



***Study Program of the  
German-Japanese Energy  
Transition Council***

**Strategic framework and socio-cultural  
aspects of the Energy Transition**

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# Final Report

Strategic Topic 2 GJETC's study program:  
**“Strategic framework and socio-cultural aspects  
of the Energy Transition”**



## Project Consortium



IZES gGmbH (Institut für ZukunftsEnergie- und Stoffstromsysteme)  
Department Environmental Psychology  
Jan Hildebrand, Sascha Heib, Irina Rau, Ann-Katrin Knemeyer  
Altenkesseler Str. 17, Gebäude A1  
66115 Saarbrücken  
Germany



Arepo Consult  
Dr. Christine Wörten, Gisa Holzhausen,  
Christina Reineck, Sarah Rieseberg  
Albrechtstrasse 22  
10117 Berlin  
Germany



Institute for Global Environmental Strategies (IGES)  
Climate and Energy Area  
Dr. Kentaro Tamura  
2108-11 Kamiyamaguchi, Hayama, Kanagawa, 240-0115  
Japan



Nagoya University  
Graduate School of Environmental Studies  
Prof. Dr. Yasushi Maruyama, Dr. Memi Motosu, Emi Ichiyanagi  
(Ph.D. Candidate of Kyoto University)  
Furo-cho, Chikusa-ku, Nagoya, Aichi, 464-8601  
Japan



National Institute for Environmental Studies  
Center for Social and Environmental Systems Research  
Dr. Toshihiko Masui, Dr. Shuichi Ashina  
Ibaraki Prefecture, Tsukuba, Onogawa, 16-2  
Japan

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# 1 Summary

Maintaining a world worth living for coming generations needs a large-scale societal transformation towards sustainability, starting now. One central component of this urgently needed societal transformation must be an energy transition, cutting off fossil-based, greenhouse gas emitting energies and instead, fostering the extension of renewable, climate-friendly energies. To be successful, the energy transition must become part of a positive socio-cultural vision of the future:

## 1.1 Objectives and approach

The German-Japanese Energy Transition Council (GJETC) is a continuous form of cooperation between experts from both countries with regard to an energy transition. The Council's work and in particular its study program are based on the concept of mutual learning from both good examples and shortcomings. Several strategic topics have been identified in the discussion with Japanese and German experts as being of mutual interests for both sides. This study covers the strategic framework and socio-cultural aspects of the energy transition. The purpose of the study is to examine in a transparent way and from different perspectives the strengths and weaknesses of both countries, identify opportunities for collaboration and for mutual learning by exchange of experts and other stakeholders, to improve the strategic frameworks and support the energy transition with socio-culturally adequate measures. The present comparative study is a coproduction between Japanese and Germany research institutes, facilitating mutual learning through joint research, elaborating socio-cultural and socio-political preconditions and success factors in both countries, finding similarities and differences in both cultures and pointing out ongoing discussions, when it comes to the design of a sound, safe environmentally and economically sustainable energy system. The study discusses opportunities to compare socio-cultural aspects of the energy transition in two countries – Japan and Germany -, which have already begun the energy transition process, but are still confronted with some obstacles.

The methodological design of this research study is divided into three steps or work packages. In the first step, the national researchers described the situation in their countries. These desk studies used two tools: they were guided by a set of questions specified by the GJETC, which the researchers also had the opportunity to discuss with the GJETC experts as well as with the GJETC Secretariat. The questions were answered one by one, but in order to reduce duplication, five narratives were developed that provide background to the questions. The resulting report was reviewed by two reviewers from the GJETC.

In the second and third step, work packages 2 and 3, the research teams reviewed the desk studies of the respective other country team, and provided comments. In a joint writing process, the differences and commonalities between the two countries were systematically extracted and learning potential was identified. This led to recommendations for policy makers, civil society, the research and education community, and a cross-country-multi-stakeholder-dialogue.

The research team is deeply grateful for the opportunity to work on this project, and for the advice by the GJETC members as well as for the support provided by the GJETC Secretariat.

## **1.2 Findings of the comparative analysis**

### **1.2.1 Background**

While half a world apart, the two countries are faced with a set of common challenges: third and fourth biggest economies of the world, heavily industrialized countries with a poor resource base, technology leadership, a dominating car industry, high quality of life, and a well-educated but aging and shrinking population. The energy systems are highly reliable and well developed, and used to be strongly centralized. But more recently, some divergence has become visible.

In Japan, the existing energy system was seriously called into question after the tsunami and the Fukushima Daiichi nuclear disaster in March 2011. The consequence was a crisis of confidence in the safety of nuclear power plants in growing parts of the Japanese society. Searching for alternatives of energy supply for the highly industrialized Japanese economy was intensified, although the continued usage of nuclear power is still an option. In May 2016, following the Paris Agreement, the current Cabinet reaffirmed its goal of reducing GHG emissions by 80% by 2050, which inevitably requires rapid and dramatic transformation of the Japanese energy system. Questions as how to achieve such a goal, what kind of strategy is required, and how possible strategies should be formulated began to attract attention.

In Germany, the Fukushima Daiichi nuclear disaster was a catalyst for the energy transition, which already was politically proclaimed and practically started some years before: The catastrophe in Fukushima yielded a decided change in the government's attitude towards nuclear power, and thus, the energy transition became a major project of German policy. With the acceleration of the transition activities, discussions about public acceptance for new infrastructures (wind turbines, transition lines) and growing costs of the energy transition were intensified and became an object in the focus of social research. Besides this pair of opposites, nuclear on the one and renewables on the other hand, also the issue of coal-fired power plants is especially in Germany a big issue of conflict. Questions regarding the exact timing of phasing out the German coal power industry and connected regulating measures are subject of current political discussions. In this report, the topic of coal phase-out takes only a very small part due to the focus on other issues, still it is important and should be addressed in further research (cf. 7.5).

### **1.2.2 Strategic framework conditions, targets, and strategies**

There are strong commonalities between the two countries – energy policy is based on the principles of economic efficiency, energy security and environmental sustainability. Long-term strategic policy frameworks exist, and considerable attention has been given to the decarbonization of the energy sector. Particularly Germany though has not taken enough steps to support the energy transition and decarbonization in the heat and mobility sectors. Both countries risk their technological and economic leadership if they do not show more ambition in challenging their industry to provide carbon-free products for these sectors. Diesel-Gate should be a warning shot for regulatory policy as well as for the industry.

However, there are also major differences between the energy policy priorities, particularly with respect to the reliance on nuclear energy. While in both countries nuclear energy was perceived as the future in the 1960s, perception has changed significantly over the last

decades. Still – the paths both countries have taken in this regard vary decisively. Despite the fact that the Fukushima Daiichi nuclear disaster directly affected Japan, and only very indirectly affected Germany, the event resulted in a decided policy shift in Germany and retriggered the nuclear phase-out process already in place. The political consequences in Japan seem minimal in comparison.

Significant differences are also noted in the governance structures: while Germany is responding to demands of the European Union, for Japan, no such supranational body influences Japanese policy. Coordination within the government is challenging, resulting in contradictory statements between the environment and economic ministries in Japan.

The policy frameworks have led to specific economic conditions. In both countries, residential energy costs are high. In Germany, power prices for large industries are low because they are exempted from a significant share of infrastructure costs, taxes, and other fees, to limit competitive disadvantages for energy-intensive industries (and “carbon leakage”). They are burdening private and commercial consumers as well as small industries, which causes criticism. In Japan, businesses are also wary of high power prices, and this resistance is limiting the willingness of the government for stronger climate mitigation measures.

Power companies in Germany encounter significant losses. They have not been able to utilize the economic opportunities offered by the energy transition. Now they are restructuring and re-orienting the corporate strategies. Japanese power companies are not challenged by economic losses.

### **1.2.3 Socio-cultural preconditions for a sustainable climate-friendly economic model, lifestyles, and behavior**

Socio-cultural conditions, lifestyles and behavior can be and are drivers and barriers for energy transition processes in both countries. People in both countries have a favorable view of energy transition and a perception of nuclear power as risky.

In Japan, due to its geographic situation, energy security concerns have been engrained in energy consumption behavior since the oil crisis. By international comparison Japan and Germany rank high concerning overall energy efficiency due to sector specific successful energy efficiency policies. Nevertheless in both countries huge energy efficiency potentials still exist. Although both countries have a strong car industry, Japan is ahead of Germany regarding the needed structural changes and innovation in the transport sector.

In Germany, a long-standing grassroots interest in energy issues exists, starting from the anti-nuclear movement in the 1970s. This movement has been influencing energy policy in many ways over many decades, including pushing for and developing renewable energies, providing data, research and insights to journalists and the public. Japan does not avail of such a strong movement.

Both countries are experiencing an aging society and a move to urbanization. This is impacting the work force, and imposing additional infrastructure requirements. A shrinking population provides an opportunity for energy savings but it is likely that this can only be leveraged with additional policy measures.

An interesting change in the economic model is the recent trend to “prosumerism”: more and more people produce and consume their own electricity, for example from their own roofs (Germany) or from community power initiatives (Japan).

#### **1.2.4 Public discourse, acceptance, and existing narratives**

Both countries show significant similarities in acceptance patterns: People like renewable energy but “not in their backyard”. Acceptance has been generated in Germany, often through economic participation models. In Japan, the government has tested interesting models for policy dialogue, e.g. in the shape of deliberative polling.

The scientific community also plays an important role as a provider of data, an advisor to decision makers, a facilitator of discourse and an educator. This can be studied well in Germany where independent think tanks have provided alternative visions to the government mainstream. Overall, this is enhancing public acceptance as well as the quality of the public discourse and cannot be underestimated in its impact.

### **1.3 Recommendations**

Looking at the energy transition pathways of Japan and Germany it becomes obvious that both countries face very big, similar challenges. In regard to the strategies to counter these challenges, the two countries also show great similarities (e.g. strong development of renewables, moving towards more participatory, decentral governance) but significantly differ in some respects (e.g. nuclear energy, transformation of the transport sector).

The comparison has identified a number of specific topics on which an exchange between policy makers and mutual learning will be very beneficial, for example, on energy efficiency policies and programs and their effective implementation, on public dialogue and participation processes, and on policy design details and their impact (e.g. FIT, auction mechanisms). For these it is highly recommended to establish a bilateral policy research dialogue between the two countries.

This dialogue needs to be complemented by a multi-stakeholder discussion that includes businesses as well as civil society and the research community. Here, concerns about energy security and affordability, safety and environmental impacts can be voiced. Civil society needs to be strengthened, and German NGOs can provide such support to Japan. But the role of the research community in these processes cannot be underestimated: the research community can help identify and understand the transferable lessons between the countries that have been partially described in this study. It can help avoid suboptimal experiences in that transfer and assess consequences on the basis of scientific evidence. A diverse and independent research community is a precondition for informed decision making along the way of the energy transition.

## 2 Introduction

Several global environmental, economic, and social trends are leading the planet towards critical conditions for human kind. Changing these trends and maintaining the planet habitable for coming generations demands a large-scale societal transformation towards sustainability. One major component of this societal transformation is the energy transition. We understand the energy transition as a planned and structured process, replacing fossil-based energies with renewable, sustainable, and climate-friendly energies and overall establishing an energy supply system with minimized risk, while reducing absolute energy demand.

In Japan, the existing energy system was called into question after the tsunami and the Fukushima Daiichi nuclear disaster in March 2011. The consequence was a crisis of confidence in the safety of nuclear power plants in growing parts of the Japanese society. The search for alternatives for energy supply for the highly industrialized Japanese economy was intensified, although the continued usage of nuclear power was, and still is an option. In May 2016, following the Paris Agreement, the current Cabinet reaffirmed its goal of reducing GHG emissions by 80% by 2050, which inevitably requires rapid and dramatic transformation of the Japanese energy system. Questions as to how to achieve such a goal, what kind of strategy is required, and how such a strategy should be formulated began to attract attention.

In Germany, the Fukushima Daiichi nuclear disaster strengthened the energy transition process already in place. The German term “Wende” means transformation, transition, or drastic change. In this document, we will analyze three major paradigms that changed compared to post-war decades: (i) a move away from nuclear power, (ii) a paradigm shift from ever larger (conventional) power plants to decentralized supply and (iii) a change in the understanding of the term energy security. The term “Energiewende” has been coined in the late 1970s/early 1980s in Western Germany. The proponents highlighted that an alternative energy future was technically feasible and environmentally and socially more benign. Over the last 30 years, the concept became more specific, and was supported with qualitative aspects and quantitative targets. It was only after Fukushima that the energy transition, understood as exclusively renewable, became an all-inclusive project of German policy and the overall debate whether a transition was really necessary was finished. From here on, the debate only focused around the question of how to transition to 100% renewables. Political discussions moved to issues of public acceptance for new infrastructures (particularly wind turbines and transition lines) and the costs of the “Energiewende”.

Looking at the different developments, the focus of this Japanese-German comparative study is on identifying the relevant socio-cultural and socio-political preconditions and success factors for energy transition. By pointing out the enabling factors and barriers for a successful energy transition in both countries, the study intends to facilitate mutual learning through joint research. This way, the study contributes to supporting both countries on their way to a sound, safe and social, environmentally, and economically sustainable energy system.

The study will show that the transition of established energy systems in different countries not only requires technological innovation, supporting legal frameworks, and a new form of energy economics, but also changes in the respective socio-technical systems. The interdisciplinary research approach will highlight that a transition towards an energy sustainable society will not be successful, if socio-cultural aspects are disregarded.

### 3 Methodological and conceptual approach (WP 1)

This comparative analysis looking at strategic framework and socio-cultural aspects of the energy transition utilizes mixed methods from qualitative social research, historic narratives, and innovation research to provide answers to a specific set of questions set out in the terms of references. It is a desk-study based on primary policy documents, as well as the historic semi-scientific literature expressing political view points since the post-war period.

The underlying hypothesis of this study is that the energy transition in both countries has been imbedded in socio-cultural, ecological, technical, and economic developments and can only be explained by looking at the interdependency of the different factors. In order to answer the Terms of Reference (ToR) questions and to analyze the different factors in one theoretical framework, the multi-level perspective (MLP) on transitions (Geels, 2012) is taken as a guiding theoretical approach. This approach allows us to describe and discuss the historical trends and framework conditions as a background, and consider the actions, articulations, and visions of innovative societal niches as driving factors for transition. Where appropriate to understand a dynamic development perspective, the three levels a) historical background, b) status quo, and c) interim conclusions were used to answer the ToR-questions. The methods used include mainly document analysis, supplemented by internal discussions both within the participating research institutes and the consortium.

#### 3.1 Narratives and Geels' multi-level framework

As it was found that the ToR-questions were touching on important aspects but did not provide full coverage of the relevant context, narratives on specific strands of the discussion in Germany and Japan were added. These narratives were then interpreted using Geels' multi-level perspective (MLP) as a heuristic framework, showing that all narratives can be interpreted as representing a niche-regime transition.

Depending on their background, researchers and scientists may emphasize different aspects and explanation patterns for a transition process. Political scientists might stress legislative processes and policies, engineers might stress technical innovation, lawyers might emphasize legal frameworks for new technologies, psychologists might attribute change to changing attitudes and behaviors (Bruns, 2008; Geels 2012). Geels' multi-level perspective acknowledges that only a combined interdisciplinary expertise can fully explain the overall transformation process and can grasp all elements of the transition. Geels points out that

*“The basic premise of the multi-level perspective is that transitions are non-linear processes that result from the interplay of multiple developments at three analytical levels: niches (the locus for radical innovations), socio-technical regimes (the locus of established practices and associated rules), and an exogenous socio- technical landscape (Rip and Kemp, 1998; Geels, 2002, 2005).”* (Geels 2012, p. 472).

In this study, we strive to identify how different niches and socio-technical regimes within one overarching socio-technical landscape succeeded to create the momentum for the overall transition in Germany, and did not yet quite succeed to achieve an overall transition in Japan.

In order to structure the presentation of the niches, regimes, and the overarching landscape, we will present different sets as so called “narratives”. The overarching narratives describe



individual aspects, such as the German anti-nuclear paradigm shift, as multi-decade trends. The narratives allow us to better visualize the interdependence of the different niche-regime processes in both countries.

The parallel nature of the three different core narratives in Germany underlines that there has not been one single cause or driver, but that the German energy transition was and still is a result of changes on several levels and dimensions. In Japan, two different narratives were identified. By juxtaposing the different narratives in each country, the lateral alignments of ideas, developments, unexpected linkages, tipping points and windows of opportunity becomes obvious (Geels 2012, p. 474).

The method of presenting parallel developments in different narratives also stresses the temporal orientation of the multi-level perspective. Narratives help to turn single events into episodes and, therefore, frame issues in a certain way which gives significance to interdependent events over time. They illustrate the MLP.

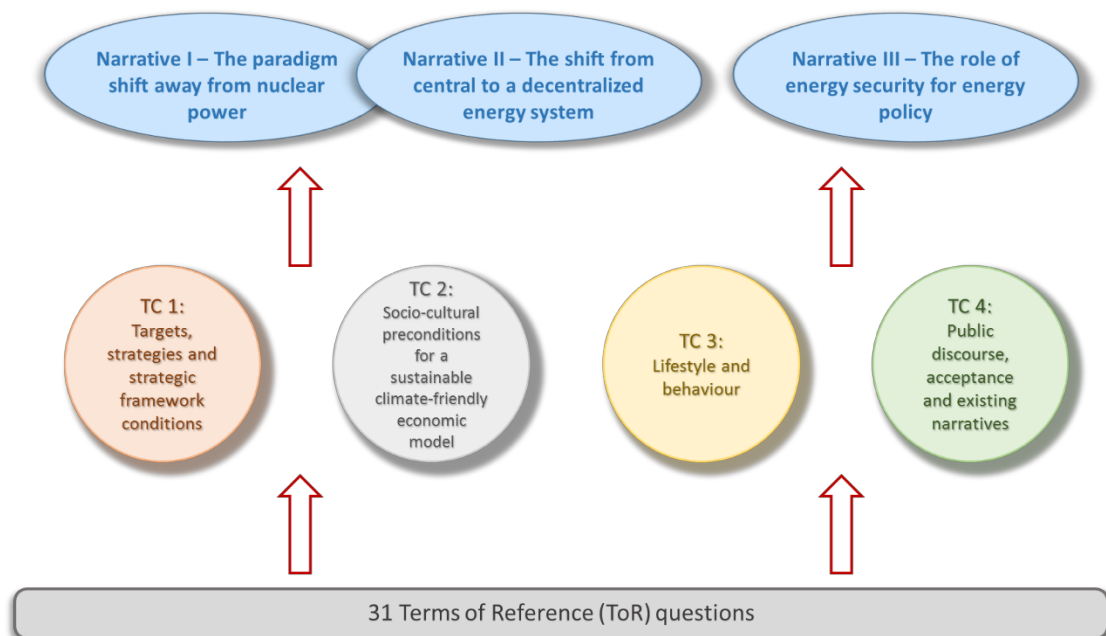
The identified narratives with intertwining effects to several ToR questions in the German context are:

1. The paradigm shift away from nuclear power (induced by the Anti-nuclear niche)
2. The paradigm shift from centralized to decentralized power systems (induced by the decentralization niche)
3. The role of energy security for energy policy (induced by the security niche)

The identified narratives with intertwining effects to several ToR questions in the Japanese context are:

1. A developing narrative for nuclear phase-out and decentralization
2. The role of energy security for energy policy

Looking at the co-existing narratives existing in each country, parallel developments and interdependencies become evident. Thus, as the MLP proclaims, they should not be understood as independent phenomena but as facets of a systemic perspective. The narratives described are the most dominant ones in each country and non-exhaustive. In order to make the coherence clearer, the narratives are narrated first in section 4. The discussion of the ToR-questions in the following section 5 will then refer back to them. Thus, the narratives constitute the empirical evidence base for the claims in the ToR questions. In WP 2, section 6, each research team provides comments to the other so that the different topical aspects can be compared.



