

Why, and what will it look like? Evaluating energy experts' responses concerning the German *Energiewende* and their implications for communication efforts

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The implementation of the German energy transition (Energiewende) is unclearly framed. The future of the transition depends on more than just technological development or economic feasibility. Rather, a positive attitude and an understanding by the general public are critical to its success. Therefore, communicating the complex, polarized and long-term process in an objective way is essential. We show that despite the alleged clarity of goals, German stakeholders have very diverse reasons for their support of the energy transition. One key reason mentioned is climate protection. Another important goal is the desired independence from energy imports. This diversity is at the heart of the communication challenges. We see a wide variety of goals triggering trade-offs and challenges in understanding the process. Therefore, we suggest an infographic as an approach to communicating the energy transition to the general public with a focus on goals and related future challenges of the transition. We conclude that communication tools should promote an inclusive discussion and debate regarding the goals and challenges of a process, such as the energy transition, to help answer the question: How do we want to live in the future?

Keywords: climate change, energy transition, communication, framing, media

1. Introduction

The German *Energiewende* is a pivotal energy transition process which has been gaining worldwide attention for many years. It is a process which is widely discussed and still ongoing (e.g. Nippa & Meschke 2015). Adequately communicating, framing and describing this complex transitional process is vital to understanding the path to a future energy system and its related technical, economic and social constraints. Effectively communicating the complex process of energy transition in an objective

way is a challenge from the perspective of energy researchers. The need for objective communication is apparent from the strong polarization and debate on the status and future of the energy transition (see e.g. Renn & Marshall 2016). One central difficulty within the transition is to present the necessary information to the public in an accessible, consistent and understandable way that is suitable for a broad audience of different backgrounds.

We used qualitative, semi-structured, in-depth expert interviews with energy professionals to gain an overview of how local and regional energy stakeholders perceive the energy transition goals and motivation. We believe motivation is the key to tackling the challenges and effectively communicating the transition process. To build an empirical basis for perceptions related to our questions, we interviewed 29 energy professionals in two German metropolitan regions in 2014 (Munich and Frankfurt-Rhein-Main). The experts are associated with different institutions and have diverse backgrounds (urban and rural perspectives, industry and small firm sector, interest groups and NGOs), as well as fields of expertise (e.g. mobility, buildings, electricity). Our study thus goes beyond a description of media coverage of topics related to the energy transition process (e.g. Bigl 2016; Djerf-Pierre, Cockley & Kuchel 2015). Rather, the study complements work related to the development of tools to improve communication strategies or change framing and display in the field of climate change and energy transition processes (e.g. Baumer, Polletta, Pierski & Gay 2015; Rebich-Hespanha, Rice, Montello, Retzloff, Tien & Hespanha 2015; Shih & Lin 2016).

This paper provides insights into why communication challenges exist regarding the transition, which challenges are relevant, what communication should focus on and what communication should convey to facilitate comprehension. Our results will help by framing content to communicate key information to non-expert audiences within the context of the German energy transition, which may also be relevant for comparable processes. Furthermore, we present one application, an infographic, to illustrate an approach for communicating and showing the motivation for the energy transition as a long- term process in an understandable way.

The paper is structured as follows: Section 2 explains the past and current status of the German energy transition, while Section 3 describes communication challenges within the energy transition process. Section 4 explains our methodology. Section 5 shares expert perceptions regarding goals for the energy transition. In Section 6, we summarize our results, deduce implications for communication efforts and present an approach using infographics to implement communication efforts. Section 7 concludes our paper.

2. The Energy Transition in Germany – Past and Present

The narrative of the *Energiewende* in Germany today contains old arguments and, at the same time, has transformed itself (e.g. Hake, Fischer, Venghaus & Weckenbrock 2015; Renn and Marshall 2016). The term *Energiewende* was first used by an ecologically motivated institute (Öko-Institut) in a 1980 German study titled *Energiewende – Growth and Wealth without Oil and Uranium* (Öko-Institut 1981). In that context, the *Energiewende* focused on the possibilities for establishing a proper economic system independent of oil and nuclear technologies, concentrating

on protecting resources in a time when climate change and global warming were not issues of broad public concern. Out of this grassroots movement, and with a new German administration, the Social Democrats and the Green Party in 1999 introduced the Renewable Energy Act 2000 promoting the installation of renewable energy technologies. At the same time, they initiated a phase-out of nuclear energy which would continue until the early 2020s. Thus, Germany set a clear goal to fundamentally transform Germany's energy supply structure. The country focused on increasing market shares of renewable technologies, like wind energy, photovoltaics and biomass. One additional main motivator for this legislative change was the increasing importance of climate protection as a global (political) issue, culminating in the adoption of the Kyoto Protocol, which commits signatories to reduce greenhouse gas emissions. The Christian Democratic-Liberal government (2009-2013) set out its energy policy goal as 'securing a reliable, economical and environmentally compatible energy supply' (German Federal Government 2010, p. 3). In accordance with this change in policy, the previously established goals were markedly changed regarding nuclear energy. In 2010, the administration granted nuclear facilities a drastic extension of their timeframes for nuclear phase-out. One motivating factor behind these extensions was to leave a secure and climate-friendly energy capacity in the system for longer (Hake, Fischer, Venghaus & Weckenbrock 2015). Since the nuclear incident in Fukushima (Japan) in 2011, accelerating a faster nuclear phase-out by the year 2022 has been brought back into political focus and was introduced by the administration. German energy policy can now again be defined as the transition of the German energy system towards a sustainable and renewable energy supply, focusing on climate protection and nuclear phase-out while maintaining a strong and competitive economy (German Federal Government 2011).

Today, the German energy transition has reached a crucial midpoint, rapidly transforming the country's energy system in recent years. The nuclear electricity phase-out is now regulated¹, which is a determining factor for further transition and has played an enormous role in public discussions and narratives. Renewable energies now constitute more than one-third of German electrical consumption, and technological innovations including electricity storage and electric mobility are gaining market shares (FMEE 2016). On the other hand, big challenges exist for furthering the implementation process of the energy transition. Table 1 shows the high number of quantitative goals the German government has made in this area, such as the promotion of renewable energies. Additionally, the German government committed to a 10% reduction in gross electricity consumption by 2020 compared to 2008 consumption, but by 2015 it had achieved only a 4% reduction (FMEE 2016). The energy demand within the transport sector is an even greater challenge. While demand increased by 1.3% between 2005 and 2015, the goal is to reduce it by 10% by 2020. Furthermore, the past, current and future costs, as well as benefits of the mentioned transition process are a relevant and widely discussed topic (see e.g. Kreuz & Müsgens 2017, 2018). In addition to these tasks, the long-term aspects of many energy transition goals pose a key challenge for communicating the complex energy transition process (see Section 3).

