Theorizing energy transition as a social process

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Abstract

Despite the vivid transition debate, we still only partly understand what actually happens in transition processes. The current approaches cannot satisfactorily answer what the interplay between actors and institutions looks like, and we still have a dominance of the national level. This means that we lack a thorough explanation of the 'inner life' of energy transitions.

This paper suggests starting from the small-scale regional level in order to gain in-depth knowledge of the specific processes of interaction that lead to energy transitions. I therefore draw upon transition literature and complement it with insights from institutional theory and the regional innovation systems approach. The resulting concept of regional transition fields facilitates an analysis of why and how actors and institutions from different social fields shape energy transition processes.

Building upon field theory, energy transition can be regarded as a social process based on individual and collective contributions from regional, national and international actors. Driving the process of transition, these actors assume new roles, build groups, re-negotiate their positions within the regional field and learn from each other. Based on isomorphic mutual adaptation, path dependencies and the varying social skills of the involved actors, the regional field is constantly restructured.

The actors involved in these processes come from all social, economic and political fields. Following the regional innovation systems approach, they can be grouped into science and education, industry (companies which compete, cooperate with or supply each other), politics (municipalities, regional administration, political parties and related actors), intermediaries (network agents, labour unions and chambers of commerce) and finance (funding schemes, venture capital and banks, etc.) as well as civil society (NGOs and mobilized citizens). These "spheres" can be understood as fields which, taken together, make up the regional field.

Regional change for sustainability hence occurs as a process of interaction within regional transition fields consisting of the outlined social, economic and political fields – and with actors and fields from the national and international levels. The occurring restructuration can be understood as strategic, normative and cognitive. With regard to *strategic* aspects, regional change processes occur as processes of negotiation and decision-making. The involved actors re-assess their strategic positions, leading to a relative redefinition of their regional power. In a *normative* perspective, actors define new norms, expectations and frameworks of acceptance and self-conception, i.e. they modify the framing of observed and conducted actions. This changes actors' understanding of what is appropriate for regional development as for energy usage and storage. Finally, turning to *cognitive* aspects, actors learn from each other and encapsulate their new knowledge (e.g. in new technologies) in the course of the outlined restructuring. Thereby, actors mimic each other, but also convey knowledge to each other in the form of practices, procedures and technological expertise. These different aspects of regional change that occur in regional transition fields also point at different regional development paths that can be derived from the dominant mechanisms of regional energy transition.

In summary, the paper contributes to transition research by clarifying the underlying processes of negotiation, norming and learning with different actors in focus. The outlined theoretical framework is further illustrated with empirical evidence from an in-depth case study in Emden, Germany.

1 Introduction

Change processes that go along with the introduction of renewable energies are usually analyzed as energy transitions. Energy transitions can be defined as encompassing socio-technological transformation processes leading to more sustainable energy production, supply and consumption (Bridge et al. 2013; Cherp et al. 2011; Coutard/Rutherford 2010; Grubler 2012; Verbong/Geels 2007). This field of research is concerned with the structures and dynamics of socio-technical transitions (Grubler 2012), usually referring to the national scale or without taking any explicit spatial perspective (Binz et al. 2014; Mattes et al. 2015). A socio-technical transition can be described as a set of "colluding developments and dynamics taking place in various realms of society, including for instance economic, cultural and technological change [resulting in] a substantial shift in the deep and underlying structure of a system" (Schneidewind/Augenstein 2012: 18). As transition theory is rooted in evolutionary economics, socio-technological transitions are usually explained as path-dependent phenomena that undergo "innovation journeys" (Geels et al. 2008) over an extended period of time. In the area of energy systems, analyses of historical transition pathways have been particularly

prominent in the past decade (Cooke/Rehfeld 2011; Essletzbichler 2012; Fornahl et al. 2012; Foxon et al. 2013; Hofman/Elzen 2010; Karnøe/Garud 2012; Lovio/Kivimaa 2012; Simmie 2012; Winskel et al. 2014).