**Figure 1. Overview of the conceptual approach to analyze the strategic framework and socio-cultural aspects of the energy transition in Japan and Germany.**

The list of ToR questions (see table 1) covers a broad spectrum of diverse political, social, cultural, historical, economic, and ecologic aspects that determine the general framework conditions which build the prerequisites for the transformation of the energy system in Japan and Germany. To create a structure, the ToR questions were allocated to four main topical clusters according to their content, nevertheless a few questions could be allocated to more than one cluster (e.g. Q 7). Additionally, some questions compose cross-sectional topics that show close links between several clusters and/or questions. Hence, these can only be answered within the context of the reciprocal comparison and commenting on Japanese and German contributions (e.g. Q 28 ff.). On a meta-level, three overarching narratives were identified, which describe long-time trends of interdependent processes.

### 3.2 Terms of Reference questions

In order to guarantee a harmonized approach between the German and Japanese research teams and to create a common understanding the project consortium clustered the ToR-questions in 4 thematic groups (Table 1). While most questions were only answered within one topical cluster, some of them touch upon issues in different clusters and thus were referred to in different sections of chapter 4, 6 and 7.

**Table 1. Overview of clustered ToR questions (own compilation based on ToR).**

Topical Cluster	Terms of Reference Questions
<b>(TC I) Targets, strategies, and strategic framework conditions</b>	<ul style="list-style-type: none"> <li>Q1 Which targets, strategies and strategic framework conditions for an energy transition are already available or planned in both countries?</li> </ul>

Topical Cluster	Terms of Reference Questions
	<ul style="list-style-type: none"> <li>• Q2 What is the role of the general policy landscape?</li> <li>• Q3 How does the German/Japanese government address possible carbon leakages of industry?</li> <li>• Q4 How does German/Japanese government handle possible losses of power companies that are transitionally caused by the energy transition? (e.g. early retirement of coal or nuclear power plants of private companies)</li> <li>• Q5 What are successful examples and failures in gaining support from citizens and confidence of investors in strategic frameworks?</li> <li>• Q6 Are the targets, strategies, and strategic framework conditions sufficient for achieving energy transition in both countries?</li> <li>• Q7 What has been the role of science in generating knowledge on technologies, potentials, feasible scenarios, policies, and impacts? What has been its role in creating a consensus or not on the feasibility of an energy transition?</li> </ul>
<p><b>(TC II) Socio-cultural preconditions for a sustainable climate-friendly economic model</b></p>	<ul style="list-style-type: none"> <li>• Q8 Which socio-cultural preconditions are already in place for a sustainable and climate friendly economic model?</li> <li>• Q9 Which were the drivers, which the barriers for such a model to date in both countries?</li> <li>• Q10 What has been the role of socio-cultural movements and traditions in catalyzing a decision on an energy transition in general, but maybe also in hindering its implementation in practice (resistance against e.g. wind power or high voltage lines, cf. also question in acceptance below)?</li> <li>• Q7 What has been the role of science in generating knowledge on technologies, potentials, feasible scenarios, policies, and impacts? What has been its role in creating a consensus or not on the feasibility of an energy transition?</li> <li>• Q14 Which conditions in economic structure (in general/in the energy sector; e.g. decentralized/municipal vs. centralized structures) support or hinder an energy transition?</li> <li>• Q15 What is the impact of the aging societies?</li> </ul>

Topical Cluster	Terms of Reference Questions
	<ul style="list-style-type: none"> <li>• Q16 What is the influence of urbanization (regarding e.g. sustainable transport systems, lifestyles) but also rural development opportunities (e.g. with renewable energies but also difficulties of finance for public administrations)?</li> <li>• Q17 Which socio-cultural preconditions are needed or already in place for a sustainable and climate friendly economic model?</li> </ul>
<b>(TC III) Lifestyle and behavior</b>	<ul style="list-style-type: none"> <li>• Q19 What approaches on changes of lifestyle and actors' behavior in the field of consumption, habitation, mobility, products, production, and services are in place for an energy transition?</li> <li>• Q20 How / why do German/Japanese power customers accept current higher electricity prices due to German energy transition?</li> <li>• Q21 How do traditions, climate, and lifestyles influence the awareness of citizens, e.g. on thermal insulation of buildings?</li> <li>• Q22 How can shifts in lifestyle and actors' behavior encouraged and enabled by policies?</li> </ul>
<b>(TC IV) Public discourse, acceptance, and existing narratives</b>	<ul style="list-style-type: none"> <li>• Q23 What has been the degree of acceptance for certain technologies such as high voltage lines, wind parks, utility scale PV parks, CCS, nuclear energy in both countries?</li> <li>• Q24 How is the energy transition perceived by the Japanese and German general public (e.g. evidence based by polls)?</li> <li>• Q25 How does the German/Japanese government communicate to the public about targets, technologies, measures, energy prices?</li> <li>• Q26 What needs to be done to enhance public acceptance in Japan/ in Germany?</li> </ul>
<b><i>Questions being answered by comparing Germany and Japan</i></b>	<ul style="list-style-type: none"> <li>• Q18 To which extent does human capacity in science and education as well as in development and implementation of technologies and solutions need to be enhanced?</li> <li>• Q27 Which sociocultural experiences can be transferred from the longstanding tradition of ecopolitical groups in Germany to the situation of Japan?</li> <li>• Q28 How does the geographical difference between the countries affect the public understanding about energy transition?</li> </ul>

Topical Cluster	Terms of Reference Questions
	<ul style="list-style-type: none"> <li data-bbox="539 342 1390 510">• Q29 Which targets, strategies and strategic framework conditions are necessary for a positive implementation of the energy transition and possible, based on the existing potentials (input on potentials provided from ST 1 study and possibly from BMUB/MOEJ project)?</li> <li data-bbox="539 544 1390 622">• Q30 What socio-cultural conditions need to be in place for a successful energy transition?</li> <li data-bbox="539 656 1390 734">• Q31 What can Germany learn from Japan in all the above-mentioned areas and vice versa?</li> </ul>

## 4 Narratives (WP 1)

The following chapter outlines the different narratives in Germany and Japan. Each of the narratives represents a combination of a particular niche with a particular socio-technical regime within the shared socio-technical landscapes of Germany or Japan. For Germany, the following three narratives were identified:

1. The paradigm shift away from nuclear power (induced by the Anti-nuclear niche)
2. The change in thinking from centralized to decentralized power systems (induced by the decentralization niche)
3. The role of energy security for energy policy (induced by the security niche)

After describing each of the German narratives, the respective narratives for Japan will be described. These narratives are

1. A developing narrative for nuclear phase-out and decentralization
2. The role of energy security for energy policy (induced by the security niche)

### 4.1 German narrative I: The paradigm shift away from nuclear power

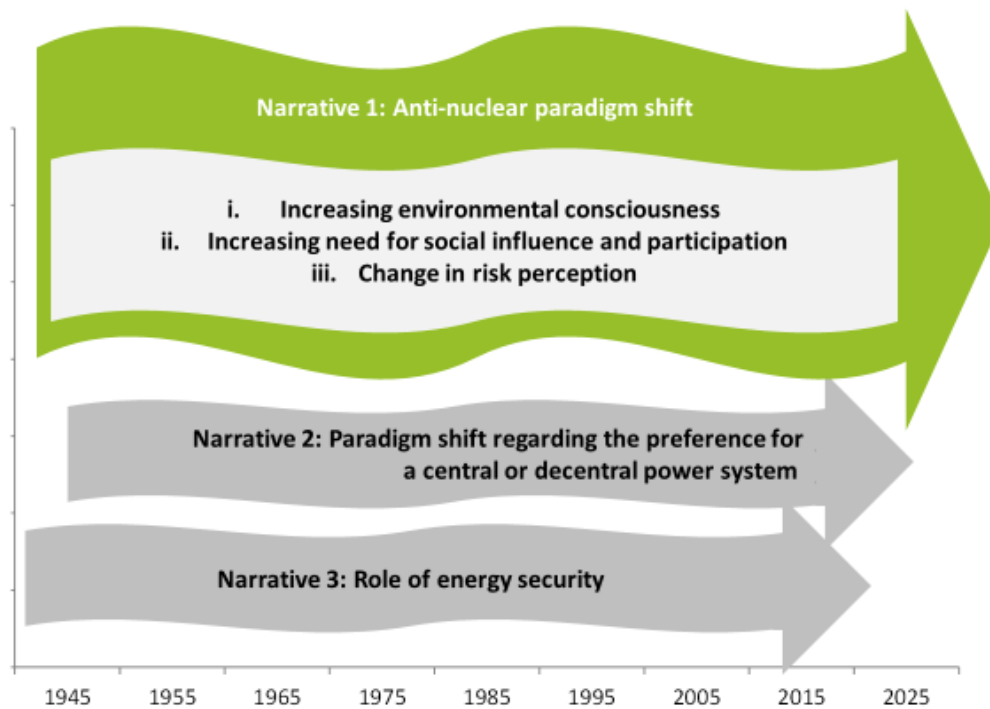
The „anti-nuclear-movement“ narrative provides a background understanding towards the societal processes connected to the paradigm shift from the positive vision of nuclear in Germany to its phase-out and a shift of the energy paradigm towards renewable energy resources. The anti-nuclear-movement narrative also answers and explains many of the ToR-questions (such as Q8, 9, 10, 20, 23, 24, 25). However, we will not refer to each ToR-question in this section, but rather refer back to this narrative in section 5 where each question is addressed individually. We will start by describing three main and interconnected socio-cultural developments which underlie the shift away from nuclear energy. On this basis, we will then depict the historic timeline of the anti-nuclear movement.

#### Socio-cultural shifts

Three socio-cultural shifts underlie the historic events described in the final section of this narrative:

- (i) the increased environmental consciousness,
- (ii) the increasing desire of people for social influence and to have a voice in infrastructure decision making,
- (iii) a change in risk perception of potential damages to human health and society as a whole.

In the following section, we will describe these changes and their impact on the energy transition. Figure 2 illustrates the parallel nature of all German narratives as well as the socio-cultural developments that constitute narrative 1.



**Figure 2. Social shifts underlying the “anti-nuclear-movement” narrative (own graph).**

The three socio-cultural shifts that constitute this narrative are strongly intertwined though having distinct parts as well. Environmental concerns found their expression through various forms of social engagement, being one field of activity besides other socially relevant topics in a landscape of perceivably increasing social engagement. Moreover, the environmental protection could certainly have such a strong impact concerning the shift from nuclear to anti-nuclear due to the different forms of protest connected to the increasing desire of “having a say”.

The first socio-cultural shift was the increase of environmental consciousness. In Germany, a first environmental movement arose around the turn from the 19th to the 20th century and a second environmental movement arose around the 1970s and 80s. The first environmental movement has its roots in Romanticism, the “Heimatschutz” movement. The environmental movement relevant here can be described as a new social movement and experienced a change in values: It expanded in its protective view from the romantic view to a more scientific and ecology-oriented perspective. This perspective was more motivated by the understanding that environmental protection meant also the protection of the human species in the face of global threats as formulated in the Club of Rome reports. Here also intra- and intergenerational justice became of relevance, finding expression in the slogan “we have only borrowed earth from our children”.

Social science addressed the new environmental movement with research on environmental consciousness: The multicomponent concept of Maloney and Ward (1973) was the basis for further studies in the area of environmental consciousness (Homburg & Matthies, 1998; Kley & Fietkau, 1979). There are narrow definitions that limit environmental consciousness to

environmental experience and concernment, and other definitions that include environmental awareness with manifest behavior (Spada, 1996).

Since the beginning of the 1970s, there is public opinion research on the topic of environmental consciousness of the population in Germany (Dierkes & Fietkau, 1988). It dealt primarily with three areas: general problem assessment and perception, need for action in environmental policies and problem-solving strategies. The research results show a growing trend of environmental consciousness and the positive behavior of citizens towards the environment, as well as a need for support and development measures of environmental protection, environmental awareness, and environmental policy (Deutsche Bundesregierung, 1976; Dierkes & Fietkau, 1988; Wissenschaftszentrum Berlin [WZB] 1981).

Even though the majority of people opposing the civil use of nuclear energy were also against the military use, the anti-nuclear energy and the peace movement were separate at this point.

In Germany and – even more – abroad, the strong anti-nuclear movement and the policy decisions on a nuclear phase-out taken by the SPD/Green government in 2002 and the CDU/FDP government in 2011 were repeatedly used as an example of exaggerated "German Angst" (cf. Czada, 2013). But this interpretation is not uncontested, as for example Paul Hockenos writes "[...]; the source of this antiatom consensus lies not in emotional populism but rather in the persuasive, fact-based arguments of a powerful, grassroots social movement that has long included nuclear physicists and other bona fide experts." (Hockenos, 2012, p. 3). Today basically all German civil society groups reject nuclear energy and a broad anti-nuclear consensus has been achieved, including environmental groups such as Greenpeace, Robin Wood, or the BUND (Friends of the Earth Germany).

Although the departure from the use of atomic energy is certainly connected with a changing risk perception (see the following section), it cannot be dismissed as the result of an emotions-driven (over-)reaction, as an expression of a typically German tendency to particular fear and misgivings. Since, a number of other countries in Europe such as Austria and Italy have also decided to cease nuclear power use, have discussed such plans, or have always renounced nuclear power plants (Gawel, Strunz & Lehmann, 2012), it would still be wrong to speak of a special German way.

The second socio-cultural shift was an increasing need for social influence and participation. Before the 1950s, democratic social influence was largely restricted – the imperial period, the Nazi regime and two world wars did neither permit democracy nor public participation. In post war Germany, during the establishment of a new democracy, people had to find a way back to (a normal) life and a new identity. According to Maslow, in this period, basic needs had to be fulfilled; people were busy organizing food and shelter for their families and were thankful for any support and grateful to government construction work.

People were experiencing a change in values, rights and understanding of living democracy. Through the years people became more used to their still young democracy and slowly the possibility to question power and people representing it developed.

Democratic protest of the 1950s and early 1960s was dominated by the peace movement and by movements against the remilitarization of the Federal Republic of Germany and the nuclear armament of the German armed forces (VdA, 2010). In the absence of an opposition within parliament, the 1960s movements were directed against the restrictions of civil rights by



government and parliament. It was also during the 1960s when first obvious conflicts in city planning occurred (Selle, 1996). As one consequence, at the societal and institutional level (Petts as cited in Cass, 2006), a loss of trust in institutions, those of governance and science in particular, in the areas of environmental and risk-centered decision-making can be ascertained and subsequently is also used as a justification for involving the public through participation (Cass, 2006).

In the late 1960s, the student movement had taken to the streets in emancipation from the German Nazi-history. The anti-nuclear movement incorporated elements of their world views by fundamentally questioning scientific authorities, large corporations, and government bureaucracy.

At the beginning of the 1970s, the spectrum of political and sociocultural scenes, groups, initiatives, and parties had grown tremendously. Different forms of protest and alternative forms of living spread showing a large heterogeneity, including (large scale) demonstrations, sit-ins, peace marches, actions on streets and public places, occupations of houses and construction zones.

At the beginning of the 1970s, estimates of the total number of active citizens' groups in West Germany ranged between 5.000 and 50.000 (cf. Guggenberger & Kempf, 1987, as cited in Selle, 1996, p. 63). This growth in the organization level of the civil society illustrates that the citizens and their initiatives had become conspicuous in the political process.

Topics addressed were mainly urban development but also environmental protection and were triggered by "consequences of the most threatening developments that were dominant in that era in industry, science and technology" (Guggenberger as cited in Selle, 1996) which were felt in the immediate or mediated field of experience. In addition to the perceived threat and the wish for more self-determination, in an environment perceived as heteronomous, the beginning of the 1970s was experiencing a political atmosphere of departure and spirit of optimism. It was felt that in many sectors of society there was a need for more democracy and more participation possibilities.

A change in risk perception and communication constitutes the third parallel and interdependent process and societal shift with impact on the narrative on nuclear energy. The attenuation and amplification of risk and risk perception is a social process. It contributes to the transformation of overall social risk perception, and influences other trends and narratives as the anti-nuclear movement.

Slovic (1987) compares the risk perception of nuclear energy by different subgroups of the public to other technologies or activities. It can be depicted by two dimensions: „dread risk“ (defined at its high end by perceived lack of control, dread, catastrophic potential, fatal consequences and inequitable distribution of risks and benefits) and the „unknown risk“ (defined at its high end by hazards judged as unobservable, unknown, new, and delayed in their manifestation of harm). The level of threat is higher and hence the perceived risk is higher when the threat is uncontrollable, the consequences possibly fatal, the risk is perceived as catastrophic with fatal consequences, strong effect for future generations, not easy to reduce or even increasing and people are unwillingly affected by it. The factor "dread risk" is the most important one – "the higher a hazard's score on this factor the higher its perceived risk, the more people want to see its current risks reduced, and the more they want a strict regulation

employed to achieve the desired reduction in risk” (Slovic, 1987, p. 283). Applying this definition to nuclear power, the risk perception of nuclear energy and its development according to changes in contextual societal factors becomes more understandable.