Consequently, additional means of achieving those challenging goals – such as new mobility, electricity and heat concepts – need to be implemented. Moreover, the conversation concerning a phase-out of coal power in the mid-term to fulfil the goals

for reducing greenhouse gas emissions is a further issue that is fuelling heavy debate (Agora Energiewende 2016; Hake, Fischer, Venghaus & Weckenbrock 2015; Renn & Marshall 2016; Leipprand, Flachsland & Pahle 2017; Leipprand & Flachsland 2018). Also this emerging topic needs to be decoded and better understood, and communicated properly.

Table 1: Selected quantitative goals of the German government in the field of its energy transition policies, Source: FMEE (2016)

Year	Share of renewable energies in electricity consumption [%]	Reduction of gross electricity consumption compared to 2008 [%]	Reduction of primary energy consumption compared to 2008 [%]	Reduction of greenhouse gas emissions compared to 1990 [%]	Development of final energy consumption in transport compared to 2005 [%]
2015	31.6	-4.0	-7.6	-27.2	+1.3
2020	≥ 35	-10	-20	At least -40	-10
2025	40-45				
2030	≥ 50			At least -55	
2035	55-60				
2040	≥ 65			At least -70	
2050	≥ 80	-25	-50	At least -80 to -95	-40

3. Energy Transition Communication Challenges and Conflict

Improved communication, discussion and explanation are needed for a straightforward reason: a sustainable as well as economically and technologically feasible transition must be based on the acceptance and approval of many – as well as key – social groups (WBGU 2011). Furthermore, Renn and Dreyer (2013) argue that acceptance must be based on identifying the goal of a process. Going even further, Grunwald (2014) argues that the *Energiewende* ‘is a social transformation including technological change but going far beyond’ it, which ‘includes a complex set of human actors such as [...] citizens affected by side effects of energy technologies and infrastructures and also citizens in their role as the democratic sovereign’ (p. 11). Although more than three quarters of German society support the energy transition (Renewable Energy Agency 2013, 2016; Setton, Matuschke & Renn 2017), the public needs to actively facilitate the process. This is essential for the energy transition, because the increasingly decentralized energy structure has a high penetration of widely distributed and privately owned renewable energy technologies. The public also needs to adopt a more sustainable lifestyle (Renn & Dreyer 2013) as energy efficiency goals are set out. Another precondition for public acceptance of the transition mentioned by the authors includes having positive perceptions regarding its possible results (goals).

Figure 1: Fundamentally contradictory posters showing polarization related to the path of the energy transition in recent years in Germany: Clockwise: (1a) ‘Save Renewable Energies’, ‘Secure employment, Empower the countryside, Enforce climate protection’: Advertisement for a demonstration in Berlin on 2 June 2016. (1b) ‘Your green electricity scares me. – Please, come to your senses’. – Source: *Vernunftkraft* – Countrywide Organization opposing the construction of renewable energy infrastructure. (1c) ‘Stop the delay: Energy transition now!’ – Source: *Campact* and *BUND*, non-governmental environmental organizations. (1d) ‘Help! The energy transition is unaffordable’ – Source: *Initiative Neue Soziale Marktwirtschaft*, organization partly funded by business organizations.



In addition to needing public support for the process, a corresponding issue is to structure and simplify information for non-experts. Media representation on climate change, sustainable development or related sub-topics (such as nuclear and coal energy) is generally increasing (e.g. Holt & Barkemeyer 2012; Leipprand & Flachsland 2018) but often criticized as unbalanced by both sides of the debate, including critics (Nießen 2016) and supporters of the energy transition (Baake 2013). Climate change is often represented in a sensationalist and shocking way (O’Neill & Nicholson-Cole 2009; Ryghaug 2011) and may cause those receiving this information to feel overwhelmed and unable to make meaningful changes in their individual lifestyle. On the other hand, such sensationalism might also ‘reduce the complexity of the issues’ (Ryghaug 2011). Available information, e.g. concerning the economic effects of renewable energies, is perceived by survey respondents as ‘contradictory and inconsistent [...], [with] too many “experts” [in that area] and [as a result respondents have] a low degree of faith in facts and figures’ (Zoellner, Schweizer-Ries & Wemheuer 2008, p. 4140). Thus, ‘knowledgeable and objective

interpretations' of the key issues are needed, especially for such 'a controversial topic' (Friedman 2011, p. 63). Leiprand, Flachsland & Pahle (2017) analyse narratives of scientific and expert advisors within the German energy transition. The authors detect two 'opposing discourses' within the debate until 2015, where one is 'pushing for a transition to renewables' (proactive), while 'the other [is] holding on to the status quo' (reactive) (p. 222). The paper argues that scientific studies in Germany 'clearly take sides in the debate' (p. 222), and also the authors of this study perceive a polarization.

Furthermore, Baake (2013)² argues that the complexity of the transition calls for 'a more detailed analysis' of energy policy topics, because the situation is 'confusing' and 'unclear even for experts' (Baake 2013, p. 20).

Certain stakeholders, such as environmental NGOs, business groups and trade unions, focus their narratives on their own perspectives and motivations (e.g. Renn & Marshall 2016). Renewable energy companies lobby strongly for the transition, and more traditional companies from the energy branch push their interests (Sühlsen & Hisschemöller 2014). Thus, these stakeholders might not provide the public with balanced and understandable information. Figure 1 illustrates how some stakeholders in recent years have evaluated the situation within the process, and how those differences of interpretation and goals might foster misunderstanding and polarization.

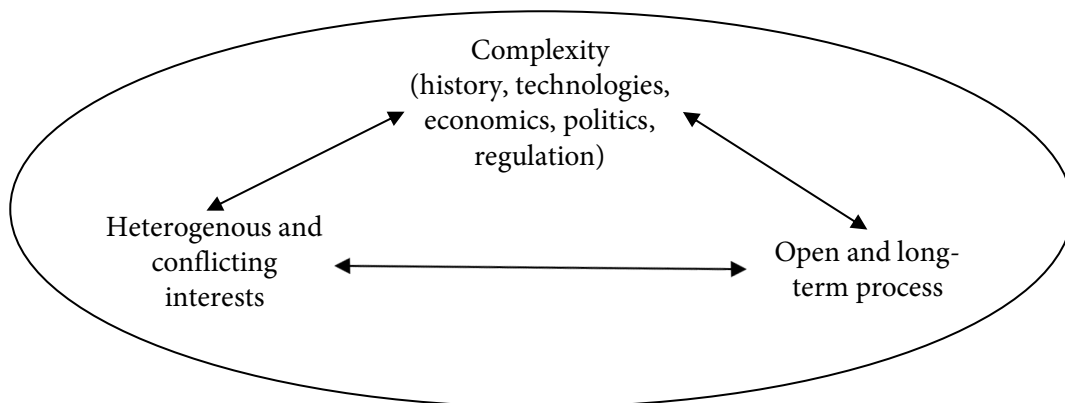
From the above considerations, we derive three major challenges for the communication of relevant information related to the energy transition process (see Figure 2):