Despite important contributions, we still only partly understand what actually happens in these transition processes. The most recent discussions hence increasingly pay attention to the interplay between actors and institutions, as well as to that between different geographical levels. First, increasing attention is being paid to the role of actors in energy transitions (Wittmayer et al. 2017). Second, the so-called 'institutional turn' stresses the importance of stable structures for understanding change dynamics (Fuenfschilling/Truffer 2016). Finally, the importance of the regional level in energy transitions has been underlined (Mattes et al. 2015). At the same time, we still lack a coherent and thorough explanation of the 'inner life' of energy transitions.

Following these considerations, the paper asks: *How are transition processes constituted and shaped by individual and collective actors and institutions at the regional level in the interplay with national, European and global regulations and dynamics?* Which specific processes occur in regions that constitute transitions? Which (successful) constellations and pathways can be observed? Because change processes occur in an interplay between different actors at different spatial scales, answering these questions is crucial for designing and influencing the ongoing social change processes, understanding unintended outcomes, entering new technological pathways and, in turn, reaching out to renewable energy aims. The paper suggests a general framework as a starting point for enhancing our understanding of energy transitions.

It proceeds in the following way. A brief overview on the current contributions to energy transitions outlines the identified research gap (chapter 2). Chapter 3 then identifies a theoretical toolkit that can tackle the outlined challenge. Afterwards, empirical insights from an in-depth case study in the city of Emden will illustrate the kind of dynamics that can be identified in the suggested research approach (chapter 4). The paper finishes with some conclusions and an outlook at further research.

2 State of the art

Several approaches have addressed the dynamics of sustainability transitions. Among the most important ones are the Multi-Level Perspective (MLP) and the Technological Innovation Systems (TIS) approach (Markard/Truffer 2008; Coenen et al. 2012; Schot/Geels 2008). The following section briefly outlines some aspects of those approaches that provide helpful starting points for a better explanation of regional change processes.

Central to the *Multi-Level Perspective (MLP)* framework is the notion of transitions as being effectuated by multiple interactions between actors, institutions and socio-technical constellations at different levels of analysis (Geels 2002, 2004, 2011a, 2011b; Geels et al. 2008; Geels/Kemp 2007; Verbong/Geels 2010). Technological transitions are explained out of the interplay between *regimes* (dominant socio-technical configurations), *landscapes* (exogenous framework conditions) and *niches* (protected areas in which alternative technologies can emerge). In short, the MLP framework gives an account of the evolution of a technology from niche to regime status.

The *Technological Innovation Systems (TIS)* approach is concerned with the performance of technological systems as they develop in the interaction between institutions, networks, actors and technologies (Bergek et al. 2008; Hekkert et al. 2007; Markard/Truffer 2008). In their original definition, Carlsson/Stankiewicz (1991: 93) describe a technological system as a "network of agents interacting in a specific economic/industrial area under a particular institutional infrastructure or set of infrastructures and involved in the generation, diffusion, and utilization of technology." Whereas the MLP describes general patterns of socio-technical transitions on an aggregate scale, the TIS approach is concerned with the performance of technological innovation processes and their respective success factors (Markard/Truffer 2008).

Drawing these different insights together with the aim to derive a more actor-oriented, dynamic perception of energy transition, the classical *TIS approach* strengthens the technological perspective that is less prevalent in the MLP. In turn, the *MLP* adds a dynamic perspective and provides a contextualization for energy transitions in the form of exogenous landscapes.

The most recent contributions to MLP, TIS and beyond have brought about three central enhancements that form the building blocks for this paper. First, the role of institutions has been stressed; second, the focus has turned increasingly to actors and actions; and third, the multi-scalarity of transitions has been outlined.

"In the recent years, the conceptualization of the socio-technical regime has undergone an institutional turn", as Fuenfschilling/Truffer (2016: 298) state. This statement points at the increased relation of transition research to institutional approaches. In this sense, Fünfschilling (2012) develops a dynamic model of institutional change, also taking into account specific actors. Similarly, Mattes et al. (2015) draw upon RIS elements to achieve a more comprehensive perspective onto transition dynamics. Furthermore, several recent contributions draw upon Strategic Action Fields to specify the institutional interplay in transition dynamics (Geels et al. 2016; Köhrsen 2018; Schmid et al. 2015).

The role of actors is highly interdependent with this. While the above mentioned institutional approaches simultaneously highlight the importance of manifold actors, other approaches focus

explicitly on particular roles actors assume in transition processes (Wittmayer et al. 2017). Additionally, actor constellations and the segmentation of actor groups into different functional spheres are increasingly taken into account in the conceptualization of MLP (Geels 2004; Geels 2014; Fuchs et al. 2016).