In the context of risk perception Sabrow (2011) describes three different sub-narratives:

- (1) First the nuclear euphoric progress-narrative.
- (2) The second narrative understands the civil use of nuclear energy not as a future hope but as a mere bridging phenomenon. In this narrative Chernobyl is confirming a “level-headed pragmatism”. The usage of nuclear energy for civil purposes is dependent on the consideration of probabilities and risk assessment. This pragmatic energy discourse follows the principle of critical rationalism and lost its status as a leading paradigm with the nuclear disaster in Fukushima.
- (3) The third narrative is the categorical rejection of nuclear energy usage based on the incalculable risk. Symbol of this movement in Germany is the protest badge “Atomkraft? Nein Danke (“Nuclear energy? No thanks”) which could be seen as a bumper sticker on millions of German cars since the 1980s (Figure 3). Retrospectively, after the nuclear disaster in Fukushima this narrative became the mainstream narrative in society as well as politics, which then gave Chernobyl the character of a historic caesura and symbol of societal change.



Figure 3. Anti-nuclear badges in German and Japanese (ausgestrahlt, 2015 & globalmagazin, 2012).

Within the anti-nuclear movement narrative, the categorical rejection of nuclear energy usage thus became the dominant niche.

Renn (2011) outlines different stadiums of risk perception. Before 1986 modern large scale technologies like the usage of nuclear energy were supported by the public and representatives of the technical elite had an essential influence on politics. The risk assessments by the experts outweighed the intuitive risk perceptions found in surveys, judging them as unjustified. So, despite existing movements against those technologies experts convinced the different political parties of the realization of different technologies, also of nuclear energies.

Renn (2011) states, that after the accident in Chernobyl in 1986 the supporters of large scale technologies found themselves in the defensive. Experts had to deal with accusations of a lack

of morality and of rationality of their specialized knowledge. In contrast, nuclear sceptics successfully introduced a new thinking about risks in politics and society. This dynamic contributed to the fact that in Germany the development of nuclear energy was suspended – the project of reprocessing nuclear waste was dismissed and later the Parliament decided the nuclear phase out and the criteria for safety became stricter. After 1986 experts were rehabilitated as the consequences of Chernobyl seemed to be not as harmful as expected and re-considered as tragic but inevitable episodes, like a flood after a dam brake. Many of the experts returned to their former approach of estimating the risk as  $[Risk] = [Probability] * [Amount\ of\ damage]$ .

In the first decade of the 21<sup>st</sup> century, the focus shifted to hazards like sabotage, terrorism etc., and eventually the new term of the “systemic risk” marked a change in thinking about risk and risk perceptions. Systemic risk implicates that not only special elements would be affected by an incident but the whole system. Furthermore, it implicates the not intentional correlation of incidents and not functionally linked events or consequences. Especially highly interconnected systems are very vulnerable where single events can lead to a breakdown of the whole system by a domino effect (Renn, 2001).

Kasperson (as cited in Renn, 2011) describes processes of amplification and attenuation concerning risk perception and risk events (see the following figure). This model transports the idea, how the experience or appraisal of risk by individuals can unfold effect and create and support movements against a technology like nuclear energy.

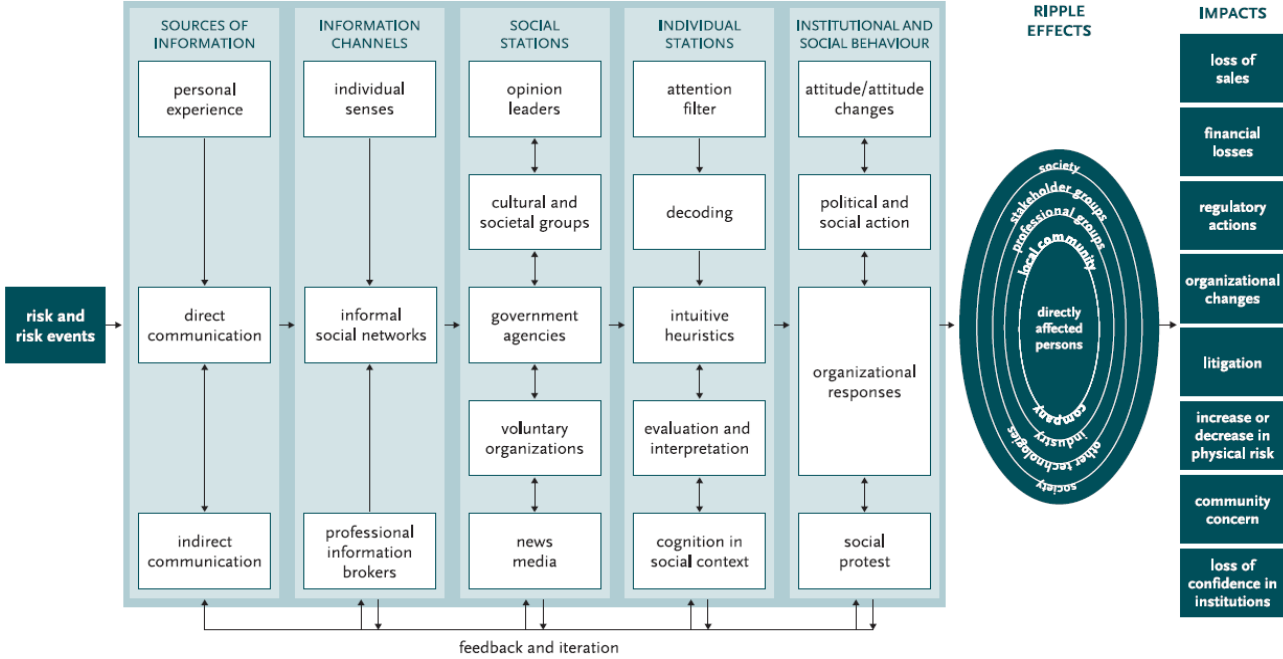


Figure 4. Overview on Concepts of Risk (Renn, 2008, p. 197).

Individuals collect and respond to information about risks and act as “amplification stations” and function as multipliers or representatives of groups through behavioral responses or communication. “Amplification stations can be individuals in socially exposed positions, groups, or institutions. The behavioral and communicative responses are likely to evoke secondary effects that extend beyond the people directly affected by the original hazard event.

Secondary impacts are, in turn, perceived by social groups or institutions so that another stage of amplification may occur to produce third-order impacts. The impacts may spread or “ripple” to other parties, distant locations, or other risk arenas. Each order of impact will not only disseminate social and political impacts, but may also trigger (in risk amplification) or hinder (in risk attenuation) positive changes for risk reduction (FAZ, 2013).<sup>4</sup> This model gives an indication of how a movement driven by different citizen groups could impact different social spheres and into politics. In combination with the two described approaches to different phases of risk perception and discourse illustrate the relevance of the topic for the nuclear phase-out.

Overall, the changing media coverage of key issues of the nuclear phase-out also reflects the three overall socio-cultural shifts. The optimistic coverage in the 1960s, as well as some incidents where information on nuclear projects was withheld from the public led the grassroots activists to adopt information and publication-oriented strategies. In the mid-1970s, a media analysis of the Research Ministry of the Federal Republic found that out of 20.000 media publications only 123 expressed concerns about radioactivity (Radkau & Hahn as cited in Morris & Jungjohann, 2016). It is therefore no surprise that the concerned public decided that it was necessary to do self-guided research and publish their own results. The first full documentation on the risks of nuclear power, “Friedlich in die Katastrophe” was compiled over years by a leading activist of the German branch of Friends of the Earth, Holger Strohm (Radkau 2011) and could be purchased only from a parallel publishing house (2001) in their own shops or by mail-order. As an alternative to the dominant media landscape, the different protest movements founded their very own media landscape with publications, newspaper, city magazines, radio stations and film groups. With this step, a multifaceted counterculture received public space and voice (VdA, 2010). These media channels became ever more important after Chernobyl. Not trusting official information, citizen groups published leaflets with up-to-date radiation-levels of food products, radio stations announced radiation levels with the weather forecasts, households measured the radiation in their homes and cities closed playgrounds to clean the sand from radioactive contamination.

The nuclear accident also found entry into popular culture. The novel “Die Wolke [The Cloud]” (Pausewang, 1987) is the dramatic story of a nuclear accident in Southern Germany in which the main character, a young girl, flees the zone of the accident. The novel describes the consequences following the accident, not only the social exclusion of the survivors, the Hibakushas, but also the complete decline of the German economy.
























### **Historic timeline**




Following the description of the underlying socio-cultural shifts the historic timeline of the anti-nuclear movement can be understood in a more holistic manner. The geographic focus of the historic events, critical to understanding the anti-nuclear paradigm shift, is West-Germany. An anti-nuclear movement did not evolve in the German Democratic Republic (DDR). While West Germany developed 37 commercial nuclear energy reactors, East Germany only built two reactors which were taken offline after reunification. Both German states did host nuclear weapons.<sup>1</sup> Table 2 gives an overview of key historic events.

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<sup>1</sup> In 2017, 8 nuclear reactors remain producing energy and around 20 nuclear weapons were hosted in the Western part of the Republic.

**Table 2. Short history of nuclear energy in West-Germany**

	<b>Event type</b>	<b>Event of the Anti-Nuclear-Movement</b>
<b>1955</b>		West-Germany reaches sovereignty and the right to use nuclear energy, the government creates a Federal Ministry for Atomic Issues
<b>1957</b>		First nuclear research reactor in Germany, establishment of Euratom
<b>1961</b>		1 <sup>st</sup> test reactor supplies electricity to the general grid
<b>1971</b>		1 <sup>st</sup> nuclear disposal site opened in Morsleben
<b>1972</b>		1 <sup>st</sup> commercial nuclear reactors in Stade and Würgassen
<b>1975</b>		28.000 protestors against a nuclear reactor construction site in Brokdorf
<b>1979</b>	 	On March 28, 1979, the nuclear accident in Three Mile Island, USA 150.000 protestors in the capital Bonn following this incident
<b>1980</b>		100.000 anti-nuclear protestors in Brokdorf
<b>1984</b>		Disposal of light-radiation nuclear waste in the intermediate disposal site Gorleben
<b>1986</b>	  	100.000 anti-nuclear protestors at site for planned reprocessing plant Wackersdorf - one protestor dies as a consequence of police violence On April 26 <sup>th</sup> , the nuclear reactor Chernobyl in Ukraine explodes and a radioactive cloud spreads over Europe. About 70% of the radioactive fallout landed in Belarus, leaving around 25% of its territory heavily contaminated ⇒ Establishment of the Ministry of the Environment, Nature Conservation, and Nuclear Safety (BMU). ⇒ The Party Congress of the Social Democratic Party (SPD) incorporates the nuclear phase out in its election program.
<b>1995</b>		1 <sup>st</sup> use of Gorleben as a final disposal site.
<b>1995-today</b>		Regular protests during Castor transports across Germany, maximum police force of 30.000 in 1997
<b>2000</b>		German parliament decides to end nuclear energy use with the SPD/Green majority
<b>2010</b>	 	The new German government (CDU/FDP) takes back the phase-out law and extends the use of nuclear power. April: 150.000 anti-nuclear protestors, September: 100.000 anti-nuclear protestors
<b>2011</b>	   	On March 11 <sup>th</sup> / 12 <sup>th</sup> the nuclear reactors of Fukushima Daiichi in Japan explode. Region is evacuated. Radioactive water reaches among others Hawaii and the West-Coast of the US 250.000 anti-nuclear protestors in various sites ⇒The CDU-FDP government decides to end nuclear energy use by 2022 Continued anti-nuclear rallies, e.g. in April: 120.000 anti-nuclear protestors
<b>Since</b>		Continued protests against Castor transports

Event type: -legislation/institutions, -nuclear technology, -protests

Source: own compilation based on BMUB, 2016a and Radkau, 2011 among others.

### **50s & 60s - The Euphoric Age of Nuclear History**

Scientists and politicians started to pin their hopes on nuclear energy as early as the 1940s. In 1942 the National Socialist and physicist A. Friedrich formulated his hopes and expectations in the following manner “[...] *we will smash these worlds of atoms, so that we can live better, heat better, eat better, build better or even fight wars better. As a master of such forces, man will be able to do whatever he wants.*”

After the war, the Federal Republic of Germany experienced increased prosperity. A strong belief in technology on the societal and the political level as well as in the media reflects the desire for peace and security, hope for a good future, social status and search for a new identity and role. Infrastructure and its expansion was associated with this economic vitality - transmission lines and grid extension were seen as a necessary and desired investment, and pylons were the symbol of being connected to technological progress and economic wealth.

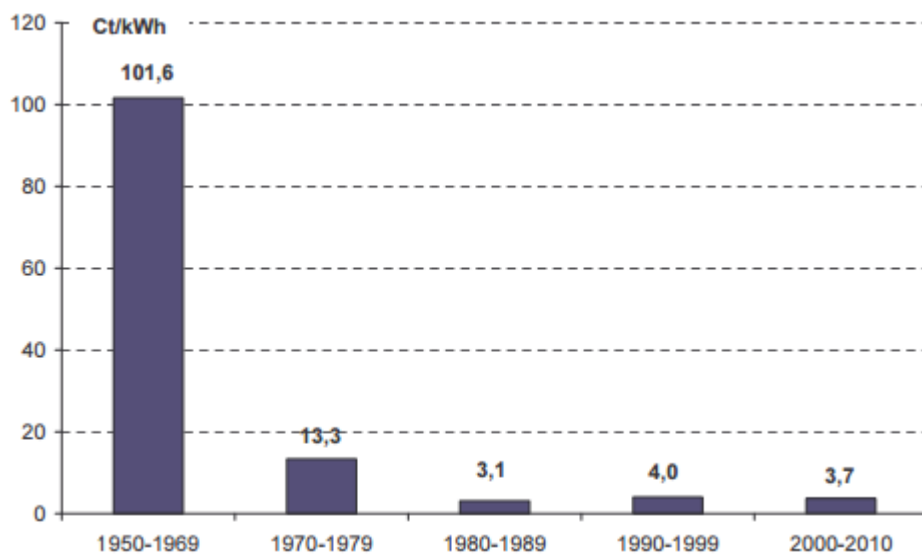
Publications from that time fully embrace the technology, and a nuclear utopia was visualized for many fields of daily life. German Environmental Historian Joachim Radkau calls it a “charismatic vision of the future”, referring back to Max Weber’s Charisma concept. People were presented with the prospect of nuclear-powered cars,<sup>2</sup> which were never realized. In the 1960s a civil, nuclear-powered ship was built (Morris & Jungjohann, 2016).<sup>3</sup> Regions applied to be chosen as a nuclear site in order to benefit from the investment and the associated economic growth. The government created a Federal Ministry for Atomic Issues. Protests were rare and limited to a local scale, e.g. in form of resistance against the planning of nuclear plants or nuclear waste disposal sites, more related to specific project characteristics than to a rejection of the technology itself (Radkau, 2011).

The German philosopher Ernst Bloch described in the 1950s nuclear energy as “*turning deserts into cropland, ice into spring; ...*” (Morris & Jungjohann, 2016, p. 304). The increasing skepticism and development of an organized anti-nuclear movement was not foreseeable during the 1950s and 60s. In line with this positive view of nuclear technology, the large amount of subsidies were spent on nuclear electricity technologies (see Figure 5).

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<sup>2</sup> In the 1940s and 50s the military constructed nuclear-powered submarines and ships which also led car designers to imagine a use in individual mobility. In 1958 Ford’s designers built a model of a nuclear-power car, the Nucleon.

<sup>3</sup> The ship was a technical success but an economic failure as it was not allowed to pass neither through the Suez nor the Panama Canal.



**Figure 5. Average subsidies in Euro Ct / kWh for nuclear electricity 1950-2010 (Meyer & Küchler, 2010, p. 7).**

### ***70s & 80s - A protest movement is born***

The demonstration against the construction of a reactor in Wyhl in 1975 became the founding moment for the nationwide movement – about 28.000 people demonstrated against the start of construction. Protesters occupied the site and established a protest camp for several months (BUND, 2015). With this, the anti-nuclear initiatives, previously focused on local construction projects, broadened to promote a more encompassing principle – “No nuclear power plant here nor elsewhere!” The scope of activities and protest forms broadened to include information events and a “Volkshochschule” in Wyhl, lawsuits, demonstrations, and street blockades. The topic was very present in the public discourse and was addressed by different groups like “Mütter gegen Atomkraft” (“mothers against nuclear energy”) or “Ärzte gegen Atomkrieg” (“doctors against nuclear war”). According to Radkau, the West-German Anti-nuclear-movement that started in the 1970s constitutes the “*biggest and copious public discourse in the Federal Republic of Germany*” (Radkau, 2011).

In 1979, the US nuclear accident at Three Mile Island was followed by the largest anti-nuclear rally in Germany until that point. An international symposium on the plans for the nuclear reprocessing plant Gorleben was held. The political mentor of the Gorleben nuclear facility plans, Prime Minister of Lower Saxony Albrecht, was forced to acknowledge that the project to construct the largest nuclear reprocessing plant of the World was “politically unfeasible.” In the same month, the Study Commission of the German Parliament on “the Future of Nuclear Policy” began its work. Radkau (2011) interprets the establishment of the Study Commission as a milestone for the parliament taking an active stance on energy policy in general.

### **The 80s - Rise of the Green party**

Coming from the German environmental and anti-nuclear movement, the Green party was founded in 1980. The entry of the Green Party in West-Germany’s parliament in 1983 marked an important step towards nuclear phase-out as a national policy.

The (West) German commitment to the environment and climate protection is a result of a combination of environmental catastrophes in the 1980s:

- Widespread forest damages (“Waldsterben”) due to acid rain (picture 1 in Figure 6 *Figure 6*. Timeline of title pages of the news magazine Der Spiegel in the 1980s (Der Spiegel, n. d.),),
- Increased scientific evidence of the climate crisis (picture 2 in Figure 6 *Figure 6*. Timeline of title pages of the news magazine Der Spiegel in the 1980s (Der Spiegel, n. d.),) and
- Chernobyl with its prelude, the Three Mile Island accident (picture 3 in Figure 6),
- The hole in the ozone (picture 4 in Figure 6).



**Figure 6.** Timeline of title pages of the news magazine Der Spiegel in the 1980s (Der Spiegel, n. d.).

As a reaction to the nuclear accident in Chernobyl of 1986, the West-German Government reassured the public, that *“no such accidents can happen in Germany”* because that particular reactor type did not exist in Germany. Information given to the public was contradictory– the public was advised to change food consumption, e.g. feed powdered milk to babies and to wash fresh foods thoroughly, while at the same time announcing that only zones 30 to 50 kilometers from the reactor were endangered (PleitenReaktoren, 2008). Confusing information policy contributed to official institutions losing credibility. A month after the nuclear accident in Chernobyl, Chancellor Kohl was forced into creating the Ministry of the Environment, Nature Conservation, and Nuclear Safety in Germany (Morris & Jungjohann, 2016, p.331). Even 30 years after Chernobyl, regional radiation level (in wildlife) remain high. In 2015 mushrooms from Bavaria still showed radiation levels of 4900 Becquerel (Dobel, 2016), while the official safety level for adult consumption is 600 Becquerel.

