Interview with project manager of a national wide competition between cities	2020-08-06	63 minutes
DE_CLC_8	Interview with member of a city administration	2020-08-10	96 minutes

Documents reviewed:

Besides the secondary sources listed in the bibliography section, we reviewed the following primary and secondary sources:

Author name	Document name	Document type	Year
Ampatzidou, Cristina; Bouw, Matthijs; van de Klundert, Froukje; Lange, Michiel de; Waal, Martijn de	The hackable city. A research manifesto and design toolkit.	Report	2014
difu	Wettbewerb "Kommunaler Klimaschutz 2015"	Press release	2015
difu	Wettbewerb - Klimaaktive Kommune 2020	Broschure	2020

Stenitzer, Grim	The "European Energy Award" for sustainable communities	Article	2005
Antonia Bartning, Caroline Frumert	Pitch your green idea	Leaflet	unknown
Climate-KIC	Climathon Playbook	Brochure	2020
Climate-KIC	Climathon	Leaflet	unknown
Stiftung Deutscher Nachhaltigkeitspreis e.V.	Vorreiter der Transformation unter Deutschlands Kommunen gesucht	Press release	2020
Stiftung Deutscher Nachhaltigkeitspreis e.V.	Wettbewerb Städte und Gemeinden	Leaflet	2020
City of Mannheim	Aktionsprogramm 2015 „Energie und Klimaschutz“ für Mitarbeiterinnen und Mitarbeiter	Brochure	2015
City of Mannheim	Leitbild Mannheim 2030	Brochure	2019

List of meetings and events attended:

Due to the current corona pandemic, it was impossible to attend meetings personally.

Detailed List of events (Timeline):

PHASE 1: Resignation Rules			
2000s	Trend	frustration of civil society actors about the failing of national state actors in the early 2000ies	Interview DE_CLC_7
2000	Policy event	Renewable Energy Sources Act: generation of renewable electricity encouraged through feed-in-tariffs	(see Agora Energiewende 2015)
2002	Policy event	Decision on nuclear phase out (nuclear consensus)	(see Agora Energiewende 2015)
PHASE 2: A new sense of responsibility			
	Trend	aim of civil society actors and local policy actors to raise attention towards sustainability	
2007	Policy event	Leipzig Charta (on sustainable urban development goals)	(BMU 2007)
2008	SIE-field event	German Sustainability Award is founded	Interview DE_CLC_7
2008	SIE-field event	The award 'Energiekommune des Monats' (energy municipality of the month) is founded (German Institute of Urban Affairs)	Online
2010	Policy event	Energy concept of the German government (for an environmentally friendly, reliable and affordable energy supply)	(BMWi 2010)
2011	Shock	Fukushima nuclear catastrophe	
2011	Policy event	Second nuclear phase out Law	(BGBl 2011 I 43 S. 1704-1705)
2014	Policy event	Renewable Energy Sources Act (EEG 2.0): from specified feed-in tariffs to system of tendering	(BGBl 2014 I 33 S. 1066–1147)

PHASE 3: Fun Formats			
	Trend	Cities are increasingly under pressure to develop formats (e.g. prizes, awards) to engage citizens and provide space for bottom-up Initiatives	
2015	Policy event	Paris Agreement (UN Framework Convention on Climate Change with long-term temperature goal)	
2015	SIE-field event	First <i>Climathon</i> event	Interview DE_CLC_5
2016	SIE-field event	'Kommune innovative' is founded (by FONA – research for sustainable development)	Online
2016	Policy event	Basque declaration (New Pathways for European Cities and Towns)	Online
2016	Policy event	Smart metering and the Energy Transition Digitisation Act	(BGBl 2016 I 43 S. 2034-2064)
2019	Policy event	Climate protection plan 2050 (for the implementation of the Paris Agreement)	(BMU 2016)
2019	Trend	Climate change for the first time as number one political topic	(Agora Energiewende 2020)
2020	SIE-field event	Mannheim Message (as response of Mayors, organisations, and individuals from across Europe to the European Green Deal; it calls for „local authorities to be key partners in the development of Local Green Deals“)	Online