Finally, the spatial character of transitions has moved into the focus particularly in several contributions to the innovation systems debate. Already Coenen et al. (2012) stress the importance of a more spatial perspective onto transitions; and Binz and Truffer (2017) outline an integrative approach that encompasses various spatial levels. The so-called "scale-transcending innovation systems" as proposed by Dewald and Fromhold-Eisebith (2015) also shed light onto the multi-spatial character of transitions that are locally rooted, but simultaneously globally interconnected.

Building upon these recent research findings and connecting them with each other, this paper seeks to enhance our understanding of regional change processes as composed of specific actions of embedded individuals and organisations (embedded in regional as well as national, European and global contexts). The research question is: *How are transition processes constituted and shaped by individual and collective actors and institutions at the regional level in the interplay with national, European and global regulations and dynamics?* Which specific processes occur in regions that constitute transitions? This paper suggests a heuristic framework that is meant as a first step in theory building and will help to find answers to these questions.

3 Theoretical Framework

In order to answer the outlined research question, this paper suggests complementing the above-reviewed transition literature with other relevant strands of literature. As some other scholars (Geels et al. 2017, Köhrsen 2018), we start from the Strategic Action Fields approach and combine it with insights from the regional innovation systems (RIS) debate and the debate on global-local interconnectedness. Insights from research on RIS help to clarify the involvement of actors from different functional fields. The debate on globalisation, in turn, grants insights in the connectedness of regions with extra-regional, national and global factors. Taken together, the combination of the different approaches will result in a more precise and manifold picture of the ongoing processes of regional energy transitions and can be used as a foundation for empirical studies. In the following, the proposal combines the transition debates introduced above with elements of institutional theory (SAF and RIS) and the global-local connectedness into *regional transition fields*.

From strategic action fields via regional innovation systems to regional transition fields

Strategic Action Fields provide a helpful perspective for grasping the dynamics that are inherent in energy transitions. At the core of this theory is the assumption that, driving the process of transition, the actors assume new roles, build groups, re-negotiate their positions within the regional field and learn from each other (Fligstein 2001).[1] While incumbents defend their position, challengers contribute new ideas and dynamics to the regional field. Based on isomorphic mutual adaptation, path dependencies and the varying social skills of the involved actors, the regional field is constantly being restructured (Fligstein 2001; Fligstein/McAdam 2011).

This perspective on institutional evolvement will further be complemented with insights from the regional innovation systems (RIS) approach. First of all, the RIS approach adds a spatial perspective by focusing on particular regions (Cooke et al. 2004) – that are embedded in a trans-spatial context (Dewald/Fromhold-Eisebith 2015). The paper mainly borrows the different "spheres" that shape innovation from the RIS approach: the involved individual and collective actors as well as institutions can be grouped into science and education, industry (companies which compete, cooperate with or supply each other), politics (municipalities, regional administration, political parties and related actors), intermediaries (network agents, labour unions and chambers of commerce) and finance (funding schemes, venture capital and banks, etc.) (Kuhlmann 2001; Heidenreich et al. 2012; Mattes 2010). These "spheres" can be understood as fields which, taken together, make up the regional field. Additionally to these five fields, two amendments are necessary to accommodate the specificities of the energy sector (Mattes et al. 2015): As households, farmers and cooperatives have become important actors in the energy transformation (Foxon et al. 2013; Heiskanen et al. 2010; Middlemiss/Parrish 2010), it is useful to add "civil society" (NGOs and mobilised citizens) as an additional field. Moreover, the political field is subdivided into "political parties" and "public administration" to distinguish between political agendas and the day-to-day work of local government. This second amendment responds to the fact that (more than in other sectors) policy assumes a very important role in energy systems, e.g. as a market organizer by fixing prices or by giving incentives for developing certain technologies (cf. Jacobsson/Lauber 2006).

Regional change in the energy sector hence occurs as a process of interaction within *regional transition fields* consisting of the outlined social, economic and political fields (Mattes et al. 2015)[2].

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[1] For the application of field theory to energy transitions, cf. also Fuchs/Hinderer 2014a; Fuchs 2014.
[2] In the cited paper, the authors talk of subsystems instead of fields.