- First, the complex nature of the energy transition is a central reason for the difficulty in producing appropriate media representation and gaining a general understanding. This complexity derives from technical, economic, social and time-related constraints and relationships.
- Second, the process currently contains multifaceted interests about certain goals and by what means and technologies they should be achieved. This creates a strongly polarized environment. Debate arises concerning different questions: What does our society want to achieve with the energy transition? Which technologies will the transition require to reach its goals? How do we want our future – with more sustainable and sufficient lifestyles – to look? Communication needs to answer these questions.
- Third, the energy transition is an open long-term process, in which the means and technologies to reach specific goals may change over time. This openness and flexibility in the transition present major challenges for communication strategies, because of the difficulty in painting a specific picture of future lifestyles and living contexts. Furthermore, factors such as cost and better technologies may make some of the currently used technologies obsolete in the coming decades. These changes could conflict substantially with some stakeholders' current goal preferences.

Based on these considerations and communication challenges, we identify the goals of the energy transition as one central aspect which needs to be clarified to improve public understanding and reduce complexity. A transition can be defined as an intended change to implement certain goals. Challenges and problems arise when stakeholders' preferred goals for the transition are incongruent (e.g. conflict of

goals, trade-offs). The main area of conflict revolves around the question of what the true goal of the energy transition is, or whether it exists. An interesting research question is to ask relevant stakeholders what they perceive the goals to be and further compare them to identify potential conflicts. The answers will assist in understanding current and potential future conflicts. Therefore, these responses can help to accelerate a discussion about the goals and the preferred ways of living in the future. Furthermore, the results can reveal topics and opinions which need to be effectively communicated, such as to explain what the motivation for the transition process actually is. The results can be used for other national and regional transition contexts.

Figure 2: Communication challenges of the energy transition



4. Methodology and Data

Qualitative, semi-structured, in-depth expert interviews with energy professionals shed light on current perceptions and future perspectives on the energy transition in the German context. Compared to more standardized methods, we see several advantages to employing qualitative semi-structured expert interviews in our context. First, our method has high context-sensitivity, especially in relation to the relevant structures of interviewees' everyday lives and the interview situation (Trinczek 2009). Interviewers were allowed to direct the conversation and elaborate on the topics, focusing on aspects the interviewee at first did not have in mind. Our method also provides an appropriate way to capture the multifaceted world of the energy professionals and gain an impression of their personal assessments concerning the path for the energy transition. Past studies with a similar purpose have also used interviews. Fischer, Peters, Vávra, Neebe and Megyesi (2011) investigated citizens' views on governance approaches to stimulate behavioural change in the field of resource use. Langevin, Gurian and Wen (2013) explore key behavioural tendencies regarding energy use reduction, energy knowledge gaps and attitudes of low-income public housing residents. Valkila and Saari (2013) conducted interviews with selected energy sector experts to examine the Finnish energy policy and to derive future perspectives. Wallquist, Visschers and Siegrist (2009) conducted detailed interviews with laypeople to explore their understandings of Carbon Capture and Storage (CCS).

We used this method to gain an overview of how the local and regional German energy industry and policy makers perceived the status quo and future of the energy

transition. We were interested in gaining a regional perspective on the energy transition rather than analysing a Federal viewpoint. We hoped that the experiential perspective of the energy expert stakeholders would offer a practical assessment. Therefore, we interviewed local entrepreneurs, regional administrations and urban energy facilities. We asked interviewees to identify goals of the energy transition with the question, ‘From your perspective, what are the goals of the *Energiewende*?’ Our stakeholders’ perspectives assisted us in addressing the communication challenges noted above and in answering our study’s questions. We outline areas of conflict, their implications and key aspects of comprehensive communication for laypeople in Germany on the complex topic of the energy transition.

To build an empirical basis for professional perceptions as a starting point of our research, we interviewed 29 energy professionals in two German metropolitan regions between spring and summer 2014 (Munich and Frankfurt-Rhein-Main). The 29 experts are affiliated with 24 different institutions and have diverse backgrounds (urban and rural perspectives, industry and small firm sector, organizations, interest groups and NGOs), as well as varied fields of expertise (e.g. mobility, buildings, electricity). The interviewees included five with an administrative background, twelve from private companies and twelve who represented associations and other non-governmental organizations (see Appendix for further information). Table 2 below provides additional descriptive information concerning the interviewed energy experts. The personal interviews lasted between 45 minutes and two hours. We recorded and transcribed the interviews, and both authors interpreted and coded the data.

Table 2: Descriptive information concerning the interviewees, frequencies and persons; A number of institutions were in some cases represented by more than one person.

	Administration	Private Company	Association/ Organization/ NGO
Male	3	8	9
Female	2	4	3
Total	5	12	12
Interviewees from <i>Frankfurt-Rhein-Main</i>	1	7	6
Interviewees from the <i>Metropolitan Area Munich</i>	4	5	6

The following examples demonstrate how the authors carried out the coding process. We coded the first statement as expressing a goal of *energy independence and energy autarky*, because the interviewee referred to the goal of independence from resource imports against the background of the political crisis in Eastern Europe in 2014. The second statement was coded as expressing a goal of *independence from large energy supply companies*, while the third one was coded as the goal of *abandoning consumption of fossil fuels*.

- ‘All right’, I would say, ‘*energy transition certainly includes the issue of resource independence*’.

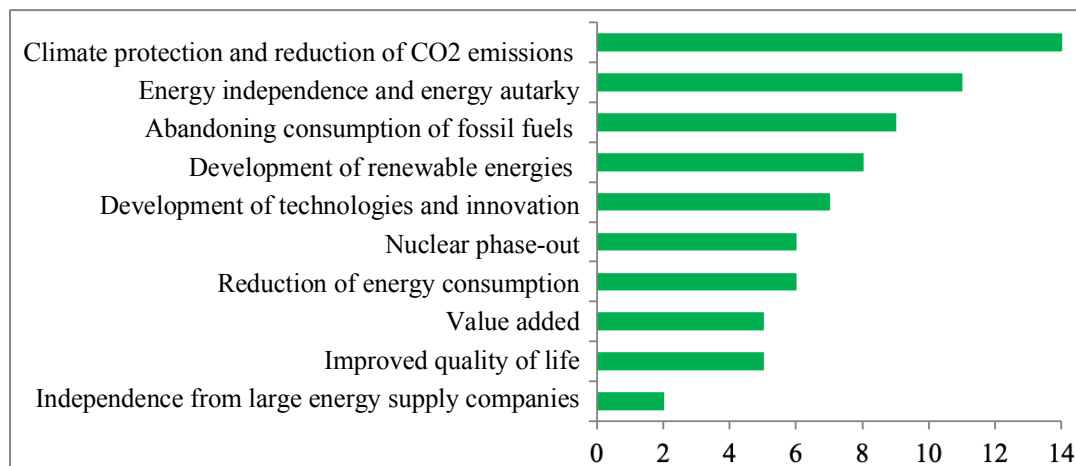
- ‘It’s romantic to have your own PV-installation on your roof. Like self-sufficiency. [...] We’ve had experience with monopolies [in the electricity sector], and I don’t think it’s a bad idea not to have all the control in one place’.
- ‘The second aspect [that our company argues], says an interviewee, ‘is that resource protection will only be realized if we are able to change our living environment in a way that means people’s quality of life won’t decline’.