In Germany, no new reactors were built since. Still, Morris and Jungjohann make the point that it was neither Chernobyl nor the Green Party to stop the rise of nuclear power but Wall Street (Morris & Jungjohann, 2016, p. 316), meaning that the nuclear power industry was not receiving new orders and due to surging costs investors were losing economic interest.

The resulting social movement has been the backbone of the Energy Transition ever since.

### ***The 90s - a time of ongoing protest***

In the 1990s and 2000s, the anti-nuclear movement had a regular mobilization event in form of the regular transport of castor containers to the disposal site Gorleben. In 1997, the



transports needed to be forced through by 30.000 policemen using water cannons and tear gas. 400 demonstrators were reportedly injured (von Hörsten, 2001). Protest forms were sitting blockades and the removal of gravel from railroad beds. Greenpeace and Robin Wood activists regularly chained themselves hanging from railroad bridges to slow down the transport. In 2004 one activist died in the attempt of stopping a nuclear transport train. The protest movement was met with surveillance, violence, and persecution by the German state institutions.

### ***2000-2010 – The official nuclear phase-outs***

In 1998, the anti-nuclear party – the Greens, joined for the first time the Federal Government in coalition with the Social Democrats (a “red-green” government). In 2000, the government passed the first law for a nuclear phase-out, to be completed after the production of another 2,623 TWh of electricity by the nuclear fleet, expected to be reached by 2022 – a key step towards achieving a core demand of the 1980s energy transition proponents. The parliamentary opposition perceived this as conflicting with strong climate protection ambitions, and invoked another parliamentary Study Commission “on sustainable energy supplies in view of globalization and liberalization.” A major result of that Study Commission was that technically, nuclear power could be replaced by renewables at tolerable additional costs.

The nuclear phase-out law survived two elections, but in 2009, CDU and FDP ran on the platform of removing that phase-out, and were elected into government.<sup>4</sup> Consequently, they rolled back on the phase-out in October 2010 and moved it to the year 2036, already under Chancellor Merkel. Quasi as a compensation, the *Energiewende* – with a strong emphasis on renewable energy and energy efficiency - was declared official government policy of the conservative-liberal coalition government.

However, four months later, and under the impression of the accident in Fukushima in March 2011, Dr. Merkel reevaluated her view on nuclear power and stated publicly: *„If in a highly developed country like Japan, (...) the nuclear consequences of an earthquake and a tidal wave cannot be prevented (...) then this has consequences for us in Germany. This also changes the situation in Germany; then we have a new situation.”* (Bundesregierung, 2011)

Already in March 2011, production in the 7 oldest nuclear power plants in Germany was put on temporary and then permanent hold. The government passed a second nuclear phase-out law, ordering the currently 8 remaining nuclear reactors shutting down in 2022.

In 2011, after the Fukushima accident, the widespread destruction convinced the remaining parts of society to reconsider nuclear power.

## **4.2 German narrative II: The shift from central to a decentralized energy system**

The second narrative dominant in Germany, “the shift from central to a decentralized energy system”, provides a background understanding of another important paradigm shift in the German energy system. The fundamental debate is ongoing whether central or decentral structures are more technologically and economically efficient and the extent to which they are

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<sup>4</sup> It is unlikely that this should be interpreted as a general view of the German public that nuclear energy should be strengthened again.

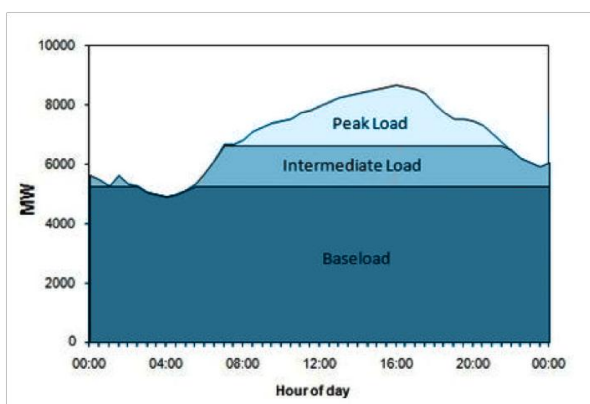
democratic. The following narrative will therefore present these four dimensions of the paradigm shift:

- Dimension I: Physical dimension: from large to larger power plants and planned infrastructures and back to smarter local structures;
- Dimension II: Legal support systems of decentral energy
- Dimension III: Economic dimension: from vertically integrated public bodies to large cooperations that are currently in the process of downsizing into several smaller companies, and at the same time from a monopolistic structure to the diversity of large, medium, and very small but vocal economic entities;
- Dimension IV: Societal dimension and public participation: from a high-level, technical discussion via an engagement of elites to a broad national discussion; and from a distrust of big utilities, via a desire to influence and for empowerment/participation to the “democratization of the energy system” (cf. anti-nuclear narrative).

This narrative also touches upon a series of ToR-questions such as Q14, 23 and 24. The respective sections in the following chapters will thus refer back to this narrative where appropriate.

### **Dimension I: Physical and technical dimension**

As can be seen in the anti-nuclear-narrative, the Post-War period, was dominated by voices very much in favor of large scale power generation and transmission systems which were promising economies of scale. The technical paradigm promised technical solutions leading to prosperity and an easier life. Power plants and all other infrastructure elements were increasing in scale because large size promised technical efficiency, for example in the dimensions of ease of managing and operating the system (i.e. as few “moving parts” as possible). The energy supply situation was perceived as carried out by a clear division of labor by base, intermediate and peak load power plants whose designs were optimized for clearly differentiated operating conditions (permanent operation at constant output vs flexible balancing of load fluctuations) (Figure 7).



**Figure 7. Traditional concept of power supply systems (IER, 2014).**

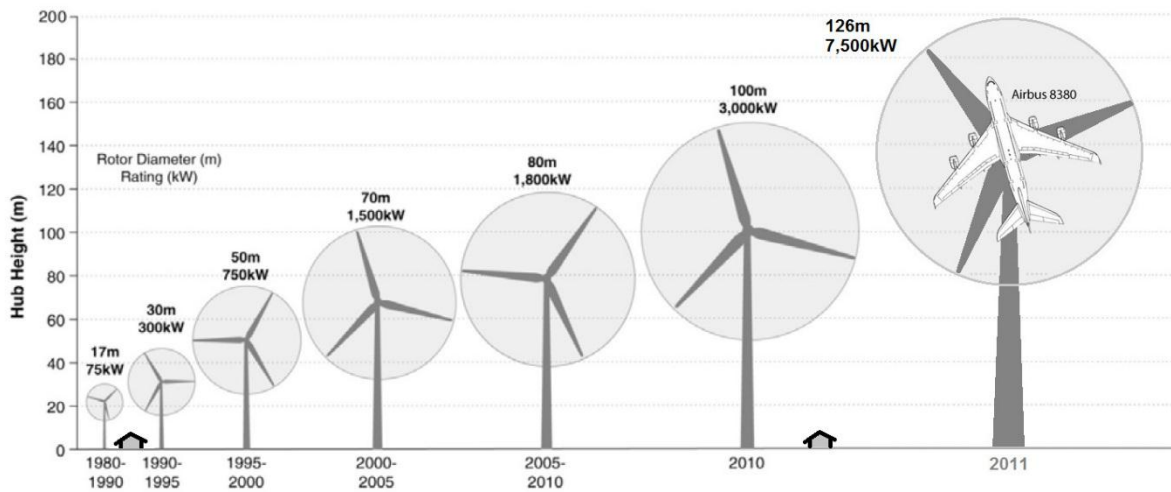
For power transport, a hierarchical grid structure was set up at 380 kV level (“Verbundsystem”) that allowed dispatch to power plants in large connected areas more or less irrespective of their geographic locations.

One part of dimension 1 was the wake of decentralized technologies. The decentralization proponents started influencing the discussion in the 1970s countering the economies of scale debate with Schumacher’s mantra “small is beautiful”. When members of the decentralization movement were starting to counter the centralized paradigm with alternative ideas, their ideas were often ridiculed by leading engineers and CEOs of the dominating power providers.

The technological development of small-scale renewables started out with a major technological failure called “Growian”. The ministry of research offered a small funding program for alternative energies. In 1983, traditional engineering and energy companies among them, MAN and RWE, constructed the 3 MW Growian („Große Windenergieanlage“-large wind power plant). The project dimensions were inadequate for such an early stage of material and technological development. One commentator compared the endeavor in the following way: “[The Growian project was] as if one had ordered Otto Lilienthal, after his first attempt at flying, to construct a supersonic aircraft (FAZ, 2013).” The project ended a complete failure and was proof to many traditional engineers that wind power was not feasible.

Nevertheless, engineering students started to look for technical alternatives. Small-scale energy technologies were neither equivalent to renewable nor too sustainable. Among the technologies developed were photovoltaics, wind energy, kite technologies, geothermal, heat pumps, small CHP units run with natural gas, biogas digesters and many more. The research for alternatives, particularly in the field of renewable energy and CHP power plants was carried out under the impression of the oil crisis (see chapter 4.3), the anti-nuclear movement (see chapter 4.1), which started to carry out its very own research and fueled by social distrust towards the centralized economic powers of the 1970s.

The alternative engineers and start-up companies had to start small, develop the necessary materials and produce functioning PV-modules and wind turbines. The technological development was eventually supported by legislative projects. In the early 1990s, when the first feed-in law was put in place a number of wind turbine manufacturers such as Enercon and Fuhrländer offered wind turbine models as small as 55 kW.



**Figure 8. Increased size and performance of wind turbines (New Zealand Wind Energy Association, 2013).**

Another notable technological trend that facilitates the paradigm shift is the smart grid technology. The establishment of modern information and communication technology is a crucial enabling factor for a decentralization of power supply and demand. This trend starts in the control centers for grid stability, where formerly, power plants were advised to regulate up or down by phone calls. Only one parameter could be monitored as the basis for these management decisions, which was the grid frequency at the control center. Today, sensor technology makes it possible to manage power lines on the basis of temperature monitoring, which provides more exact forecasts for power flow and dispatch (or curtailment) decisions. Further downstream, smart meters and bidirectional information flows will enable local power and energy provision and load management. This trend is much-discussed in Germany, but little implemented yet. All power companies, however, start to focus more on the end customer and the more detailed, fragmented, and more decentralized market opportunities aligned with that.

It is however debated whether the 2020s will constitute a period of technological re-centralization. Over the last two decades, particularly wind power has made technological jumps and the size of the individual turbines grew up to 8 MW in 2017 (Kempkens, 2016).

Approaching the 2020s, renewable energy has matured and has become centralized to large degrees; the Chinese Tengger Desert Solar Park has a capacity of 1.500 MWp and the wind farm “Alta Wind Energy Center” in California a capacity of 1.020 MW. In Germany, the population density is preventing large-scale renewable energy infrastructures. Nevertheless, most German wind farms, the biggest being the offshore farm ‘Stößen-Teuchern’ with 177 MW, can be found in the North feeding large amounts of power with comparatively high levels of continuity into single grid nodes far away from the consumption points, which are concentrated in the South.

In contrast to these developments, more and more customers are considering self-generation – a good example is the legal battle currently ongoing around the plug-and-play solar systems that people can put on their balconies or windows, plug into the power “outlet” in their











apartment and have the meter slow down or run backwards. Other examples are provided by the swarm concepts of Lichtblick - who are supporting investments into decentralized CHP plants that are jointly managed for the sake of selling their power to the grid by Lichtblick – or Sonnen – who provide a similar service for home batteries. IT-oriented startups like Greenergetic are providing white-label solutions to utilities that help local power grid operators support their customers in building solar roof systems. Already it can be observed that all major energy corporations have start-up incubators, to not miss out on opportunities for customer retention or new services.




## Dimension II. Legislative Support for decentralized technologies

As indicated above, the small-scale technological developments were eventually supported by legislative projects. The paradigm shift from central to decentral in terms of energy market players had a number of key turning points, among them:

- the European rules on liberalization and unbundling of the vertically integrated public utilities, and
- the support to decentralized power generation facilities, provided by the Feed-in law (starting as early as 1992) and by the CHP law.

**Table 3. Historic overview of key Energy Transition legislation (own compilation).**

	Event type	Event in the Energy Transition history
1989		Solarenergie-Förderverein Deutschland e.V. [Solar Energy friends' association Germany] suggests to the ministry of economics the first feed-in-tariff
1990		Parliament passes the 1st renewable energy feed-in legislation (Stromeinspeisungsgesetz)
1993		In the city of Aachen citizen groups among them a solar and a wind energy association suggested a communal feed-in legislation to their council. Hammelburg became the first municipality to introduce the municipal feed-in legislation according to the „Aachener Modell“. Hammelburg is followed by 40 other cities until 2000.
1996		First EU Directive for Liberalization of the electricity market
1998	 	Liberalization of the German electricity market. The EU Directive for the domestic electricity market is being transposed into national law by the amended law for energy economy of 1998. First EU Directive for Liberalization of the natural gas market
2000		The Feed-in legislation of 1990 is replaced by the new Renewable Energy feed in legislation
2004		Liberalization of the German market for natural gas
2005		The amended Energy Economics Law effectuates the EU Directive for the domestic market for energy and natural gas of 2003 into national law.
2009		3rd EU Energy package (another revision of internal market rules on energy)

Event type:  -EU directive,  -study,  -legislation

## EU LEGISLATION

In the early 1990s, the environmental movement succeeded in pushing through renewable energy feed-in legislation at federal and local level (see legislative events in Table 3). The first feed-in law for renewable energy was passed in 1990 (StromEinspG). Together with the traditional run-of-river hydropower plants small-scale wind turbines qualified for this first feed-in tariffs in Germany. The government accompanied this development with a monitoring program for the first 250 MW of wind power, which helped significantly to make these turbines operational.

The legislation was refined in 2000 by the red-green (SPD & the Green Party) government to the *Renewable Energy Feed-in Law* (“EEG”). It introduced more attractive and comprehensive rates, included solar energy and the guarantee of a renewable energy power plant to be connected to the grid by the local grid company.

Together with the EEG the coalition passed a CHP-subsidy-legislation. The legislation was passed to support the production of CHP. Small-scale natural-gas run CHP units in industry or residencies are still considered in line with German energy transition policies as a form of bridging technology. The current targets for CHP production are 110 TWh of electricity production by 2020. Just like with the EEG, the costs of the CHP-subsidy are added to electricity consumers’ bill.<sup>5</sup>

Though many small-scale renewable energy companies had emerged throughout the 1990s during the first feed-in law “StromEinspG”, the EEG created an unexpected industrial boom. The success of renewables had silenced many of the opponents. Hirschl (2007, p. 169) describes the impact as follows: “[In 2005], overall, the EEG's opponents had grown apart or had learnt something. While only a few actors still openly demanded the abolition of the EEG, the arguments increasingly shifted towards more or less far-reaching reform proposals [of the promotion systems for renewable energies]”. Table 4 shows that the number of employees in the renewable energy sector was an equivalent of 80% of the workers employed by the four market-dominating power companies. After a period of high unemployment levels throughout the 1990s, 170.000 employees in the sector particularly in regions of East Germany had a high political weight.

**Table 4. Key indicators of the four market dominators (RWE, E.ON, Vattenfall, EnBW) in comparison to the renewable energy sector in 2005 (Hirschl, 2007, p. 168)**

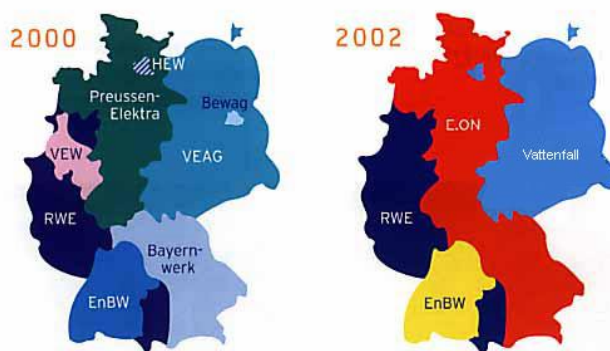
	RWE	E.ON	Vattenfall	EnBW	<i>Renewables</i>
Volume [Billion €]	41.8	56.1	10.5	8.1	<i>18.1</i>
Employees	85,900	79,600	20,400	17,900	<i>170,000</i>
Power Volume [TWh]	299	258	173	107	<i>64</i>
Power plant capacity [MW]	43,270	27,757	16,300	14,000	<i>9,500*</i>
* Determination of power plant capacity of renewable energy sources as conversion factors according to average full-load hours; hydropower 4500h, wind power 1700h, photovoltaics 900h, biomass- and geothermal-plants each like conventional power plants with 7500h.					

<sup>5</sup> While the total subsidy for renewable energy in 2017 was 24 billion Euros, total CHP subsidy was only 1.2 billion Euros (Netztransparenz.de, n.d.)

In 2005 the Energy Transition was integrated in conservative policy making. As a result of the success of the renewable energy policy, a key moment occurred when the conservative-liberal (CDU-FPD) government, which followed the red-green coalition, passed its 2010 energy concept. With this move the renewable energy paradigm moved from being an environmental-left wing plan to a main-stream and conservative strategy. Governments following the red-green coalition reviewed and sometimes drastically changed<sup>6</sup> the core policy instrument, the Renewable Energy Feed-in Legislation, but continued the legislation and bought into the concept of an Energy Transition. In its 2010 version of an energy transition, the conservative-liberal government slashed the nuclear phase-out of the previous government and included longer production periods for nuclear energy (though no new power plants). This phase-out of the nuclear phase-out only lasted a few months and was reversed shortly after Fukushima. The risks of nuclear energy had become once more so apparent in public consciousness that it was no longer politically viable to support it. See the discussion about energy security perceived as acceptable and safe in our energy security narrative.

### Dimension III. Economic / market -level

Unbundling as dictated by the Common European Market for Electricity rules led to a multitude of players initially, but very fast consolidation into the “Big 4”: RWE, Vattenfall, E.ON and EnBW.



**Figure 9. Structure of German Utilities (Leuschner, 2014).**

Today, the power generation branches of the utilities are less profitable than they used to be due to very low power prices at the power exchange. While RWE and E.ON both have made headlines with record losses, even the conventional power section of RWE still made an operational profit of 1.5 billion Euros in 2016. The losses are derived from depreciation of assets and other types of balance correction. The government is affected due to a loss in tax income. While the break-down of tax income does not affect the federal budget, it poses a significant challenge to municipal governments whose finances hinge on the profits of the traditional energy companies.