The occurring restructuration can be understood as strategic, normative and cognitive (Scott 2009). With regard to *strategic* aspects, regional change processes occur as processes of negotiation and decision-making. The involved actors re-assess their strategic positions, leading to a relative redefinition of their regional power. In a *normative* perspective, actors define new norms, expectations and frameworks of acceptance and self-conception, i.e. they modify the framing of observed and conducted actions (Goffman 1974). This changes actors' understanding of what is appropriate for regional development as for energy usage and storage. Finally, turning to *cognitive* aspects, actors learn from each other and encapsulate their new knowledge (e.g. in new technologies) in the course of the outlined restructuring. Thereby, actors mimic each other, but also convey knowledge to each other in the form of practices, procedures and technological expertise. These different aspects of regional change that occur in regional transition fields also point at different regional development paths that can be derived from the dominant mechanisms of regional energy transition.

The interplay between regional and global factors in the wind energy sector

The regional level is important for explaining regional change, but regional actors and consequently regional transition fields are not independent of other levels (Smith 2007; Hargreaves et al. 2013). For example, funding schemes and general political guidelines are often developed supra-regionally, i.e. at the national or even global level (Fuchs/Hinderer 2014b). This turns regions into hubs where globalization occurs in the form of inter-connections between different localities (Giddens 1990). The outlined change process thus takes place in an interplay not only of different fields, but also of different spatial scales, with regions being embedded in larger, national and global, networks. The MLP acknowledges the importance of "external" institutional factors via the concept of landscapes (Geels 2004). In a more spatial perspective and moving into a more interdependent perspective, Dewald and Fromhold-Eisebith (2015) outline "scale-transcending innovation systems" which stress the interaction between multiple scales. This idea of linking regions to global development is also inherent in the idea of "globalized RIS" (Cooke 2004), where the most prevalent linkages are brought about via multinational companies. In the concept of "global innovation systems", Binz and Truffer (2017) accommodate regional, national and transnational systems as different scales for the construction and usage of innovations and underline the interdependence between the various spatial scales. The local – global connectedness hence goes far beyond the existence of multinational companies but are also connected to the work force, technological knowledge, discourses, norms and laws that may provide links to other localities.

In this sense, regional embeddedness adds variety to otherwise globally harmonized sectors (characterized by globally prevailing technological standards and routines). Dense regional networks

bring about not only geographic, but also a high degree of institutional, cognitive and social proximity (Boschma 2005), thereby intensifying the ongoing interaction processes. This interplay between local and global drivers of energy change requires a thorough analysis of concrete socio-technical arrangements in regional transition fields, including patterns of decision-making, negotiation, norming and learning.

Regional transition fields – summary of the theoretical approach

Bringing the interplay of actors and institutions (manifesting itself in social processes of negotiation, norming and learning) together with the embeddedness of regions in national and global networks, this paper proposes *regional transition fields* as a heuristic framework. Regional transition fields highlight transition processes as emerging out of negotiation, decision-making, learning and norming processes (Scott 2009) of individual and organizational actors in and between various regional fields as well as in the interplay between regions and extra-regional factors (cf. figure 1).

Figure 1: Regional transition fields: Overview of the heuristic framework (own representation)
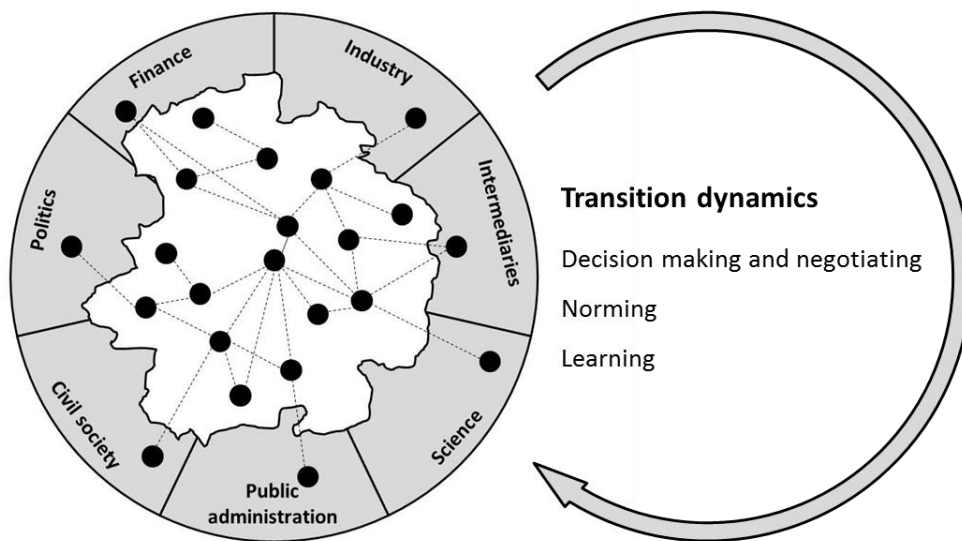
4 Empirical illustration