5. Blurred Goals – Why do people want the energy transition?

We asked our stakeholders to name relevant goals for the energy transition in Germany. Our results show remarkably varied goals (see Figure 3). We identified 10 different goals for the German energy transition from our interviews. Three interviewees did not name any goal, while many others named several goals.

Climate protection and reduction of CO₂ emissions were mentioned most often. A second frequently mentioned goal for many of the stakeholders was to establish greater energy independence or energy autarky. Other goals include reducing the consumption of fossil fuels (which impacts other themes, such as sustainability, inter-generational fairness and resource protection), increasing renewable energies and phasing out nuclear energy.

Figure 3: Responses to the question regarding goals of the energy transition.



Below we present some of our interviewees’ statements, which show how stakeholders argue that *climate protection* is one of the key goals:

- ‘[...] as a matter of principle, [energy transition] is about climate protection’.
- ‘The primary goal [...when the *Energiewende* began] was climate protection. Certainly I support that. But I think that more possibilities go along with that’.
- ‘In general I would say climate protection is the second reason [besides nuclear phase-out], which is doubtless the goal’.
- ‘The pressure and urgency due to climate change is one reason. Not just the resources, which are finite, but also the processes of climate change’.

Other statements show the variety of our interviewees’ goals:

- ‘You can notice that the public doesn’t perceive the topic of greenhouse gases to be as relevant as it once was’.

Energy independence is communicated as another important goal and seems to be crucial to our stakeholders for very different reasons. One reason is the favoured reduction of dependence on energy imports. The argument is also connected to creating value within Germany due to the transition process:

- ‘A reduction of dependence on expensive energy resources. I think that is a goal’.
- ‘Energy independence from countries exporting energy sources or a stronger independence, whether complete or not. It needs to be focused more on regional economic cycles – the value chain’.
- ‘I am proud to be living in a time when we can say that we use renewable energies and are trying to be independent of [energy] imports. That is absolutely the right way to go’.
- ‘From my perspective, it is important that here in Germany, not having that many subsoil assets [...], [the country] is more self-sufficient and eco-friendly’.

This political argument favouring less dependence on foreign energy imports is connected by other interviewees to another goal, that of creating added value. Their argument is that added value creates profits for Germany, rather than for other countries, like oil-exporting states. The *promotion of renewable energies* is also mentioned as a goal of its own and not merely as a means to defeat climate change, which might confuse the public discussion:

- ‘The goal is to increase the share of renewable electricity and heat as much as possible. That means going back to the level of development seen between the years 2000 and 2008 [under the previous administration]. In that decade, we managed to increase electricity production from renewables to about 25%. If we get moving with that, we might reach the next 25% by 2025. The technology is already there.... That is the goal’.

Furthermore, respondents see disadvantages and challenges, but also options within the transition process:

- ‘Currently, this transition is painful, because we have the Renewable Energies Act Levy³, which is steadily increasing [...]. But from my perspective, it is actually a driver of innovation for the regional industry’.
- ‘The transition will only be successful, if we achieve a change in lifestyle that people like. In the beginning we might have the feeling that we need to abstain from something [...] but we will fail if that happens. We need to organize it in a way that [living conditions] improve in the end, that the quality of life is higher than previously’.
- ‘Of course, I would prefer more decentralized energy distribution infrastructures. Maybe, because people realize that particular infrastructures are not politically enforceable. Everyone is afraid of a new *Stuttgart 21*⁴. The mega electricity link from north to south⁵ could develop in a similar way’.

Other interviewees believed that *no clear goals* exist for the transition:

- ‘I can’t keep up with the goals of the government. I can’t define them; they are hard for me to grasp. There is no clear structure for me. There is a permanent back and forth: ...like nuclear phase-out, [re-]introduction of nuclear technology and then nuclear phase-out again. It’s not really clear what they want to do’.

In conclusion, climate protection is one essential reason for the energy transition in Germany according to our interviewees. To that extent, our results show a focus

comparable with other surveys (see e.g. Joas, Pahle, Flachslund & Joas 2016; Schubert & Möst 2014). However, we also identified further issues. Our interviewees highlighted energy independence and energy security as central elements for Germany's energy transition goals.

6. Results, Implications and one Implementation

6.1 Main Results

In recent decades, Germany has taken the initiative to address a transition of its energy system. Fundamental transition efforts can only be successful if society accepts and supports them, and if changes are communicated within an understandable frame and narrative. To address the communication challenges of the energy transition – its complexity, open-ended nature and varied underlying motivations – we interviewed energy experts to clarify the goals and motivation on which to focus communication efforts. Analysing the answers will improve our ability to communicate energy transition issues more transparently and especially to make them understandable to people with limited prior knowledge.

We show that despite the alleged clarity of goals, German stakeholders have additional and very diverse reasons for the transition. The qualitative, semi-structured expert interviews show which goals and reasons might motivate that transition. Our results indicate that one key reason is climate protection. Another important reason for the transition is a desire for independence from energy imports, mentioned in connection with current political events. However, this argument had already prompted early support for renewable energies in Germany (e.g. Jurca 2014). Other motives include abandoning fossil fuels, developing renewable energies, nuclear phase-out and reducing energy consumption. Therefore, we find a heterogeneity of goals⁶ which can trigger conflicts. Challenges and problems were mentioned as well.

6.2 Implications and Recommendations

By using the method of qualitative, semi-structured, thorough expert interviews with energy professionals, we gain experts' insights into the goals of the energy transition. We conclude with implications taken from our interviews that will help to clarify what gives rise to challenges when communicating the complex topic of the *Energiewende*. We derive four major implications, which we use to specify our recommendations for improving communication efforts to effectively explain the need and reason for energy transition measures.

1. Showing and explaining the (heterogeneous) goals for the energy transition is highly relevant for communication.

In response to question one, interviewed stakeholders expressed at least partly contradicting perspectives, opinions and goals of the energy transition. The diversity of goals may result in significant challenges for designing and communicating the energy transition. For example, a prominent public debate concerns electricity generation from lignite, which currently represents up to 25% of German gross electricity generation. On the one hand, burning lignite to provide electricity harms the climate, because the resource produces very high levels of greenhouse gas emissions. On the other hand, lignite is available in large quantities in Germany.