The “Big 4” started to disintegrate in the 2010s, under economic (and partially political pressure): First they had to sell off their transmission grid operations due to unbundling and

<sup>6</sup> A dramatic cut of compensation of solar producers in 2012 was followed by the collapse of the solar industry in Germany. In 2014 the EU Commission made the use of pre-set guaranteed feed in tariffs illegal and forced European countries to convert to competitive bidding mechanisms.

cartel laws. In 2016, E.ON and RWE split their businesses into the conventional power generation and the “new business fields” (grid operations, renewable energy generation, energy efficiency and final customer service). Vattenfall is withdrawing from the German generation market including its loss-making lignite business, due to political pressure from its owner, the Swedish government. EnBW has been sold back to the State of Baden-Württemberg by its previous owner, EdF, and is now testing innovative business strategies.

The biggest utilities with many assets in the fossil fuel industry have started to split their assets and safeguard their renewable investment line in new companies (RWE Innogy, Eon, Vattenfall Europe New Energy GmbH), while their fossil fuel assets such as coal and nuclear are parked in companies that might eventually be go insolvent (Eon-Uniper (fossil fuels), Eon-Preussenelektra (nuclear), RWE Power AG (lignite, nuclear), RWE Generation SE (conventional)).

These same low power prices, however, have turned Germany into a big power exporter in Europe. They have caused new power plants, particularly those based on gas generation, to make losses because they are not able to recover their investment costs. In this low-price market environment, only fully depreciated lignite and some anthracite power plants can still sell power at a profit.

The above-mentioned trend of integrating information and communication technology into the power system, as well as the trend to electric cars, will again change the economic structures in the power sectors. This will allow the energy company to get closer to the customer, which is increasingly seen as important – as customers can choose their power providers freely.

At this point, it is fitting to address ToR question Q4 (How does the German government handle possible losses of power companies that are transitionally caused by the energy transition? (e.g. early retirement of coal or nuclear power plants of private companies)): German utilities are private companies and the government is prohibited by EU law to intervene in their investment decisions. But an additional income opportunity has opened up for fossil fuel power plants via the strategic grid reserve. Due to limitations in the transmission grid infrastructure, the German government is offering a lifeline for 10.400 MW (winter 2017/18) dispatchable power plant capacity, which are forced out of the market by offering them access into the grid stability reserve (BNetzA, 2017). These power plants are kept as a reserve, outside of the market in case of critical supply situations. The payments are considered a subsidy according to EU law. In 2016, payments amounted to 126 Mio. Euros (European Commission, 2016).

Among many other factors, a notable movement has contributed to these more recent changes in business strategies of the „Big 4“: After reunification, there was a strong movement to have the municipal grids and electricity structures integrated in the larger utilities, and many concessions for operating distribution grids had been given to them. Recently, a significant “recommunalization movement” has lobbied for cities to re-found their own municipal utilities for managing power grids. Technical and financial reasons been, this would allow municipal utilities (“Stadtwerke”) to use the revenues from power grid management for cross-financing other public services (like public transit or public swimming pools). But in addition to this, the movement is also fueled by some of the social factors discussed below.

In addition, the renewable energy feed-in law of 1992 (StromEinspG) provided a clear exception to the monopolistic structure of the power sector: it re-introduced the concept of Independent



Power Producers (IPPs) into the German regulatory environment. A major success factor was that the contractual relationship during unbundling was mandated to be with the grid operator (rather than with another power generator). As the StromEinspG also limited the revenues of the renewable energy generators, it was not providing interesting investment opportunities for the large power concerns that arouse out of the deregulation – these were interested in highly risky, high return opportunities with investment hurdle rates of around 20% or more. But the EEG was calculated on the basis of 7.5% IRR. Therefore, investments under the EEG needed to be financed from sources that were satisfied with these lower rates of return. Due to this limitation, project developers created a new investment structure, the closed fund in the legal shape of a GmbH & Co KG which sold shares on the “grey” investment markets – private individuals could buy shares in chunks of 1000 or 10.000 Deutschmarks. This facilitated not only a wind investment boom, it also created a large number of literal stakeholders – dentists, lawyers, teachers, were suddenly owners of power generation facilities. They benefited first from tax deductions, and then from revenues of the early wind farms – and from the feeling that their investments were producing environmental benefits. Naturally, they took a bigger interest in the discussion around the Energy Transition in Germany.

This was reinforced by the EEG in 2000, which promised high feed-in tariffs for solar roof top facilities, as well as – to a lesser extent – by the CHP law which provided for a premium on CHP-generated power. Overall, sources estimate that Germany has more than a million such “energy entrepreneurs”.

Regarding ToR question Q5 (What are successful examples and failures in gaining support from citizens and confidence of investors in strategic frameworks in Germany?), it can be stated that the German feed in tariff is considered by investors to be safe and guaranteed for the 20-year payment period. The high levels of confidence furnished to this tool can be shown by the large amounts of private investors. Figure 10 shows that in 2012 47% of installed renewable energy capacities were owned by individual citizens and cooperatives.

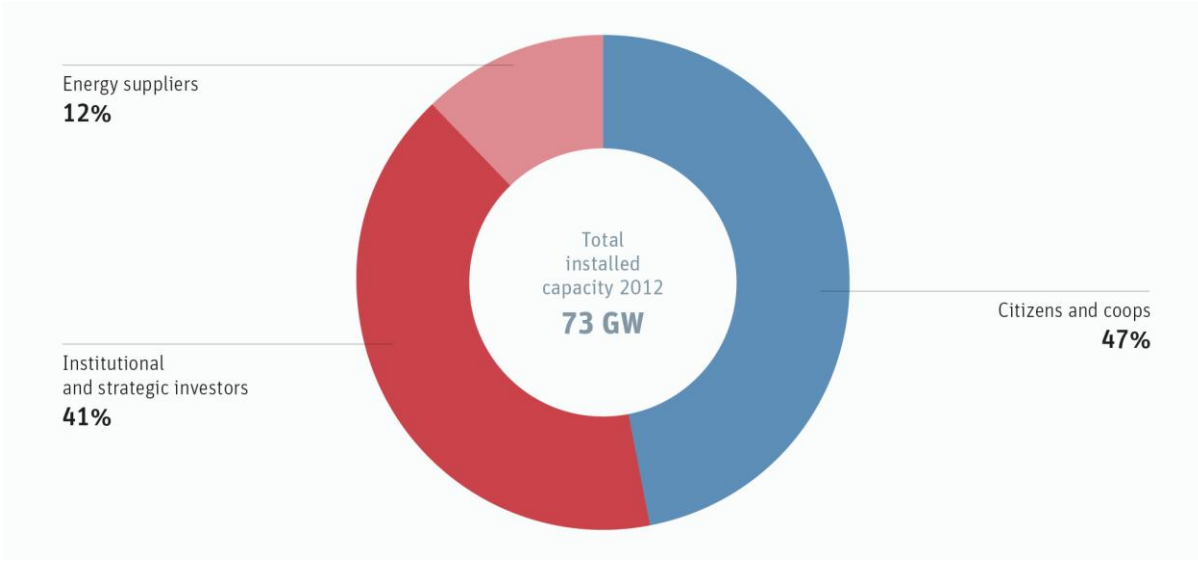


Figure 10. Community energy in Germany - Ownership of renewables by ownership type in 2012 (AEE, 2013).

#### **Dimension IV. Social / political level**

Generally, in the 1950s - 1970s, the discussion around a centralized system (specifically for electricity) was framed with positive attributes: *efficient, effective, competent, organized, safe and securing energy security*, the paradigm shift in the public discussion is characterized by the increasing domination of negative attributes: *anonymous, profit-oriented, power-oriented, slow, non-progressive, non-innovative, dirty (fossil / coal/ nuclear)*.

At the same time, the decentralized positive attributes received stronger influence in public discourse: *democratic, innovative, personal/near to the people, clean/green, self-determined, self-organized, solidary, and common welfare-oriented*. Here the interdependencies with wish for decentralized and democratic processes from the anti-nuclear narrative become evident. But during the last years, some negative attributes for a decentralized renewable energy system are re-vitalized or newly invented (justice discussion): *inefficient, negative for social-justice (reallocation from bottom-up through feed-in-tariffs/ EEG), risk for security of supply*.

In 1985, Hennicke, Johnson, Kohler and Seifried identified in their book "the energy transition is possible" four main barriers for the realization of the energy transition (1) the market concentration in the hands of few power companies, (2) the legal framework securing the energy oligopoly, (3) the physical centralization of power production in large power plants, (4) the entanglement of the few power companies with the state finances particularly on communal level.

The Energiewende with its decentralized components makes it possible for citizens to play an active role in shaping the development of different energy-relevant sectors, leading to the picture of a (re-)democratization of the energy system (Kunze & Becker, 2014; Radtke, 2013; Heinrichs, 2013). Especially in the field of decentralized energy generation, involvement is possible through participation in planning and permitting procedures. The financial participation or investment, e.g. in energy cooperatives, is another opportunity for having a direct influence (Holstenkamp & Müller, 2013, Klemisch, 2014).

Furthermore, in a more decentralized system people can participate in the initiation and design of climate protection concepts and energy-related goals and guiding principles, for example the goal of a 100% EE region (see Moser, 2013). In addition to these functions, citizens' participation in planning and authorization procedures can also contribute to enhancing public confidence in public administration and politics, promoting democratic understanding and improving knowledge and the level of information available to the public (Hauser, Hildebrand, Dröschel, Klann, Heib & Grashof, 2015). From a systemic perspective, the psychological variables such as trust and the motives attributed by the stakeholders are of importance. For example, external private stakeholders (companies, investors) are more likely to be perceived as only profit oriented and untrustworthy. On the other hand, regional stakeholders are seen to be not profit oriented - a classic example of this are citizens' initiatives, regional environmental protection groups or energy cooperatives.

Individual persons or institutions can act as "change agents" in the sense of active acceptance and act as promoters, multipliers, and good example providers (Heins & Alscher, 2013). The demonstration by a relevant and perceptive or networked person in the regional environment, that something is possible and feasible and also benefits, stimulates imitation in the sense of

"learning on the model" and supports the long-term process of developing a social norm (Ibid., Cf. Bandura, 1979).

In this context, there are many good examples in which the factors of trust in stakeholders, identification with energy technology and regional added value have been successfully implemented; also with regard to the communication between the stakeholder groups involved. This applies both to different renewable energy technologies such as wind farms or solar systems, as well as to larger systems such as bioenergy villages and 100% EE regions (Wüste, Schmuck, Eigner-Thiel, Ruppert, Karpenstein-Machan, & Sauer, 2011; Moser, 2013). All these cases have in common that intensive communication elements were used to represent regional relevance and benefits, as well as dialogical possibilities for participation in planning and implementation.

Energy cooperatives have developed into a success model and thus a relevant actor in the energy sector in recent years (Holstenkamp & Müller, 2013). For example, energy cooperatives produced 580 million kilowatt-hours of green electricity, which could meet the needs of 160,000 households a year. The total investments of energy cooperatives also have risen from 792 million euros in 2011 to about 1.2 billion euros in 2013 (Klemisch, 2014). In addition to the participation in local or regional value chains, energy cooperatives also offer the possibility of using a decentralized renewable, (in principle, ecological) energy production, which corresponds to the attitude and motivation of many citizens as well as municipalities and at least partly explains the rapid spread of energy cooperatives; these have certainly developed into a model for citizens' energy (see Radtke, 2013). Many initiatives throughout Germany started to produce their own electricity. The citizen groups were forming a knowledge base and created a very well (self) educated human capital. One example of such an initiative is the "*Power Rebels of Schönau*": As a result of Chernobyl, the citizens started energy saving campaigns to the "scrap" nuclear power plants by demand reductions (EWS Schönau, n.d.). They founded a company to support electricity production from small-scale hydro, small CHP plants and photovoltaics. The *Power Rebels* demanded from their energy utility to offer renewable energy tariffs and support for energy savings, but were met with heavy resistance. When their local electricity grid concession was to be renewed for another 20 years in 1990, the citizens rejected the sale and forced through that the citizens themselves could run their grid. Today the Rebels are running a renewable energy power utility.

In spite of the described positive developments, there is also criticism of the organization of participatory processes within the energy sector in the sense of a systematic reinforcement of social inequalities. These inequalities are related to both the procedural and distribution levels.

At the procedural level, there is a major challenge that must be actively questioned, that, intensified informal possibilities of participation, insofar as they occur unreflected, may lead to structural distortions, as well as to the structural reinforcement of social inequalities: certain participatory methods address in part different target groups; and the access to the formats is easier for some groups whereas there are structural barriers for others (see Nanz & Fritzsche, 2012). Already at the formal level there is an imbalance between the people involved, as far as the socioeconomic status is concerned. In general, people with a higher socioeconomic status are more likely to be involved. It is important to focus on which stakeholder groups are affected and should be represented within a participation process and, where appropriate, require a more specific inclusion strategy.

There are also developments that need to be critically reflected with regard to the financial redistribution effect. Critics lament that the EEG was a "re-allocation machine" which privileges those citizens who already have the appropriate capital and the know-how to hedge risks at the expense of the possibly not so financially strong generality (Buchholz-Will, 2005). Also with regard to the positive development of the energy cooperatives, there is the fear that the economic interests or the goal of the return on investment may become more important than its democratic orientation and sustainability and thus the originally alternative character of the energy cooperatives is spoiled (Chatalova & Valentinov, 2014): "Sustainability, the guiding principle of the energies, requires a sensitization of companies towards their economic, ecological and social environment. Sustainability is a matter of course for cooperatives, which is why they are particularly well suited to promote a rethink. In order to meet this role, however, they must keep their alternative character and not be allowed to betray it in profit interests" (ibid.).

Another motivation, connected to the demand of a decentralized energy system, is the hope to reduce impacts of energy infrastructure on local environment. Some stakeholder groups hope to minimize the need for new energy infrastructure like transmission line by establishing a decentralized renewable energy system combined with storage systems and a smart usage approach (Zimmer, Kloke & Gaedtke, 2012). On the other hand, there is a question of increasing numbers of decentralized energy plants like wind and PV and their spatial distribution: Some regions already complain that their threshold is crossed and that they have too much wind turbines installed and that public acceptance is decreasing due to this technical overflow. The complexity of this topic emphasizes the need for a regional differentiation – there are several possible types of "decentral" regions, therefore, a more efficient and systemic multi-level-governance as well as comprehensive spatial planning strategies regarding distribution in energy production and addressing also responsibilities and decisive power is needed.

Another development that needs to be mentioned in this dimension III is the growing anti-wind sentiment and anti-power line protests. The perception of renewable energy infrastructure is addressed by ToR Q 23 ("What has been the degree of acceptance for certain technologies such as high voltage lines, wind parks, utility scale PV parks, CCS, nuclear energy in Germany?" and is strongly linked to the central-decentral debate).

With the increasing capacity of renewable energies, especially wind energy, a need for grid intension was identified and decided in the Grid development plan (50Hertz Transmission, Amprion, TenneT TSO & TransnetBW, 2012), defining the need for 3.800 km more power lines until 2022. This development was accompanied by a rising resistance against power lines. In the period 2009-2012<sup>7</sup> there was a consensus about the need for more grids to integrate renewables, the topic of debate was the technological question whether to use over-land-lines (heavily opposed by rural neighbors) or more expensive underground cables.

Meanwhile there has been a shift to the "if question", the general need of power lines is questioned, often connected with the vision of a local energy autarky with limited need for national and international transmission lines.

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<sup>7</sup> In this periode the "dena I and II" grid studies were published identifying the "need" for transmission lines.

A strong civil-society movement – often denounced as a NIMBY movement (e.g. Fröhlingsdorf, 2011) - against transmission lines and wind farms has since emerged throughout Germany. As a reaction, several conservative regional governments have de-facto stopped the further construction of wind turbines and the overland construction of transmission lines.

While the 100% Renewable Energy Transition seemingly became an official all-party-consensus with the 2010-Energy concept, certain shares of liberal-democrats backed by strong business associations and parts of the CDU did not buy into the transition project and keep attacking it fiercely via media campaigns such as shown in Figure 11.



**Figure 11. Anti-energy transition campaign by the Initiative Neue Soziale Marktwirtschaft “Stop the electricity price horror!” (Heine, 2017).**

An important organization in the anti-energy transition movement has become “Vernunftkraft” translating into “the power of ratio”<sup>8</sup>, their main slogan is the demand for a “reasonable energy transition”. This protest movement includes activists from the anti-wind movement<sup>9</sup> and anti-grid extension initiatives. More information about the anti-grid extension groups can be found in the central-decentral narrative (chapter 4.2). The new populist-right party AFD serves as a political vehicle for anti-energy transition groups. This newly emerging party denies climate change and advocates nuclear energy and the use of domestic fossil energy resources such as lignite and fracking of shell gas while reversing the use of renewable energies.

As a reaction to increased rural opposition to windfarms the conservative governments of two large federal states (in German “Bundesländer”), Bavaria (Lang & Lang, 2016) and North-Rhine-Westphalia, have passed or announced building restrictions on wind turbines which heavily limits the possible sites for further turbines.

<sup>8</sup> [www.vernunftkraft.de](http://www.vernunftkraft.de)

<sup>9</sup> [www.windwahn.com](http://www.windwahn.com); [www.gegenwind.de](http://www.gegenwind.de)

### 4.3 German narrative III: The role of energy security for energy policy

In the following, we are presenting a third facet of the German energy transition: The role of energy security for energy policy. This narrative covers the same time frame, actors, and conditions as before, but focuses on the issue of security. From the very term, it is already obvious that security is also interlinked with risks – which we have addressed particularly as risks to human health in the anti-nuclear narrative earlier. Several historical events and factors influenced the energy security paradigm. Narratives around energy security are: Influence on foreign policy, national - role of European Union

- Energy import dependency of Germany
- Accessibility and Affordability Crisis
- International Relations and Integration

In order to analyze the development and influence of the energy security narrative on the German energy transition, the different dimensions of the term have to be understood.

An economy has reached energy security, if the current and future demand of fuels, resources and energy is secured in a safe, technically, and economically reasonable manner and according to the requirements of environmental considerations (Article 1 of the German Energy Law [Energiewirtschaftsgesetz; EnWG]). The word security (German “Sicherheit”), has two basic translations: (1) reliability (sicher = verlässlich, bestätigt) and (2) safety (sicher = vor Gefahren geschützt). According to Ren and Sovacool (2014, p. 847) energy security is characterized by four factors: availability (technically) and accessibility (geopolitically) of resources, affordability, and acceptability.