After laying the building blocks for a heuristic framework, this section will give a brief insight into empirically observed shifts in the three dimensions of regional transition fields. In order to do so, the

paper draws upon empirical insights gained from a case study in Emden, Germany.[3] Emden is a small harbor city with approximately 50,000 inhabitants in north-western Germany. It is a traditional ship-building city that has transformed itself into an active player in the wind energy sector. Emden has won several prizes for improving its renewable energy targets and aims at increasing its share of renewable energies to 100%. In the following, we will discuss decision-making and negotiating, norming and learning in Emden's energy transition processes and then briefly address its national and global connections.

Decision-making and negotiating

Emden already has a certain history of energy-saving and climate protection. Nonetheless, it is clear that different interests face each other. In order to canalize different voices, the city administration has set up the position of a so-called "climate manager". He is in charge of managing climate-related projects, but also to coordinate already existing climate-related activities in the city. In this sense, his position is created to establish him as a new, potentially powerful, player in the local negotiation games.

Companies active in the energy sector are also regarded as increasingly powerful actors. The following quote illustrates that they know how powerful they are, but see themselves rather as a beneficiary whose power automatically increases in the course of energy transitions. This shows that the redefinition of regional power is not always a strategic act.

> "Weil eigentlich unsere primären Ziele sind nämlich nicht Energie und Klimaschutz, wir sind Nutznießer dieser Entwicklung. Wir verstehen uns als Engineering Dienstleister für die maritime Industrie, insbesondere für die Off-Shore-Windenergie. Und das heißt also, wir bieten eigentlich/ wir versuchen Lösungen zu entwickeln und zu verkaufen, zu konstruieren, die im Rahmen des Energiewandels erforderlich sind. Ich empfinde uns aber, oder auch wir insgesamt, wir empfinden uns eigentlich nicht als, oder nur in einem sehr geringen Maße als Wegbereiter oder Mitspieler in der globalen oder grundsätzlichen Energiewende." (Inteviewee Industry, 14 16-18)

Other regional actors, in the following example the allocated university of applied sciences, actively push their own position as a driver and key player for regional energy change.

> „Also die Zielsetzung ist, (…) wir schreiben uns Nachhaltigkeit und gesellschaftliche Verantwortung auf die Fahne. Der zweite Punkt ist, wir wollen Impulsgeber für die Region sein. Impulsgeber kann man mit Sicherheit nicht allein sein, aber wir wollen ein WESENTLICHER Impulsgeber für die Region sein. Und wir organisieren als Hochschule auch regelmäßig einen runden Tisch und sehen unsere Rolle halt eben auch so, dass WIR die Initiative ergreifen und die Gebietskörperschaften und die, sind wieder dieselben, die IHKs, die Kammern, Handwerkskammer. (…) Nicht die Hochschule wird nur von allen zu Rate gezogen,

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sondern wir möchten uns auch ein bisschen in die Mitte stellen und auch die Initiative zum Vermitteln übernehmen." (Inteviewee Science, 46 147)

This involves the active initiative for building and re-building networks, setting topics and involving new players.