Thus, a lignite phase-out lessens greenhouse gas emissions drastically, but might increase Germany's dependence on energy imports, which conflicts with another frequently named goal of energy independence (see Section 5). Further goal conflicts exist, such as trade-offs between green energies and the security of supply (Röpke 2013; Schmalensee 2011).

Evidently, conflicting goals (and subsequent trade-offs) cannot be solved easily and are a critical challenge for the communication process. If the political focus changes or reforms deprioritize certain goals – for example, weaker growth of photovoltaic installations than projected, or substituting domestic coal for additional gas imports which increases energy import dependence – broader approval and acceptance of the transition might grow among some groups. This situation arises because groups focus on their very specific preferred goals. For a different group, the same goal (e.g. promoting renewable energies) is interpreted as a means to reach another goal (e.g. climate protection), where the final goal is more important than the means of getting there. These conditions risk social conflicts, which may in turn bring disappointment and a rejection of the energy transition.

Hence, communication strategies should focus on conveying the diversity and heterogeneity of goals. Key to the success of the energy transition is expressing differences of opinions concerning the goals, reasons for these views, as well as explaining the technologies and means of executing specific goals. By focusing on the essential motivation of the energy transition towards a climate-friendly economy, stakeholders can engage in debate and discussion their preferences, what they oppose and whether proper agreements are possible, such as in tackling trade-offs.

2. Climate change is a unifying and largely established reason for the transition.

Our interviews showed climate change to be a central common interest among stakeholders in realizing the energy transition. Thus, besides the argued heterogeneity of preferences, climate change may be an essential argument for communicating and simplifying issues regarding the need for energy transitions to diverse target groups, including children and laypeople, especially because it is familiar to most people.

3. Illustrating alternative developments as well as advantages and disadvantages of certain strategies

First, while communicating and debating goals for better understanding (e.g. climate protection, see (i)), it might be helpful to explain the relevance of certain goals by illustrating alternative developments or scenarios, such as the effects of average global temperature increases as well as natural regional changes. Furthermore, economic changes in people's daily lives might show the importance of certain goals. Clarifying specific motivations can highlight pollution and climate change risks or other mentioned goals.

Second, the effects of certain measures to reach the goals can be beneficial or disadvantageous to certain people or groups, such as employees of specific industries and regions. Furthermore, people living in rural areas may perceive unfavourable changes, such as harm to wildlife or negative landscape changes due to renewable energy installations (see e.g. Bertsch, Hall, Weinhardt & Fichtner 2016). Those effects need to be shared and discussed to facilitate a broader consensus on certain means to reach goals: How much wind energy do we want to install to decrease carbon

emissions and energy dependence (see Section 5), but without excessively harming nature and wildlife?

4. Exogenous events can spontaneously change the topicality and relevance for certain goals and narratives.

We conclude from our interviews that energy independence is a crucial reason for the energy transition, especially against the current backdrop of political tensions in Europe. The dominance of this argument may be explained by the timing of our interviews. Europe was undergoing sharpened political and military conflict in Ukraine and there was increased public awareness of Germany's strong dependency on foreign energy resources, such as natural gas and oil imported from Russia (see e.g. Westphal 2014; Westphal & Fischer 2015).

Therefore, it is important to acknowledge that discussions about the energy transition cannot be separated from current events. Recent research studies the effect of so-called *tipping points* (e.g. WBGU 2011; Fichter & Clausen 2012). Examples of tipping points might be political crises. For example, the Fukushima incident in 2011 prompted Germany's current nuclear phase-out. Goals thus change and shift. Consequently, recent political and social developments must be considered when establishing communication tools. The need for proper narratives and the communication and presentation of motivations discussed above must encompass recent developments.