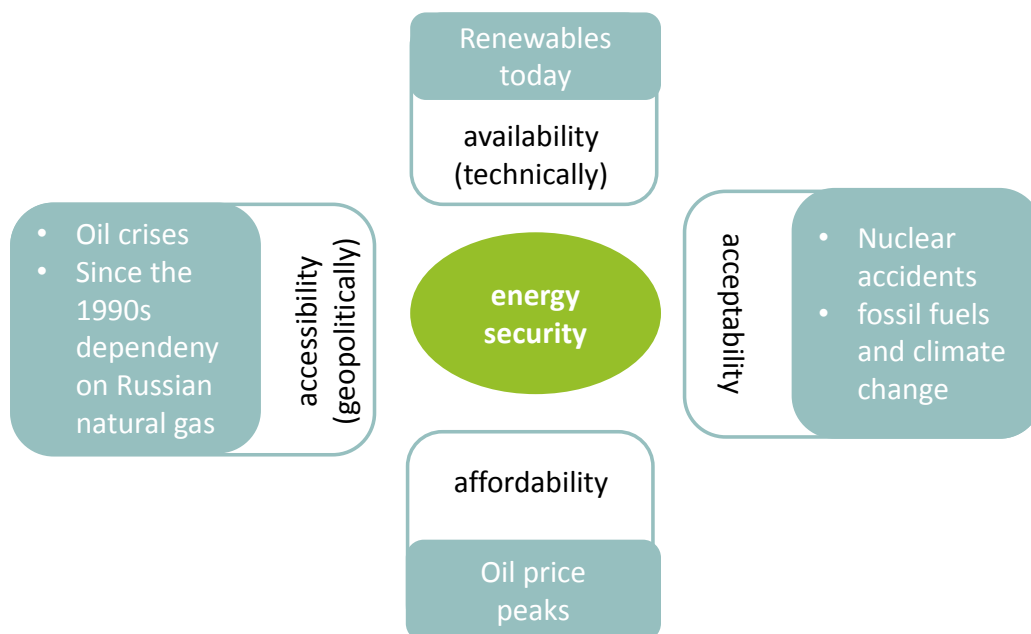


Figure 12. Energy security (adapted from Ren & Sovacool, 2014).

These four factors determine whether the energy supply of an economy or country/region is classified as reliable and safe. The first three factors availability, accessibility and affordability have, however, a strong influence on the fourth one – acceptability. Definitions of energy security fuse traditional conceptions of national security with emerging concepts of human rights, sustainable development, and individual security (Sovacool & Valentine, 2013).

Energy security today is defined as equitably providing available, accessible, affordable, reliable, efficient, environmentally benign, proactively governed and socially acceptable energy services to end-users.

Consequently, two different levels of energy security threats need to be distinguished: (1) systemic threats such as the limited availability of fossil fuels, growing demand and competition, and centralization affecting the reliability dimension and (2) situative factors such as terrorism, strikes or political interventions affecting the safety dimension.

Since energy demand is ever growing and the systemic limits to satisfy the demand needs to be addressed. Even if the safety dimension is left aside, a business as usual in regard to energy supply inevitably increases the conflict potential over (fossil) energy resources (Hennicke & Bodach, 2010).

### **Accessibility dimension**

The Soviet Union and later Russia have been perceived as a weakness in Germany's energy supply concept ever since 1948. As a reaction to the currency reform, the Soviet Administration of Eastern Germany blocked all commodity flows into the three sectors of West-Berlin. This blockade included the disruption of electricity supply from the Zschornowitz lignite plant. The blockade was countered by the allied forces by the Berlin airlift. 62% of the air freight transports brought coal to Berlin (Kuhrt, 2010).

In the 1950s and 60s, Germany went through a phase of reconstruction and economic development, along with rising energy consumption and un-interrupted energy supply.

The oil crisis, in 1973<sup>10</sup>, was a massive shock. It redefined energy security for decades to come. One of the instruments applied were driving-prohibitions on Sundays which left the impressive German highway infrastructure, a symbol of the nation's wealth and progressiveness, deserted. The pictures of empty highways, as seen in Figure 13, became engrained in the West-German consciousness, says historian Frank Bösch (2013).

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<sup>10</sup> The Arab-Israeli Yom Kippur War caused that the oil producing countries used oil as a weapon for the first time. The OPEC (Organisation of the Petroleum Exporting Countries) imposed an embargo against the US and the Netherlands, the other industrialised states were suddenly receiving much less oil from the Arabs. 1973 the price for a 159-litre barrel of oil was three US Dollar – 1979 during the peak of the second oil crisis the price was 38 US Dollar per barrel.



**Figure 13. Empty German highway on a Sunday in November 1973 (Bösch, 2013).**

These car-free Sundays were an innovation trigger that motivated people to find alternative means of transport: bikes, roller skates, even horses, as well as alternatives in the energy production, particularly renewable energies. Bösch points out that the first energy saving policies like consumption norms for cars, housing standards like doubling glassing even in older buildings were products of the oil crisis. Energy stopped being viewed as infinite.

As a reaction, the German federal government passed the plan to construct 40 additional nuclear power plants (which were never built) and Great Britain and Norway expanded their fossil fuel exploitation of the North Sea (Handelsblatt, 2013).

In the 1980s, natural gas imports increased substantially as the oil price went down. In the 1990s, with continuously low prices and improved access to Eurasian hydrocarbons resulting from the end of the Cold War, energy security concerns decreased further and there was thus also less justification e.g. for hard coal subsidies. Because of the economic deficit and because the subsidization contradicted EU subsidy legislation, the German parliament decided in 2007 to terminate domestic hard coal mining by 2018.<sup>11</sup>

The Russian-Ukrainian gas crisis in 2009 brought the import dependency back into public consciousness that had become so neglected after the OPEC induced oil crisis.

Although Germany's heavy reliance on imports from Russia did not significantly change over the past decades, conflicts between Russia and transit countries such as Ukraine fostered the fear of energy supply disruptions all over the EU (Eurostat, 2016).

It is worth noting that actual disruptions did not materialize – but the import dependency argument was firmly integrated into the energy transition discourse. The transition to renewable energies was perceived as a contribution to energy security of Germany and the EU - because it replaces international imports by domestic energy resources. Seifried and Witzel stated in 2010 (p.20): "*Dependence on energy imports not only means a heavy outflow*

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<sup>11</sup> The phase-out was carried out gradually between 2008 and 2018.



*of capital, but also narrows political leeway and [...] increases the likelihood of armed combat over scarce resources.”*

In the context of the Energiewende, renewable energies, ever since the 1980s, have been perceived as an infinite, nationally available resources. According to Hennicke and Bodach (2010), energy efficiency should also be perceived as an energy resource. Today, almost all actors involved in Germany (e.g. UBA, 2017) and the EU stress on the same strategies targeting the supply as well as the demand side in order to become more independent.

The main narrative element has thus become: A truly stable, long-term energy supply and, thus, energy security can only be guaranteed if in the short term the import of resources is diversified, and in the long-run energy demand shall be minimized and supply guaranteed by a mix of national/European renewables replacing (imported) fossil fuels (Hennicke & Bodach, 2010).

The energy transition will make Germany less dependent on fossil fuels (from regions of conflict) and ultimately reduce the potential for armed conflict over scarce reserves.

The energy transition is often solely viewed as a solution to limit climate change. While energy security actors, frameworks, and development as such do not constitute a niche, the “appropriation” of the energy security realm by renewable energy creates new niche actors and regimes and thus momentum for change.










Climate change has been framed as a security topic since 2007, after the publication of the 4<sup>th</sup> Interim Report of the IPCC (2007) and the awarding of the Nobel Peace Prize to former Vice President of the US Al Gore and the IPCC that year. In 2007, the German Advisory Council on Global Change (WBGU) also identified climate change as a security threat (WBGU, 2007).





The WBGU argues that a change in the energy system is one solution to avoid wars over resources and the destabilization of regions are part of the social impacts. Especially oil reserves are located in politically sensible regions. In 2005, OPEC members held three quarters of all proven oil reserves. “Indeed, five countries of the volatile region of the Persian Gulf – Saudi Arabia, Iraq, Kuwait, the United Arab Emirates and Iran – alone make up 60 per cent of global oil reserves.” (BP, 2007, p. 6) Climate change aggravates economic, ecological, and social problems and risks, social orders are further destabilized, distributive justice is multiplied and policy systems are overstrained (WBGU, 2007; Goodman & Catariou, 2009). In this line of reasoning, it is argued that a change to more climate friendly energy technologies makes one more independent from energy imports from instable regions like Venezuela, Russia and the Middle East: “The dependence on these [oil- and gas-rich] states makes the external relations more complicated and compels to ungrateful compromises on questions such as human rights and the promotion of democracy. This dependence is also extremely vulnerable to interruptions in delivery - an opportunity for potential attacks that has not been unseen by various terrorist and criminal organizations in recent years.” (Goodman & Catariou, 2009)

### **International Relations and integration to increase energy security**

One of the first incarnations of the EU was the European Coal and Steel Community (ECSC), a joint economic zone between six countries including Germany and France founded in 1951. It was considered as an instrument to prevent wars and supervise Germany’s coal and steel production via regional economic integration.

**Table 5. Establishment of energy institutions and reserves in Germany (own compilation).**

Establishment of energy institutions and reserves in Germany	
1951	 Establishment of the European Coal and Steel Community (ECSC)
1951	 Establishment of the Union pour la coordination de la production et du transport de l'électricité (UCPTE)
1957	 Establishment of Euratom
1966	 Mandatory oil reserves of German oil companies
1973	 1 <sup>st</sup> oil crisis Establishment of the International Energy Agency (IEA) of the OECD countries
1979/80	 2 <sup>nd</sup> oil crisis
1999	 Conversion of the UCPTE into the Union for the Co-ordination of Transmission of Electricity (UCTE)
2009	 Conversion of the UCTE into the European Network of Transmission System Operators for Electricity (ENTSO-E)
2013	 Introduction of a National Reserve of Back-up power plants (many outside of Germany)
2015	Development of the EU Energy Union (European Commission, n.d.) Strategy

- Institutions in the power sector,  institutions in the nuclear power sector, - institutions in the oil sector,  - institutions in the coal sector.

Already in 1951, the Union for the Coordination of Transmission of Electricity (UCPTE) was established, coordinating the transmission between Belgium, Germany, France, Italy, Luxemburg, Netherlands, Austria, and Switzerland. Among the European partners, blackouts need to be avoided by any means. Also, the engineers were convinced that the integration of the electricity systems would contribute to peace in Europe after WWII. The international network should substitute national reserve capacity.

The European Atomic Energy Community (Euratom) establishment followed soon after in 1957, creating a market for nuclear power in Europe (see anti-nuclear narrative).

This shows that technical, political und trade orientation solutions were used to achieve not only energy security but also a peaceful integration in Europe.

In 1965, Germany decided to develop a strategic oil reserve, with a regulation that German companies producing or importing oil or oil products were obliged to hold 90 days reserves (Deutscher Bundestag, 1965). After the oil price crisis in 1978, the oil reserve was transformed into a national reserve. Its costs are covered by the consumers and are about 0.27 €cents/liter petrol (Höber, 2016).

Until today, Germany has not introduced an obligatory national gas reserve. Current gas reserves are held on a voluntary basis by the gas companies.<sup>12</sup> In the 1970s, West Germany also started ‘pipes for gas’ deals with the Soviet Union (Stern, 2005).

The two oil price crises in the 1970s, however, reminded Germany and the EU that energy-related dependency makes a country vulnerable to political blackmailing by suppliers such as the OPEC countries. The crises were less a result from limited availability of resources than political calculation. As a result of the first oil price crisis, the International Energy Agency was founded with the aim to stabilize the energy market if needed.

Until 1989, the electricity supply of East and West Germany were separated. Full integration was achieved in 1995, just before the inclusion of other Eastern European states such as Poland, Hungary, Czech Republic, and Slovakia.

Since 1996, several policy packages established a single European electricity market and made free energy trading possible within the European Union (Stoerring & Horl, 2017). In 2009, the Union for the Co-ordination of Transmission of Electricity (UCTE) was converted into the European Network of Transmission System Operators for Electricity (ENTSO-E). Their annual Adequacy Forecast Reports analyze the security of supply situation particularly due to increased shares of fluctuating renewables with a time horizon of 10 years and publish a Ten-Year Network Development Plan. Germany’s electricity grid is already well-connected to its neighbors and Europe has established a single European electricity market with the EU electricity exchange in Leipzig. The interconnectors allow Germany to balance intermittent electricity from wind and solar by exporting or importing electricity (Cherp, Vinichenko, Jewell, Suzuki & Antal, 2017).

Within the EU, a secure energy supply is no longer understood within national boundaries but perceived as a regional task. Germany is also well-connected to the European gas grid and can rely on its neighbor countries for emergency gas supplies. To increase temporary supply security, the EU reacted to the Russian-Ukrainian gas crisis in 2009 by changing the regulation on energy security and ordered the member states to keep certain oil reserves (Council Directive 2009/119/EC, 2009). As a reaction to the Ukraine crisis, the German foreign minister called for “more Europe” (Auswärtiges Amt, 2014a). Europe should become an Energy Union with a fully integrated domestic energy market. Europe as a whole should become less dependent on imports. In November 2010, the EU Commission agreed to a strategy for 2020 which defined energy policy priorities. As one of the priorities, it also mentioned that good relationships with third countries delivering energy resources to the EU have to be maintained (Eurostat, 2016).

The key strategy in Germany/ the EU to increase energy supply security is diversification. The supply side strategies and policies focus on achieving diversification in three dimensions:

- (1) Diversification of primary energy sources,
- (2) Diversification of supply countries,

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<sup>12</sup> The buildup of an obligatory national gas reserve, was, however, discussed more thoroughly in 2008 as a reaction to the conflict between Russia and Georgia (Gitschier, 2008). The Germany gas suppliers perceived a mandatory reserve as superfluous, since voluntary reserves which can hold up to 28 % of total national annual demand already exist to react to price volatility and sudden changes of temperature in winter months (Mihm, 2008)

- (3) Diversification of transport routes e.g. for oil and gas transportation (Zhang, Ji & Fan, 2013).

### **Acceptability dimension: Energy security and risk perception**

Energy security does not only mean reliability of imports, but also the reduction of risks associated with energy sources – such as oil spills, nuclear meltdowns, or gas explosions. Resulting from risk perception, different technologies become acceptable – or not.

Climate change is mainly caused by the use of fossil fuels works and poses a risk to the very survival of mankind: Extreme weather events such as hurricanes, heat waves, or climate wars directly pose a threat to our safety – not the technical availability and reliability of resources. In this context, the use of fossil fuels just like nuclear energy have in recent years started to become unacceptable risks

Nuclear energy is considered a high-risk technology in terms of its impacts on human health (see also anti-nuclear narrative). Since 9/11 it is imaginable, that nuclear plants become the target of terrorist attacks (Hennicke & Bodach, 2010). Since uranium needs to be imported, availability is not a strong argument for promoting nuclear energy in Germany. In addition, Nuclear energy plants are connected to nuclear weapons. Supporting other countries in building nuclear power plants could mean giving them a better access to nuclear weapons – a less desired outcome from a security perspective. As Felix C. Matthes (2005, p. 3) demonstrates, there are lower-risk options available to fight climate change. *“Investing in nuclear energy carries not only considerable health, financial and security risks; it may also prove to be a dangerous lock-in and dead end.”*

The risks related to nuclear energy do not outweigh the risk of global warming. The prevention of a nuclear revival under the threat of climate change is mainly due to the effect of the energy security narrative, catalyzed by Fukushima. The WGBU as well, refuses a climate change strategy based on nuclear energy due to its unclear risks, costs as well as the proliferation and security risks (WBGU, 2003).

### **Energy security as a window of opportunity**

However, solutions on how diversification is implemented or how a reduction in demand can be achieved are debated and answered differently depending on the individual balancing of the four factors availability, affordability, acceptability, and accessibility (Figure 12) – and they vary between actors in Germany. Tradeoffs between factors have to be accepted. *“For instance, the development of renewable energy resources is beneficial to improve ‘availability’ but it may also simultaneously lower ‘affordability’.”* (Ren & Sovacool, 2014, p. 847)

The weighing of the four factors leads to favoring one resource over the other, e.g. coal for availability, renewables for accessibility, and is highly influenced by situative factors and political windows of opportunity.

In order to push for particular policies, the energy security argument is often used. Situative factors such as oil spills (Brent Spa, Deepwater Horizon), gas explosions or Fukushima pose windows of opportunities to push this narrative. The security argument is thereby used to push for all kinds of factors.

As soon as the Energiewende was framed as a question of security, it gained in momentum, as could be witnessed in 2014. Former foreign minister Frank-Walter Steinmeier stated in his inauguration address at the Munich security conference in 2006 that in the 21<sup>st</sup> century *global security is intrinsically tied to energy security and thus energy policy becomes a core interest of foreign policy* (Müller-Kraenner, 2008). Just a few years later in 2014, the Ukraine crisis made this relation painfully obvious to the broader public. At that point energy security was not a short-, medium- or long-term topic anymore, but the crisis made energy security top priority of foreign policy, Steinmeier stated (Auswärtiges Amt, 2014a).

The former Polish Prime Minister Donald Tusk also argued that the EU is “enslaved” to Russia and the former EU Commissioner for Energy Günther Oettinger said that Russia has too much leverage over the EU (Schmitz, 2014). Due to political instabilities and depleting resources, Russia cannot be seen as a reliable partner anymore. For EU states “the bigger the dependence on gas from Russia, the bigger the nervousness”, according to Steinmeier (Auswärtiges Amt, 2014a). However, this could be considered anti-Russian populism and was not necessarily shared by energy experts. Following the arguments on risk perception, it still resonated well in the public and the media.

### **Renewable Energies and energy efficiency in the security context**

Renewable energy technologies are not without risks, as explosions of biogas plants have shown, but their impact is a lot lower. Risks are mainly associated with RE in regard to big hydropower dams. In addition, any form of big, central technology such as large solar plants have a higher impact if the supply is disrupted, but extreme environmental effects comparable with oil spills or nuclear meltdowns are not possible.

In parts, security is also used as an argument against the Energiewende. Particularly the German industry raised the argument that the Energiewende would threaten national energy security because an increased share of fluctuating RE would increase the probability of blackouts (“Die Lichter gehen aus”).<sup>13</sup> This was used by the industry as a counterargument against the Energy Transition. The energy transition is pushing for the digitalization of the electricity grid, but smart grids open the door for hacker attacks (Rudolf, 2017).