"Und gerade bei diesen Themenstellungen wie Nachhaltigkeit und Energie, die uns ja hier jetzt im Moment besonders bewegen, denke ich mal, muss man halt eben auch die Mitspieler suchen und finden. Und muss versuchen, das also mit anderen Akteuren zusammen zu machen. Also das ist auf jeden Fall auch eine unserer Leitlinie, gute Ideen zu haben, aber die guten Ideen mit anderen umzusetzen. Deswegen gehen wir auf die Region zu und vielfach ist das halt eben so, dass die Region auch auf uns zugeht." (Inteviewee Science, 46 25)

As these quotes show, energy transition entails the re-definition of roles, the re-assessment of power and the involvement of new actors. This does not always run smoothly; hostile positions form part of the game. In the following, an interviewee describes movements against renewable energies.

"Also die Hafenmafia, so würde ich sie bezeichnen, ist gewaltig stark. So und aus der Szene raus kommt immer noch, "Scheiß Windenergie, eigentlich brauchen wir ein Kohlekraftwerk". Oder wenn es nach denen geht sogar ein Atomkraftwerk. (…) Da gibt es eine Reihe Personen, die ganz knallharte Interessen haben, ihre Firmen, ihre Firmen im Hafen ja weiter nach vorne zu treiben." (Inteviewee Industry, 59 299-322)

Norming

Based on existing renewable energy initiatives, the self-conception of the city and the citizens gradually changes. Above all, an interviewee describes the increased degree of awareness for topics in the context of renewable energies.

„Die Region ist, wie ich gesagt habe, schon lange auf dem Weg, was Energie betrifft, das Themenfeld Energie betrifft. Und die sind hier im höchsten Maße sensibilisiert für dieses Thema hier. Und nicht nur, sage ich mal, die Akteure innerhalb des Netzwerkes der Unternehmen, sondern auch, sage ich mal, die breite Bevölkerung. Die ist für das Thema auch sehr sensibilisiert." (Inteviewee Public Administration, 47 277)

Examples that mirror this general awareness are manifold. They include the initiative "Emder ups Rad" which encourages citizens to use the bike instead of their car. There is also energy education at primary schools, and the city administration uses renewable energy in its electricity supply. The local energy supplier subsidizes citizens when they buy energy-efficient electronic devices such as fridges, which again underlines how renewable and sustainable energy is defined as the "appropriate" solutions. All this leads to the willingness to spend money in the sector, which again increases as Emden wins the European Energy Award (Inteviewee Public Administration, 2 276-277). Together with its self-definition as "Europe's capital in producing renewable energies" (Inteviewee Politics, 50 74-78), this serves as a self-re-enforcing virtuous circle.

The central facilitating factor is that the locals know how much work in the region depends on the sector of renewable energies. This means that energy transition is the central opportunity for the region to remain vivid and livable and to cope with its structural problems.

> "Der Schiffbau baut in Deutschland seit den siebziger Jahren ab (…) Und da hofft man ja mit dem Energiewandel halt auch hier auf eine neue Chance für eine Industrie." (Inteviewee Industry, 30 25)

In sum, energy transition in Emden is a process of awareness increase in the whole region, and the result of defining renewable energies as the appropriate solution to fight structural weaknesses.

Learning

The activities in renewable energies have triggered the emergence and allocation of knowledge regarding this field. The university of applied sciences has established a specific curriculum of energy efficiency to answer this need of knowledge. As the curriculum has been established in cooperation with the city administration, the aim is also to learn from each other and to benefit of each other.

> „Also ich sage mal, über den Austausch gibt es, denke ich, schon einen Know-How-Transfer, klar. (…) Ich sage mal so, wenn wir jetzt, beispielsweise, ein studentisches Projekt haben, wo die Studenten für die Stadt ein Gutachten ausarbeiten oder eine Untersuchung durchführen, dann lernt man erst mal daran, was die an Energie und Daten erzeugen, sozusagen und wir können dann davon profitieren, was die erzeugt haben. Das ist, denke ich, so ein klassischer Informationsaustausch oder ein Austausch von Wissen." (Inteviewee Public Administration, 58 259-266)

Trade fairs also foster the discussion of up-to-date knowledge.

> „Also vor zwanzig Jahren haben die Emdener Stadtwerke hier angefangen mit ihren Emdener Energietagen. Das waren eine der ersten Stadtwerke in Deutschland, die gesagt haben, Mensch, wir machen so eine Verbrauchermesse und drängen auf erneuerbare Energien, stellen mal irgendwie so ein kleines Windrad auf und erzählen was von Energieeinsparung, obwohl wir eigentlich Strom verkaufen." (Inteviewee Intermediary, 5 35)

Finally, Emden has established a so-called "ecological centre" which is open for all citizens and informs about energy-saving and related topics. It assumes a broad function of informing, but also participates in local projects. This increases the cooperation between different local actors and again fosters mutual learning.