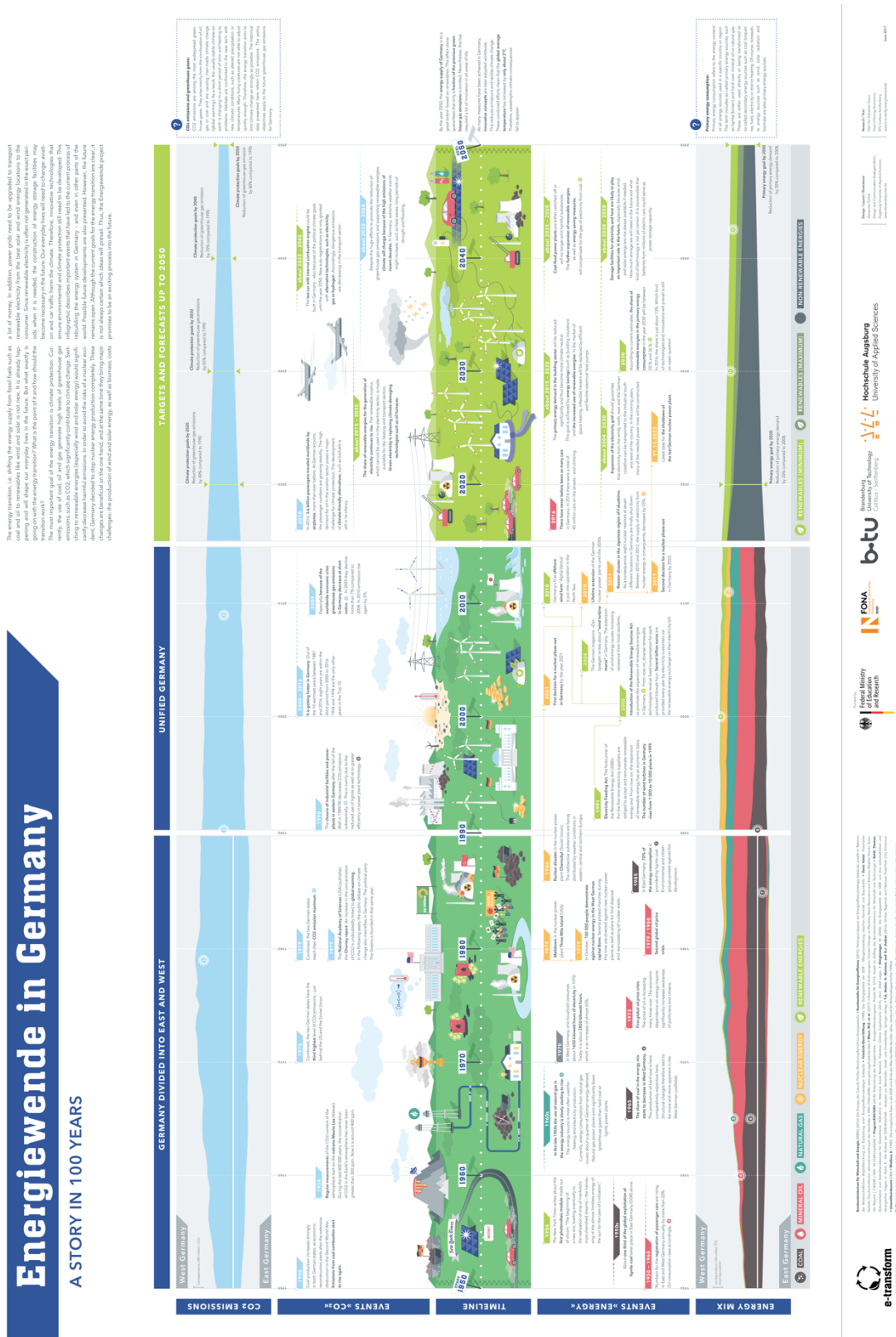
6.3 First Implementation: Infographic

The interviews were carried out as part of the research project e-transform, under the auspices of the research initiative 'Social-ecological Transformation of the Energy System' of the German Ministry of Education and Research. They focused on disseminating content, general orientation and knowledge regarding the energy transformation from a German perspective. The project created novel and advanced media artefacts (e-transform 2019). Knowledge transfer in this regard is important but a complex issue to achieve. Within this paper, we briefly describe infographics as one tool to communicate energy transition to the general public within a broader time-related narrative that addresses the transition's main goal, challenges and trade-offs.

Infographics can be used to present complex content in an appealing way for the general public. Smiciklas (2012) defines infographics as 'a visualization of data or ideas that tries to convey complex information to an audience in a manner that can be quickly consumed and easily understood' (p. 3), and it 'is a type of picture that blends data with design, helping individuals and organizations concisely communicate messages to their audience' (p. 3).

The infographic portrays the energy transition as a process over a period of 100 years – starting from 1950 up to the year 2050. The year 2050 is for many institutions and regulators a year which represents a target for reaching certain climate goals (see Section 2). The graphic can be separated into nine parts (3 x 3). The upper part shows actual and target greenhouse gas emissions for Germany as one of the major goals with highest relevance for stakeholders. The second part below uses a pictorial format to show important events and relevant points in time of the German energy transition since 1950 and is strongly connected to the data shown in the upper part.

Figure 4: Infographic: *Energiewende* (energy transition) in Germany (e-transform 2019).⁷



The third part shows the consumption and distribution of primary energy resources and by that the energy mix. The graphic can be separated into the past, the present and the future along the time axis.

The graphic illustrates an approach to portraying the energy transition as a long-term process that has resulted from the past (e.g. with economic growth and crises) and connects previous decades with more recent social and political developments, such as preferences for renewable energies and their financial support, as well as the widely supported nuclear phase-out. Furthermore, it displays methods (certain technologies) for reaching the goal of greenhouse gas reduction in the future via changes within the current and future energy mix. The graphic also indicates challenges; these include the recent increased demand for resources in the transport sector, the increase and relevance of wind power in the landscape, and technological tasks to integrate a higher share of volatile renewable energy sources into the current energy system.

The graphic portrays these aspects of the energy transition without giving the reader final answers for each of the recent and future challenges. In this way, it opens the door for debate and discussion. Furthermore, the graphic depicts certain threats for the coming decades, such as extreme weather events. The illustration is therefore a tool to bring people together for debate and learning, while not requiring answers to all the relevant questions and leaving room for individual opinions and debate on how to live in the future.

7. Recommendations and Conclusion

This paper describes essential challenges and conditions for communicating the energy transition process. Providing energy transition narratives is a useful tool for establishing adequate communication mechanisms, such as films, games, databases, homepages, pictures and infographics. They should include the motivation and goals of the transition, as well as facts, context and possible developments. This alone can help clarify the issues for stakeholders, especially for people who disagree on certain goals or favour different ones.

Mistrust and polarization can be countered by communicating, debating and improving people's understanding of the diverse and heterogeneous reasons for the energy transition, with their concurrent trade-offs (see e.g. Figure 1). Simplifying the transition process for laypeople is key to achieving a better understanding of it. Communicating relevant knowledge and interrelationships enables non-experts to better understand the process and differences in opinions between experts. We show an example of a media tool (infographic) that focuses on goals to effectively communicate the course of discussion regarding the transition process for non-experts.

An essential task for the coming years is to provide communication tools that incorporate the 'big story' of tackling climate change within smaller and individualised story lines that are specific to national and regional circumstances. As we have shown in Section 6, integrating a story line regarding motivations for the energy transition and challenges within a specific point of view, e.g. of a certain country, can deliver knowledge and understanding in an easier and more understandable manner.

For communication-related stakeholders, such as public institutions and interest groups these findings contribute to understanding arguments and to creating possible objective narratives for the energy transition, and may assist them in comparable transition processes worldwide. Further research should include broader

surveys on transition goals from a more diverse group of stakeholders (such as rural vs. urban). Furthermore, research should focus on ensuring that the language used in communication tools is appropriate for a lay audience without specific prior knowledge.

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Notes

¹ Current legislation aims to close the last nuclear power plant in Germany by the end of 2022.

² Until 2013, Rainer Baake led the very influential German think tank *Agora Energiewende* and was Undersecretary of State in the German *Federal Ministry for Economic Affairs and Energy* until 2018.

³ The Renewable Energies Act Levy or surcharge (EEG-Umlage) is the tool to collect money for every consumed unit of electricity. Currently it is about 6.4 €-cents/kWh for each household consumer. This money is used to pay for each kWh produced by renewable energy installations under the Renewable Energies Act (see e.g. Kreuz & Müsgens 2017).

⁴ Stuttgart 21 is a huge transport and urban development project in the German city of Stuttgart. These plans have been controversial and led to immense protests in the region and also other cities in Germany for years.

⁵ ‘Mega electricity link from north to south’: The term refers to the task of expanding the electricity grid in Germany, which triggers protests. The expansion is needed, as most of the renewable wind capacity is produced in the north of Germany and electricity has to be distributed to the industrial region in the west and south of the country – especially because of the nuclear phase-out and higher degrees of renewable energy in the German energy mix.

⁶ Joas, Pahle, Flachsland and Joas (2016) came to a comparable conclusion with very different social groups, e.g. with policy makers.

⁷ The infographic is available in English and German.