On the other hand, a climate friendly energy supply is often more decentral and thus more resilient to attacks and disruptions. An energy transition in the name of climate change thus also means energy security – a more independent, energy supply resistant to disturbances.

Renewable energies do not only work as a climate change mitigation strategy but promote stability and safety.

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<sup>13</sup> Prime Minister Hans Filbinger labeled the project as indispensable because otherwise the „lights would turn off“ in the state of Baden-Wuerttemberg. After heavy protests and juristic problems the project was still canceled. But a power shortage didn't occur even though no direct compensating measures had been taken (e.g. building a coal power plant); on the contrary there were considerable excess capacities.

#### **4.4 Japanese narrative I: A developing narrative for nuclear phase-out and decentralization**

Discourses over nuclear power and centralized/decentralized electricity system have been intertwined in Japan. Like in Germany, nuclear power plants were at the core of the traditional electricity system in favor of large scale power generation and transition systems which were promising economies of scale. In other words, under the centralized electricity system, the promotion of nuclear power was a national policy (for economic, energy security and climate change reasons). It was economically rational to develop large-scale power plants and build a long-range grid. Nuclear power was perceived to be a symbol of future energy, and out of ten regionally monopoly utilities nine (except the Okinawa Electric Power Company Inc.) have built nuclear power plants.

Nuclear power is perceived as a stable, “domestic” energy source, and the promotion of nuclear power was also tightly connected with discourse over energy security of Japan. A nuclear fuel cycle system in which spent fuel from nuclear power plants is reprocessed to extract plutonium for reuse as fuel was envisioned as an ultimate measure to secure domestic energy sources. The Monju fast-breeder reactor, a core component of the system, was once touted as a “dream reactor” for an energy-scarce country that produces more plutonium than it consumes. In reality, however, it has been in operation a mere 250 days since it first reached criticality in 1994. More than ¥1 trillion in taxpayer money has so far been spent on Monju, and maintenance alone costs ¥20 billion a year. The decision to decommission the Monju fast-breeder reactor was made in December 2016. On the other hand, it is still not clear when the nuclear fuel reprocessing plant — another key component in the program and whose construction began in 1993 — will be ready for operation. Its scheduled completion date in 1997 has been delayed more than 20 times due to a series of technical glitches and other problems. Its construction cost has ballooned three times the original projection to ¥2.2 trillion. Despite these difficulties, the government has not abandoned the nuclear fuel cycle program.

Nuclear power was also perceived and promoted by the government and industry as a countermeasure to climate change. For example, when the Japanese government, led by the Democratic Party of Japan, pledged to reduce its national GHG emission by 25% from 1990 levels by 2020 at COP15 of 2009 in Copenhagen, the large part of the reduction would be achieved by rapid expansion of nuclear power. The Japan’s Energy Basic Plan of 2010, envisioned the construction of nine new nuclear power reactors between 2010 and 2020, in addition to the 54 reactors already existing.

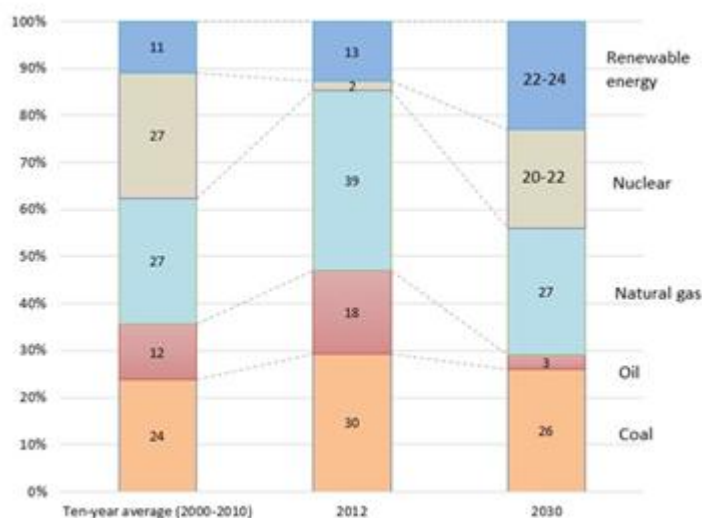
A precondition to these discourses over the promotion of nuclear power was the “myth” of safety. However, the Fukushima nuclear power plant accident pulled this precondition into question. Instead, renewable energy sources caught attention. Propelled by the increased interest in renewable energy following the Fukushima accident, the Renewable Energy Act to introduce the feed-in tariff scheme passed the Diet in August 2011 and was enacted in July 2012. The FIT scheme actually boosted renewable energy installation, in particular solar PV due the high tariff rate (JPY42/kWh for 20 years at the start of the scheme), which was among the highest in the world (WWF Japan, 2012). In 2015, 10 GW of solar PV was installed. The share of renewable energy which was 9% in FY 2011, has increased to 15% in FY 2016 (Renewable Energy Institute, 2017).

The Fukushima accident not only questioned the safety myth of nuclear power but also posed several questions against the traditional, centralized electricity system. In particular, rolling power outages under the tight supply-demand balance in the wake of the Fukushima nuclear accident, resilience of the centralized electricity system was questioned. A discourse that a decentralized electricity system, rather than a centralized one, may be able to supply electricity more stably and durably emerged. Weak grid operation was also widely recognized. Japan uses two different electricity frequencies to transmit power, with the eastern half of the country operating at 50Hz and the western half at 60Hz. Between the two frequency zones, only 1.2 GW in total can be transferred at three conversion locations. In addition, within the two frequency zones connections between regions were also weak. It became obvious that more flexible grid operation is urgently needed.

In April 2013, the cabinet approved the Policy on Electricity System Reform, which had three major objectives: (1) to secure the stable electricity supply, including enhanced use of renewable power; (2) to suppress electricity rates to the maximum extent possible; and (3) to expand choices for consumers and businesses (METI 2013). Since then, a series of measures for electricity system reform has been or will be implemented in Japan. For example, the Organization for Cross-regional Coordination of Transmission Operators (OCCTO), and the Electricity and Gas Market Surveillance Commission were established in 2015; full retail liberalization was implemented in April 2016, and legal unbundling of power generation and transmission/distribution is planned for April 2020 (TEPCO already unbundled them in April 2016).

In reality, however, the wholesale electricity market has not been developed so far. Its trade volume is as low as account 2.6% of the total electricity demand (as of June 2016). After retail liberalization began, only 3.3% of the contracting households have switched their suppliers from major utilities to new power suppliers (as of November 2016). On the other hand, renewable energy, in particular solar PV, has rapidly increased after the introduction of the FIT scheme. In some regions, there are some days when the share of renewable energy amounts to around 80% of the demand — nearly 70% generated by variable renewable energy sources, solar PV, and wind. It becomes obvious that more flexible grid operation and market design are urgently needed (Obayashi 2016b).

The roles of nuclear power and coal-fired power are still under discussion. The 2014 Basic Energy Plan stated that dependence on nuclear power would be reduced as much as possible in future, but called for a swift restart of existing nuclear power plants once the Nuclear Regulation Authority approves their safety. The Long-term Energy Supply and Demand Outlook of July 2015 indicated the energy mix for 2030, which in turn became the basis for bottom-up calculation of emissions reduction target for 2030 (METI 2015). Nuclear and coal were seen as base load power sources. Figure 14 presents power source mixes of ten-year average before the Fukushima nuclear accident, 2012, and 2030. The power source mix for 2030 seems well-balanced in terms of diversity of power sources. However, it would be unrealistic to expect that 20-23% of electricity could come from nuclear power, given the regulatory requirements and the current public sentiment against the re-operation of nuclear power plants (Wakiyama & Kuriyama, 2015). The 26% share of coal-fired power plants is almost equivalent to ten-year average before the Fukushima nuclear accident and is questioned after the Paris Agreement entered into force.



**Figure 14 Power Source Mixes for 2000-2010, 2012, 2030 (Sources: METI 2015)**

In September 2016, METI established the Policy Subcommittee for Acceleration of Electricity System Reform. However, so far, the most important issue to be discussed under the Subcommittee is how to finance the costs associated with the Fukushima nuclear accident, including decommissioning, decontamination, and compensation, as well as the costs for decommissioning other nuclear power plants, in the liberalized market. At the same time, new systems that could be at the heart of the system reform, such as a capacity mechanism, base load power source market and the non-fossil value trading market are being discussed under the Subcommittee. Some observers raised concerns about the contexts of on-going discussions, i.e., the main focus seems to be on the relief measures for major utilities, especially their nuclear power business, and these discussions seem to move against the reform toward a decentralized electricity system (Obayashi 2016b).

Compared with German narratives over anti-nuclear and decentralized power system, Japan has not yet geared up for full energy system reform toward a decentralized system. Major utilities have vested interest in nuclear power. Nuclear power business is still lucrative for them, and is seen essential to improve their financial conditions. For example, it is openly mentioned that the reoperation of currently stalled nuclear reactors is essential for TEPCO to continue to compensate the huge damage the Fukushima nuclear accident caused. Major industry and the labor union are also reluctant to immediately stop or even phase out nuclear power plants. Political momentum for anti-nuclear was also not built. The results of most of public polls indicated that majority was against the restart of currently suspended reactors, and several political parties pledged phase-out or immediate shutdown of nuclear power plants. Unlike Germany, however, the Japanese election system consisting of single-seat constituencies and proportionally represented multiple-seat constituencies made it difficult for single-issue political parties, like Green Party, to obtain seats. Those political parties which pledged a phase-out or immediate shutdown of nuclear power plants also did not win elections after the Fukushima nuclear accident. Nuclear power business is based upon the large, centralized electricity system. Unless the paradigm shift in nuclear power discourse occurs, it might be difficult for Japan to gear up for a full-fledged, decentralized electricity system.



## 4.5 Japanese narrative II: The role of energy security for energy policy

Just like Germany, Japan went through significant economic re-development after WWII. However, perhaps the notion of energy security has played even a greater role in Japan's energy politics due to the historical, economic, and geopolitical differences compared to the German situation as below.

First of all, although difficult to estimate the degree of actual influence, the historical memory of the 1940s encourages Japan, perhaps more than Germany, to prioritize addressing energy security threats in energy policy. In the 1940s, a fear of being colonized by western powers was a major driving force for Japan to seek and secure external oil in South East Asia. During this period, oil was considered as the national lifeline as only it can fuel the most important industry at that time, military to protect sovereignty (Sagan 1988; Suzuki 2014). When the US and its allies introduced trade sanctions and finally imposed oil embargoes against Japan in 1941, the US had 738 times more oil production capacity, 52 times more oil refinery capacity, and 8 times more oil stock (Iwama 2006; Suzuki 2014). It was apparently a losing game from the very beginning as Emperor Hirohito stated later in his life "*Oil started and ended The Pacific War*" (Terasaki 1995). This disturbing memory first prompted Japan to see the overdependence on foreign energy resources as a direct threat to national security (Suzuki 2014).

After the WWII, Japanese economy grew at a higher speed than Germany and this growing trend lasted longer. From 1946 till 1973, Japan's GDP yearly grew by 9.4% on average which was often praised by foreign economists as an economic "miracle" (Johnson 1982). This upward trend, although slowed down after the oil crises in the 1970s and 80s, continued until the beginning of the 1990s. Correspondingly, the energy supply in Japan increased dramatically to support its highly growing economy by 10.4% every year during the first three decades after the WWII and an upward trend was kept until the beginning of the 2000s (EDMC 2014).

Against the backdrop of such high economic growth and increasing energy demand, Japan had far less domestic energy resources available compared to Germany which had abundant supply of domestic coal. Therefore, Japan continued increasing external energy dependence and securing the supply of oil returned to become the most important element of Japanese energy policy once again, but this time to protect its economic growth. In 1973, Japan relied on external oil by 77% for primary energy supply, of which 80% was imported from Middle East (ANRE 2013). Thus, a series of hostile and institutional actions of oil producing states which started in 1973 brought a devastating blow to the Japanese economy. The price of imported oil increased fourfold in 1974 in relative to the 1972 level, causing "skyrocketing inflation" (Iyoda 2010). As a result, Japan recorded its first negative GDP growth in 1974 since 1945 (EDMC 2014). This experience reminded that the concept of energy security should be at the heart of the country's energy policy and self-sufficiency of energy is vital to secure the continuity of economic prosperity as well as social functions (Suzuki 2014).

After the oil crises, just like Germany, Japan tried to mitigate the risk of sudden disruption of energy supply by diversifying the energy mix (replacing oil with natural gas and coal wherever possible) as well as by securing alternative energy suppliers. In the absence of other domestic

alternative energy resources such as renewable energy back then, the only possible way to increase the otherwise minimal energy self-sufficiency was to accelerate electrification and deploy as much nuclear power as possible. Indeed, most of the growth in energy supply after 1974 was due to the rapid increase of electricity production. Between 1974 and 2010, the electricity supply in Japan grew by 266% in contrast to a 140% growth of the primary energy supply (Suzuki 2014; EDMC 2014). In this growing role of electricity in Japan's energy supply, nuclear power increased from 3% of the total electricity supply in 1973 to 29% in 2010 (the peak was in 1998 when nuclear supplied 37%) (Suzuki 2014).

What made and still makes these situations more challenging for Japan in regards to energy security is that, in contrast to Germany where a single national electricity grid as well as gas pipelines are well-connected to European markets, the Japanese power grid is not only fragmented regionally (See Chapter X for details) but also isolated and there is no gas pipeline connected to any neighboring countries as of today. Having no such safety net as emergent energy supply from friendly neighbors, it was perhaps more difficult for Japan to aim for a radical transition with rather new technologies such as renewable energy. However, recently, a concept developed by Masayoshi Son, Chairman and CEO of the SoftBank Groups (a major telecommunication and internet company of Japan) to establish a regional power market in Asia known as "the Asia Super Grid" gains increasing attention as a potential solution. This concept aims to connect potentially the major suppliers of renewable energies such as Mongolia for wind and India for solar with big energy consuming countries including Japan (Ohbayashi 2016). This would, if it comes true, bring significant benefits to Japanese energy security.

## **5 Topical Clusters and ToR questions (WP 1)**

### **5.1 Topical Cluster I: Targets, strategies and strategic framework conditions (TC I)**

Content of this first Topical Cluster are the following ToR-questions:

- Which targets, strategies and strategic framework conditions for an energy transition are already available or planned in both countries? (Q1)
- What is the role of the general policy landscape? (Q2)
- How do the German and the Japanese governments address possible carbon leakages of industry? (Q3)
- How do the German and the Japanese governments handle possible losses of power companies that are transitionally caused by the energy transition? (e.g. early retirement of coal or nuclear power plants of private companies) (Q4)
- What are successful examples and failures in gaining support from citizens and confidence of investors in strategic frameworks in Germany and Japan? (Q5)
- Are the targets, strategies and strategic framework conditions sufficient for achieving energy transition in both countries? (Q6)
- What has been the role of science in generating knowledge on technologies, potentials, feasible scenarios, policies, and impacts? What has been its role in creating a consensus or not on the feasibility of an energy transition? (Q7)

#### **5.1.1 TC I: JAPAN**

##### **5.1.1.1 Which targets, strategies and strategic framework conditions for an Energy Transition are already available or planned in Japan? (Q1)**

The Act on Promotion of Global Warming Countermeasures, which was enacted in 1998 as the first climate-dedicated law, is a framework legislation for climate change policy in Japan. Based upon the Act, the Kyoto Protocol Target Achievement Plan was formulated in April 2005. The Act also provided legal foundation for the Global Warming Prevention Headquarters (GWPH), which was originally established within the Cabinet in December 1997, to achieve the Kyoto Protocol's 1st commitment period target and comprehensively advance concrete and effective measures for the prevention of global warming. The Prime Minister serves as the chief of the GWPH, and the ministers for the Environment (MOEJ) and the Economy, Trade and Industry (METI) serve as deputy chiefs.

Another pillar of Japan's framework policies for tackling climate change is the Act Concerning the Rational Use of Energy (or Energy Conservation Act), which was enacted in 1979 and is a comprehensive legislation on energy conservation. The Energy Conservation Act is significant from a climate change mitigation perspective for two reasons (Takamura, 2012). First, it covers energy-related CO<sub>2</sub> emissions, which account for about 90% of national GHG emissions. Second, it contains mandatory measures (for example, the requirement of energy management in industrial and commercial sectors, and energy efficiency standards for machinery and equipment including Top Runner Standards for electric appliances and

vehicles, as well as for residential and commercial buildings), while most other energy and climate measures are not mandatory.

Regarding the long-term direction of energy policy, the Basic Act on Energy Policy of 2002 requires METI to develop the Basic Energy Plan. The Basic Energy Plan provides the general direction of national energy policy for the next two decades. Approximately 90% of Japanese GHG emissions are energy-related, which is why climate policy and energy policy are considered as two sides of the same coin particularly in Japan. There are three decisive elements that have long played a key role in formulating Japan's energy policies, known as 3E: Energy security; Economic efficiency; and Environment. The first Basic Energy Plan was developed in 2003 and further revised in 2007, 2010 and 2014. After the Great East Japan Earthquake and the subsequent tsunamis followed by the Fukushima Daiichi nuclear accidents inflicted a serious blow to the stability of energy supply and raised concerns on the use of nuclear energy, "Safety" became an additional element to the 3E and thus reflected in the Basic Energy Plan 2014.

Reflecting upon the aforementioned Basic Energy plan, MOEJ takes a leading role in developing the Basic Environment Plan, a comprehensive and long-term framework of Japan's strategy on environment conservation. The Basic Environment Plan is codified in the 1993 Basic Environment Act, and is not a law, but new legislation need to comport with it because the Cabinet adopted it. In 2012, the fourth revision of the Basic Environment Plan mentioned that Japan would aspire to reduce GHG emissions by 80% by 2050. Several pathways to achieve 80% reduction by 2050 were assessed and discussed at the MOEJ Central Environment Council. However, no concrete steps to achieve that goal were defined. However, the National Institute of Environmental Studies (NIES), while introducing the concept of "low carbon society", published a report in 2007 showing that it would be technically possible to reduce CO<sub>2</sub> emissions by 70% from 1990 levels in 2050, while meeting service demand required.