> „So, das Power-to-Gas-Projekt mit den Stadtwerken ist eigentlich ein schönes Beispiel, dass (…) man eben wirklich gemeinsam (…) son Projekt macht. Sowohl nach außen dargestellt. Also sowohl, wenn Sie die Stadtwerke fragen, die werden auch sagen, "Wir machen das zusammen mit der Hochschule", Es wird eben auch so gelebt. Das ist eben wirklich mehr oder minder auf Augenhöhe, dass beide sozusagen dieses Projekt weiterentwickeln. Natürlich jeder in seiner, mit seiner Kompetenz und seinem Ding. (…) wir sind sehr häufig bei den Stadtwerken und umgekehrt sind Mitarbeiter der Stadtwerke eben auch häufig hier und nutzen die Möglichkeiten, die wir hier haben aus für dieses Projekt. Und umgekehrt greifen wir natürlich auf die Ressourcen der Stadtwerke zurück, auf das Netzwerk. Da schwingen ja auch bei solchen Sachen viele Dinge, die gar nicht technischer Natur sind, mit. Genehmigung, Finanzierung, solche Dinge. Das machen wir schon dann, besprechen wir auch gemeinsam. Da können wir dann vielleicht nicht immer viel beisteuern, aber das ergänzt sich ganz gut, ne. Das ist wirklich ein gelebtes, gemeinsames Projekt." (Inteviewee Science, 16 185-186)

In this sense, energy transition in Emden is a big knowledge building process, involves the emergence and installation of new technologies and at the same time fosters the connectedness and learning between multiple actors.

Embeddedness in national, European and global frameworks

The vivid regional activities in Emden are backed up, fostered and facilitated by "external framework conditions". As a small city, the actors in Emden do not expect an active role in shaping national policies, but instead perceive them as external conditions that define possibilities and limitations. In this sense, German and Lower Saxony energy politics are perceived as the framework which channel regional actions. Moreover, programmes such as the European Energy Award and the German "Masterplan 100% Klimaschutz", give incentives and access to funds for putting into practice renewable energy projects. The existence of these programmes are important for the initial decision of the mayor to foster renewable energies, and even more so form a basis of legitimation and a framework to keep the activities going. Finally, the wind energy sector with its global reach and the existence of multinational companies in Emden form direct linkages to other localities. The orientation of these companies is hence not primarily to Emden, but their selective embeddedness is accompanied by an international network of suppliers, customers and competitors (Mattes 2016). In this sense, energy transition in Emden is embedded into the context of the German "Energiewende", political programmes, funding schemes and the global networks arising from the international orientation of its multinational companies.

5 Outlook and further research questions

This paper has identified a need to break energy transitions down and has suggested concretizing them by looking into the specific processes that manifest energy change in regions. By complementing transition literature with insights from institutional theory, it is possible to analyze energy transitions as processes of negotiating, norming and learning in and between various social fields. These regional fields are embedded into the national, European and global context. The short empirical section shows how manifold energy transition is in practice, and that the heuristic framework of decision making, norming and learning can help to shed light into the occurring processes.

At the same time, the glimpse into Emden's energy transition underlines its complexity. Energy transitions occur in the interplay between various functions, actors and their institutional frameworks. The heuristic framework that this paper suggests can provide starting points for

shedding more light onto the specific processes of energy transition and the underlying dynamics between actors and institutions.

This leads directly to further research. In order to make the heuristic framework applicable for comparative empirical studies, it should be broken down further. Moreover, a systematic empirical foundation should be achieved by not only conducting individual case studies, but choosing comparative set-ups in a national or international setting.[4] In the end, there remains much to do if we want to achieve a full understanding of energy transition processes.

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[4] Work into this direction is conducted by the REENEA research team in a project financed by the German Research Foundation and led by the author. More information on how the project analyses regional energy transitions as social processes of negotiating, norming and learning in the wind energy sector can be found at https://www.uni-oldenburg.de/en/europeansocieties/research/regional-energy-transition/

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