References

- Agora Energiewende (2016). Was bedeuten Deutschlands Klimaschutzziele für die Braunkohleregionen? [How will Germany's Goals for Climate Protection Influence Regions of Lignite Coal Extraction?], Analysis, Berlin, April 2016.
- Baake, R. (2013). Germany's *Energiewende*: The Prospects of a Grand – Scale Project, *Georgetown Journal of International Affairs*, Vol. 14, No. 1 (Winter/Spring 2013), Georgetown University Press.
- Baumer, E. P. S., Polletta, F., Pierski, N., Gay, G. K. (2015). A Simple Intervention to Reduce Framing Effects in Perceptions of Global Climate Change, *Environmental Communication*. <https://doi.org/10.1080/17524032.2015.1084015>
- Bertsch, V., Hall, M., Weinhardt, C., Fichtner, W. (2016). 'Public acceptance and preferences related to renewable energy and grid expansion policy: Empirical insights for Germany', *Energy* 114 (2016) 465-477. <https://doi.org/10.1016/j.energy.2016.08.022>
- Bigl, B. (2016). Fracking in the German press: securing energy supply on the eve of the 'Energiewende' – a quantitative framing-based analysis, *Environmental Communication*. <https://doi.org/10.1080/17524032.2016.1245207>
- Christensen, P. (1997). Different Lifestyles and their Impact on the Environment, *Sustainable Development*, Volume 5, Issue 1, pp. 30–35. [https://doi.org/10.1002/\(SICI\)1099-1719\(199703\)5:1%3C30::AID-SD59%3E3.0.CO;2-5](https://doi.org/10.1002/(SICI)1099-1719(199703)5:1%3C30::AID-SD59%3E3.0.CO;2-5)
- Djerf-Pierre, M., Cockley, J., Kuchel, L. J. (2015). Renewable Energy: A Comparative Study of Newspapers in Australia and Sweden, *Environmental Communication*, 10:5, 634-655. <https://doi.org/10.1080/17524032.2015.1056542>
- e-transform (2019). Homepage of the research project e-transform: www.e-transform.org, containing all relevant currently finished media artefacts and research results.
- Federal Ministry of Economics and Energy (FMEE) (2016). Die Energie der Zukunft, Fünfter Monitoring-Bericht zur Energiewende [The Energy of the Future, 5th Monitoring Report about the Energy transition], long version, year under report: 2015.
- Fischer, A., Peters, V., Vávra, J., Neebe, M., Megyesi, B. (2011). Energy use, climate change and folk psychology: Does sustainability have a chance? Results from a qualitative study in five European countries. *Global Environmental Change* 21(3), 1025-1034. <https://doi.org/10.1016/j.gloenvcha.2011.04.008>
- Friedman, S. M. (2011). Three Mile Island, Chernobyl, and Fukushima: An analysis of traditional and new media coverage of nuclear accidents and radiation, *Bulletin of the Atomic Scientists* 67(5) 55–65. <https://doi.org/10.1177/0096340211421587>

- German Advisory Council on Global Change (WBGU) (2011). Transformation zur Nachhaltigkeit [Transformation towards Sustainability], Facts-sheet No. 4/2011. Berlin.
- German Federal Government (2010). Energiekonzept für eine umweltschonende, zuverlässige und bezahlbare Energieversorgung [Energy Strategy to promote an environmental friendly, reliable and affordable energy distribution].
- German Federal Government (2011). Der Weg zur Energie der Zukunft - sicher, bezahlbar und umweltfreundlich, Eckpunkte des Energiekonzepts von 2011 [The Path to the Energy of the Future – secure, affordable and environmentally friendly, basic points of the energy strategy of 2011].
- Grunwald, A. (2014). Sustainability research as inter- and trans-disciplinary activity: the case of German *Energiewende*, *Problemy Ekorozwoju – Problems of Sustainable Development* 2014, vol. 9, no 1, 11-20.
- Hake, J.-F., Fischer, W., Venghaus, S., Weckenbrock, C. (2015). The German *Energiewende* – History and status quo, *Energy* 92, 532-546. <https://doi.org/10.1016/j.energy.2015.04.027>
- Holt, D., Markemeyer, R. (2012). Media Coverage of Sustainable Development Issues – Attention Cycles or Punctuated Equilibrium?, *Sustainable Development* 20, pp. 1–17.
- Joas, F., Pahle, M., Flachsland, C., Joas, A. (2016). Which goals are driving the *Energiewende*? Making sense of the German Energy Transformation, *Energy Policy* 95, 42–51. <https://doi.org/10.1016/j.enpol.2016.04.003>
- Jurca, A. M. (2014). The *Energiewende*: Germany's Transition to an Economy Fueled by Renewables, *The Georgetown International Environmental Law Review*, Vol. 27:141.
- Kreuz, S., Müsgens, F. (2017). The German *Energiewende* and its roll-out of renewable energies: An economic perspective, *Frontiers in Energy* 11(2): 126 – 134. <https://doi.org/10.1007/s11708-017-0467-5>
- Kreuz, S., Müsgens, F. (2018). Measuring the cost of renewable energy in Germany, *The Electricity Journal* 31, May 2018, 29-33. <https://doi.org/10.1016/j.tej.2018.04.002>
- Langevin, J., Gurian, P. L., Wen, J. (2013). Reducing energy consumption in low income public housing: Interviewing residents about energy behaviors. *Applied Energy*, 102, 1358-1370. <https://doi.org/10.1016/j.apenergy.2012.07.003>
- Leipprand, A., Flachsland, C., Pahle, M. (2017). Advocates or cartographers? Scientific advisors and the narratives of German energy transition, *Energy Policy* 102 (2017), 222-236. <https://doi.org/10.1016/j.enpol.2016.12.021>
- Leipprand, A., Flachsland, C. (2018). Regime destabilization in energy transitions: The German debate on the future of coal, *Energy Research & Social Science* 40 (2018), 190-204. <https://doi.org/10.1016/j.erss.2018.02.004>
- Marchand, A., Walker, S. (2008). Product development and responsible consumption: designing alternatives for sustainable lifestyles. *Journal of Cleaner Production*, 16 (11), 1163-1169. <https://doi.org/10.1016/j.jclepro.2007.08.012>
- Morten, T., Müller, K. (2016). Lusatia and the coal conundrum: The lived experience of the German *Energiewende*, *Energy Policy* 99 (2016), 277–287. <https://doi.org/10.1016/j.enpol.2016.05.024>

- Nießen, S. (2016). Energiewende – Complements to the Mainstream in the Media, *International Journal for Nuclear Power* Vol. 61, Issue 3.
- Nippa, M., Meschke, S. (2015). Germany's "Energiewende" as a Role Model for Reaching Sustainability of National Energy Systems? History, Challenges, and Success Factors, *Handbook of Clean Energy Systems*. <https://doi.org/10.1002/9781118991978.hces175>
- O'Neill, S. J., Nicholson-Cole, S. (2009). "Fear won't do it": Promoting positive engagement with climate change through visual and iconic representations. *Science Communication*, 30(3), 355–379. <https://doi.org/10.1177/1075547008329201>
- Öko-Institut (1981). Energie-Wende: Wachstum und Wohlstand ohne Erdöl und Uran [Title in English: *Energiewende – Growth and Wealth without Oil and Uranium*], Frankfurt am Main, S. Fischer.
- Rebich-Hespanha, S., Rice, R. E., Montello, D. R., Retzlöff, S., Tien, S., Hespanha, J. P. (2015). Image Themes and Frames in US Print News Stories about Climate Change, *Environmental Communication*, 9:4, 491-519. <https://doi.org/10.1080/17524032.2014.983534>
- Renewable Energy Agency (2013). Erneuerbare *Energiewende* ist bei Deutschen weiterhin hoch im Kurs [Renewable Energy transition is Popular in Germany]; *Renews Kompakt*, September 2013.
- Renewable Energy Agency (2016). Die Akzeptanz für Erneuerbare Energien im Spiegel von Umfragen in Industriestaaten [The Acceptance of Renewable Energies in Surveys for Industrialized Countries]; *Renews Kompakt* from March 2016.
- Renn, O., Dreyer, M. (2013). Risiken der *Energiewende*: Möglichkeiten der Risikosteuerung mit Hilfe eines Risk-Governance-Ansatzes [Risks of the Energy transition: Chances for the Distribution of Risks with the help of the Risk-Governance-Approach], *DIW Vierteljahreshefte zur Wirtschaftsforschung*, No. 3, pp. 29-44. <https://doi.org/10.3790/vjh.82.3.29>
- Renn, O., Marshall, J. P. (2016). Coal, nuclear and renewable energy policies in Germany: From the 1950s to the "Energiewende", *Energy Policy* 99, pp. 224-232. <https://doi.org/10.1016/j.enpol.2016.05.004>
- Röpke, L. (2013). The development of renewable energies and supply security: A trade-off analysis, *Energy Policy* 61 (2013), 1011–1021. <https://doi.org/10.1016/j.enpol.2013.06.015>
- Ryghaug, M. (2011): Obstacles to Sustainable Development: The Destabilization of Climate Change Knowledge, *Sustainable Development*, 19, pp. 157–166. <https://doi.org/10.1002/sd.431>
- Schmalensee, R. (2012). Evaluating Policies to Increase Electricity Generation from Renewable Energy, *Review of Environmental Economics and Policy*, Vol. 6, Issue 1, Winter 2012, pp. 45–64. <https://doi.org/10.1093/reep/rer020>
- Schubert, D. K. J., Möst, D. (2014). Social Acceptance and Energy Pathways: deviations of Public Opinions and Energy Targets; Conference Proceeding from 14th IAEE European Conference "Sustainable Energy Policy and Strategies for Europe".
- Setton, D., Matuschke, I., Renn, O. (2017). Soziales Nachhaltigkeitsbarometer der Energiewende 2017 – Kernaussagen und Zusammenfassung der wesentlichen Ergebnisse [Social Sustainability Barometer of the Energy

- Transition 2017 – Quintessence and Summary of the Most Substantial Results], Institute for Advanced Sustainability Studies (IASS), Potsdam, Germany, DOI: 10.2312/iass.2017.019.
- Shih, T.-J., Lin, C.-Y. (2016). Developing Communication Strategies for Mitigating Actions Against Global Warming: Linking Framing and a Dual Processing Model, *Environmental Communication*. <https://doi.org/10.1080/17524032.2016.1154886>
- Smiciklas, Mark (2012). *The Power of Infographics – Using Pictures to Communicate and Connect with Your Audience*, Pearson Education.
- Sühlsen, K., Hisschemöller, M. (2014). Lobbying the ‘Energiewende’. Assessing the effectiveness of strategies to promote the renewable energy business in Germany, *Energy Policy* 69 (2014), 316–325. <https://doi.org/10.1016/j.enpol.2014.02.018>
- Trinczek R., (2009). Wie befrage ich Manager? Methodische und methodologische Aspekte des Experteninterviews als qualitative Methode empirischer Sozialforschung [How do I survey Manager? – Methodological Aspects of Expert Interviews as a Qualitative Method of Empirical Social Research]. In A. Bogner, B. Littig, W. Menz (Hrsg.). *Experteninterviews: Theorien, Methoden, Anwendungsfelder* [Expert Interviews: Theories, Methods, Areas of Application], Wiesbaden: Vfs.
- Valkila, N., Saari, A. (2013). Experts' view on Finland's energy policy. *Renewable and Sustainable Energy Reviews*, 17, 283-290. <https://doi.org/10.1016/j.rser.2012.09.036>
- Wallquist, L., Visschers, V. H., Siegrist, M. (2009). Lay concepts on CCS deployment in Switzerland based on qualitative interviews, *International Journal of Greenhouse Gas Control* 3(5), 652-657. <https://doi.org/10.1016/j.ijggc.2009.03.005>
- Westphal, K. (2014). The European Gas Puzzle: Over-Securitization, Dilemmas and Multi-level Gas Politics on the European Continent a Year after ‘Euromaidan’, Norwegian Institute of International Affairs, Policy Brief 11/2014.
- Westphal, K., Fischer, S. (2015). Energy and Statecraft: A German Perspective, in: Bleischwitz, R., Fischer, S., Holland, A., Johnson, C., Westphal, K. (2015): *Reducing Vulnerability: A Transatlantic Approach to Energy Security*, AICGS Policy Report 60, American Institute for Contemporary German Studies, The John Hopkins University.
- Zoellner, J., Schweizer-Ries, P., Wemheuer, C. (2008). Public acceptance of renewable energies: Results from case studies in Germany, *Energy Policy* 36 (2008) 4136–4141. <https://doi.org/10.1016/j.enpol.2008.06.026>

Appendix

Table 3: Background information regarding the interview partners. Some institutions performed the interviews with more than two energy experts.

No.	Institution	Category
1	City of Frankfurt/Main	Administration
2	District Office Dillingen	
3	City of Munich, Planning Department (Environmental Issues)	
4	City of Munich, Economic Department	
5	City of Munich, Planning Department (Urban Planning)	
6	Chamber of Crafts Frankfurt-Rhein-Main	Association/ Organization/ NGO
7	Bavarian Chamber of Architects	
8	Chamber of Crafts Swabia	
9	Energy cooperative in central Hesse	
10	Environmental Competence Center Augsburg	
11	Greencity Munich, Environmental NGO	
12	Chamber of Industry and Commerce Munich and Upper Bavaria	
13	Caritas, social service organizations	
14	Energy Information Center Frankfurt	Private Company
15	Bank, Frankfurt	
16	Automobile producer	
17	Architect and Building Design	
18	Company within Energy and Housing Industry	
19	Regional Energy provider	
20	Operator of Industrial Locations	
21-24	4 x Architect's Office	