#### **5.1.1.2 What is the role of the general policy landscape in Japan? (Q2)**

In regard to the general policy landscape, first of all the climate policy in Japan has to be analyzed. Following the decision not to participate in the second commitment period of the Kyoto Protocol, The Act on Promotion of Global Warming Countermeasures was amended to mandate both central and local governments to formulate the Plan for Global Warming Countermeasures from 2013. After the adoption of the Paris Agreement, the Cabinet approved the Plan for Global Warming Countermeasures in May 2016, which stipulates 80% reduction by 2050 (the base year was not specified though) as an aspirational goal, along with 2020 and 2030 mitigation targets and also describes how Japan's nationally determined contribution (NDC) will be achieved. The plan specifies detailed actions that government entities, business sector and citizens shall take to achieve the 2030 target. The plan emphasizes the PDCA (plan-do-check-act) cycle to monitor the status of progress every year and the plan will be revised, if necessary. Requested by the Paris Agreement which invites all parties to formulate and communicate long-term low GHG emission development strategies, mindful of its long-term temperature goal, by 2020, MOEJ and METI began discussing long-term strategy for

achieving the 2050 goal separately and compiled two reports which are conflicting each other on key elements (See Table 6)<sup>14</sup>.

**Table 6. Comparison of MOEJ and METI reports**

	MOEJ Report	METI Report
Main message	<ul style="list-style-type: none"> <li>To solve climate change issue (substantial domestic emissions reduction) and solving other national challenges simultaneously</li> </ul>	<ul style="list-style-type: none"> <li>To contribute to the global emissions reduction by providing low carbon technology to the world</li> </ul>
Basic approach	<ul style="list-style-type: none"> <li>Based on the concept of “carbon budget,” how to manage the total cumulative emissions is a basis for climate policy.</li> </ul>	<ul style="list-style-type: none"> <li>Due to uncertainty in science, technology and int'l. cooperation, “no regret policy” should be taken.</li> </ul>
Domestic or overseas reduction?	<ul style="list-style-type: none"> <li>Domestic emissions reduction</li> <li>Substantial domestic reduction can boost Japanese companies’ competitiveness in “promised markets” in the world.</li> </ul>	<ul style="list-style-type: none"> <li>Japan should consider how it can contribute to global emissions reduction, rather than domestic reduction.</li> </ul>
Innovation	<ul style="list-style-type: none"> <li>Innovation is key, and not only technological one, but also changes in economic and social system and life-style</li> </ul>	<ul style="list-style-type: none"> <li>Long-term technological innovation is key.</li> </ul>
Carbon pricing	<ul style="list-style-type: none"> <li>Carbon pricing should be prioritized policy.</li> </ul>	<ul style="list-style-type: none"> <li>Level of “carbon pricing” in Japan is the highest in the world.</li> <li>Cautious discussion is required.</li> </ul>

As for energy policy, the second important policy area, the latest energy policy of Japan, entitled “Strategic Energy Plan” or commonly refer to 2014 Basic Energy Plan, published in April 2014, states that “the point of the energy policy is to first and foremost ensure stable supply (“Energy Security”), and realize low cost energy supply by enhancing its efficiency (“Economic Efficiency”) on the premise of “Safety.” It is also important to make maximum efforts to pursue environment suitability (“Environment”)” (METI 2014). In this policy, particularly for electricity supply, coal, nuclear, ordinary hydro, and geothermal energy are labeled as “base load power source” that can operate “stably” and “low cost”, natural gas as “intermediate power source” that is relatively affordable and flexible energy, and oil and pumped-storage hydro as “peaking power source” that is less affordable but can act quickly to

<sup>14</sup> MOEJ and METI’s draft plans of Japan’s long-term climate strategy (2017).

<http://www.env.go.jp/council/06earth/y0618-14/mat03-1.pdf>

METI’s plan for Energy Innovation Strategy (2016)

<http://www.meti.go.jp/press/2016/04/20160419002/20160419002-1.pdf>

“The Plan for Global Warming Countermeasures” (Cabinet Decision, 2016): providing an overview of Japan’s mid-term and long-term emissions reduction targets and outlines broad range of possible actions.

<https://www.env.go.jp/press/files/en/676.pdf>

<http://www.env.go.jp/press/files/jp/102816.pdf>

Cabinets report:

“National Energy & Environment Strategy for Technological Innovation towards 2050 : National Energy & Environment Strategy for Technological Innovation towards 2050” (2016)

[http://www8.cao.go.jp/cstp/nesti/gaiyo\\_e.pdf](http://www8.cao.go.jp/cstp/nesti/gaiyo_e.pdf)

[http://www8.cao.go.jp/cstp/nesti/honbun\\_e.pdf](http://www8.cao.go.jp/cstp/nesti/honbun_e.pdf)

fill the gap between energy supply and demand. Renewable energy is considered as “promising, multi-characteristic and important energy source” that is relatively unstable and costly at the moment.

This plan, formulated under the LDP-led government, also states that dependence on nuclear power will be reduced as much as possible in the future, but called for a swift restart of existing nuclear power plants once the Nuclear Regulation Authority approves their safety. However, the 2014 Basic Energy Plan itself did not indicate the energy mix for 2030, since there was still uncertainty about the issue of nuclear power safety examinations, international climate negotiation, and the progress in the feed-in tariffs scheme. Instead, the Long-term Energy Supply and Demand Outlook of July 2015 indicated the energy mix for 2030, which in turn became the basis for bottom-up calculation of emissions reduction target for 2030 (METI (Ministry of Economy, 2015). With this outlook, which was also referred in Japan’s first Nationally Determined Contributions submitted to UNFCCC, Japan aims to deploy all of the aforementioned energies to further diversify the country’s energy systems towards 2030 (METI 2015). The government plans to supply the country’s total energy demand in 2030 by oil (30%) in addition to liquefied petroleum gas (3%), coal (25%), natural gas (18%), nuclear (10~11%), and renewables (13~14%). Electricity which is expected to supply 28% of energy in 2030 will be produced from oil (3%), coal (26%), natural gas (27%), nuclear (20~22%), and renewables (22~24%).

However, this future outlook may be revised soon as there is still much uncertainty particularly in balancing the role of coal, nuclear, and renewables under the expectation of continuous population decline as well as energy efficiency improvement and subsequent decrease in energy demand. Moreover, the 2015 Paris Agreement further pushes countries including Japan to accelerate their GHG emissions reductions efforts. Against these backdrops, there is an increasing number of changes made in the construction plans of new coal power plants in Japan. For example, the Kansai Electric Power (KEPCO) cancelled the plan to switch the Ako oil-fired power plant to coal in January 2017, and later on cancelled plans to build a new coal power plant in Ichihara (KEPCO, 2017). This is the first case of cancellation of a new coal power plant among the 49 coal power plants which are either planned to be newly built or re-constructed since 2012. MOEJ has been warning the plans for new coal-fired power plants as part of a legally mandatory environment impact assessment procedure.

Regarding ocean renewable energy, Japanese government shifted to promote ocean renewable energy after the Great East Japan Earthquake. As a matter of fact, Basic Plan March, Tonen General Sekiyu and Kanden Energy Solution (a subsidiary of KEPCO) on Ocean Policy started to commercialize and facilitate introduction of offshore wind turbines and promote technological development and experimental studies. In addition, several demonstration projects of offshore wind energy by government and some projects by private companies have been implemented.

However, expansion of offshore wind projects in Japan is slow, compared to Germany. While demonstration projects of floating type or bottom-fixed type in general sea areas where legal framework has not been established can be seen, the number of commercial offshore wind projects is still small and most of the commercial projects tend to be implemented only in port areas.

### 5.1.1.3 How does the Japanese government address possible carbon leakages of industry? (Q3)

The current rate of carbon tax (global warming countermeasures tax) in Japan is JYP 289/t-CO<sub>2</sub> (USD 2.6/t-CO<sub>2</sub>). Legally, the carbon tax is a surtax on the existing upstream Petroleum and Coal Tax. All fossil fuels that were exempted from the Petroleum and Coal Tax before October 2012 (e.g. imported coal for the iron and steel production and volatile oil feedstock for the production of petrochemical products) are also exempted from the carbon tax in order to maintain international competitiveness of energy-intensive industries. Other major carbon pricing schemes are emissions trading schemes by Tokyo Metropolitan Government and Saitama Prefecture. These emissions trading schemes are largely targeting office buildings. Therefore, carbon leakage has not taken place in Japan.

However, many Japanese energy intensive industries as well as the biggest and most influential industry association, Keidanren, argue that the introduction of a more stringent carbon pricing would not help reducing emissions but could encourage more emissions by the effect of carbon leakage. This concern is reiterated by the latest document published by METI on Japan's long-term climate strategy, which states that the Japanese carbon price is already at the world's highest level and the introduction of more stringent carbon pricing would widen the gap of prices between countries, resulting in carbon leakage since it would not reduce emissions per consumption (METI 2017).

The problem of the METI's argument is that their working definition of "carbon pricing" includes a multitude of policy instruments and effects (e.g. fuels prices, carbon tax, fossil fuel taxes, FIT, and even cost of voluntary action). As mentioned above, the level of the Japanese tax itself is very low (see Figure 15). Furthermore, METI's statistics itself show that total energy prices in Japan are not necessarily so high as they claim (See Figure 16). Nonetheless, the industry and METI have successfully blocked the introduction of substantial carbon tax so far.

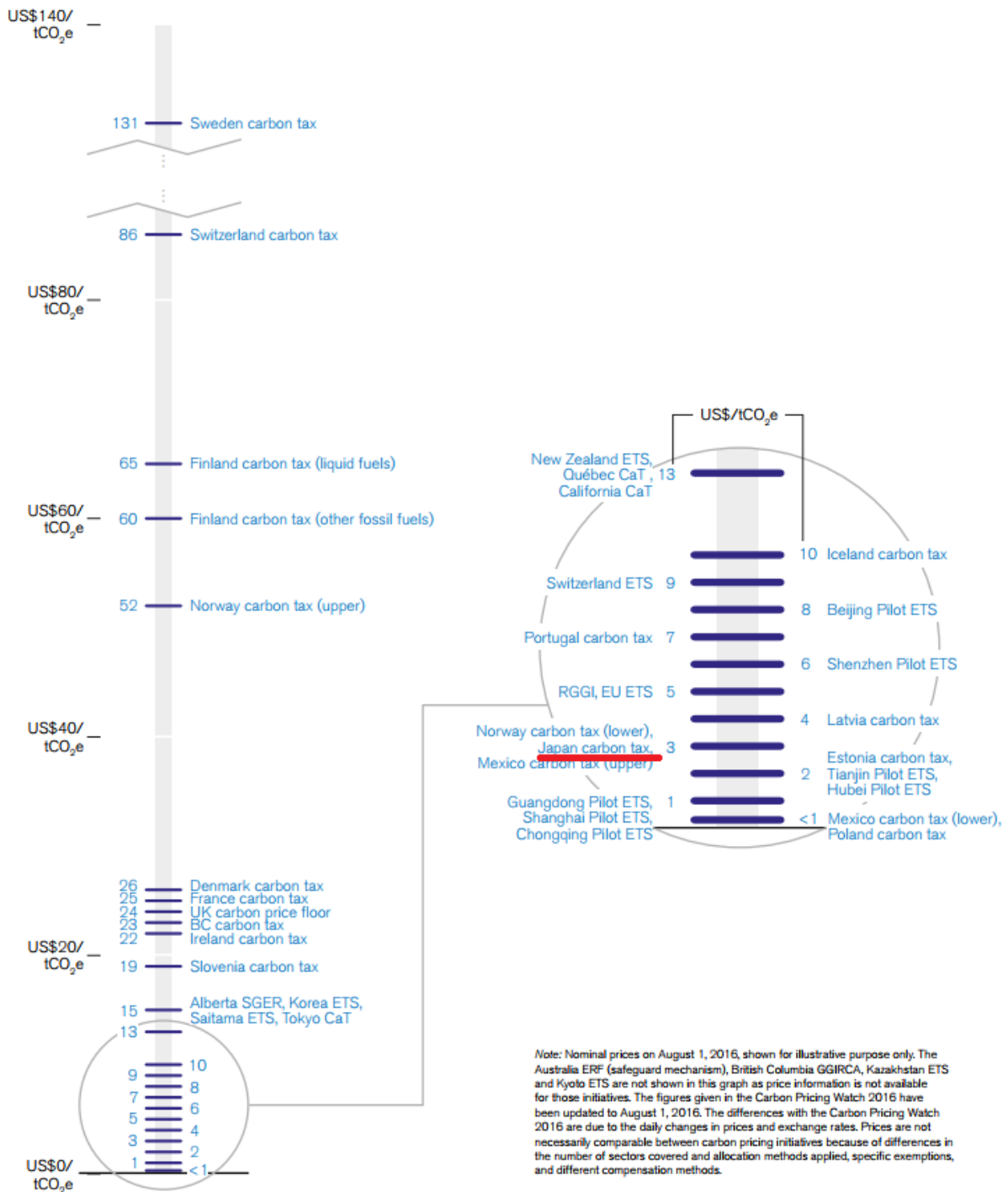
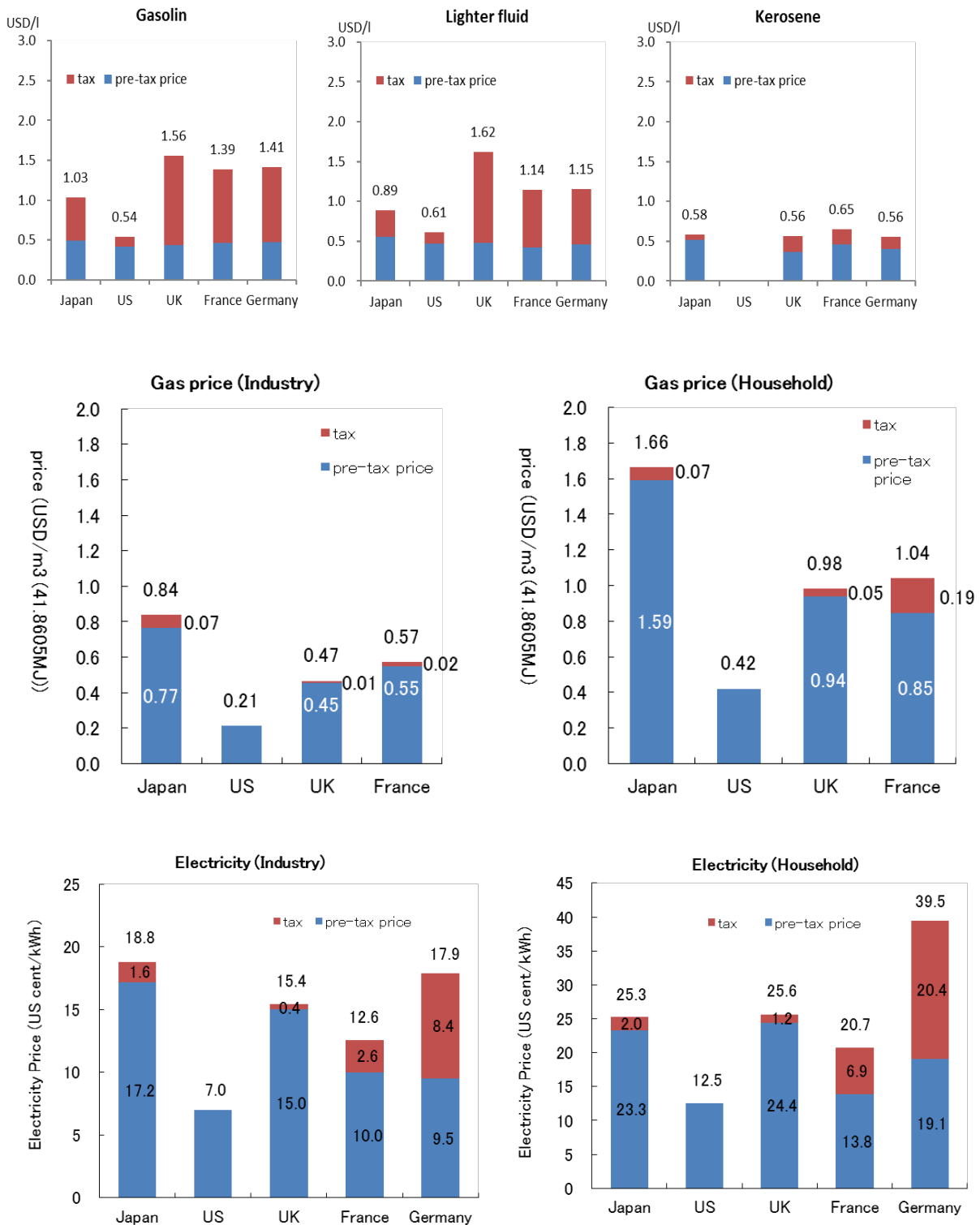


Figure 15. Prices in existing carbon pricing initiatives (World Bank (2016) The State and State of Carbon Pricing)





**Figure 16. International Comparison of Energy Prices.**

MOEJ is in favor of introducing a strong carbon pricing policy, noting that risk of carbon leakage can be addressed by institutional designs of a carbon pricing scheme. Pros and cons of various options to address carbon leakage have been discussed at MOEJ's council and Ministry of Finance's study group. Such options include: free allowance allocations based on

grandfathering, fixed sector benchmarking and output-based allocation; administrative exemptions; rebates; and border carbon adjustment.

#### **5.1.1.4 How does Japanese government handle possible losses of power companies that are transitionally caused by the energy transition? (e.g. early retirement of coal or nuclear power plants of private companies) (Q4)**

In Japan, ten power companies long enjoyed regional monopolies for almost 50 years after the World War II (except Okinawa Electric Power Company which joined the market when Okinawa was returned to Japan from the US occupation in 1972) during which the rate-of-return regulation was applied to the power market and the cost of electricity was fully reflected in consumer prices. Since 1995, a series of policy reforms has been introduced to gradually liberalize the market, but it was not until 2016 that Japan opened the retail sector for free competition.

It is planned that by 2020, the transmission and distribution sector will be unbundled from the current vertically integrated monopolies, making the electrical grids fairly accessible to the existing and future power providers. Only then will we know how the Japanese government will actually handle possible losses of (the existing) power companies. But it currently discusses possible measures to maintain nuclear and thermal power, which have higher upfront and fixed costs compared to renewable energy, yet are considered as most reliable base load energies in the new competitive market. Such measures include the introduction of capacity market and contract for difference (CfD) scheme.

MOEJ has been warning against the plans for new coal-fired power plants.

The ten power companies long enjoyed regional monopolies for electricity generation, transmission and distribution for almost 50 years after the World War II during which the rate-of-return regulation was applied to the power market and the cost of electricity was fully reflected in consumer prices. As of today, the power generation and retail sectors are open to competition, yet the transmission and distribution sector is and continue to be regulated for the purpose of securing stable supply of energy, according to the government, in the foreseeable future.

This long history of regional monopolies poses several constraints for an energy transition. For example, the electrical grids in Japan are physically separated into ten regions with limited capacity of cross-regional transmission. This caused a serious shortage of electricity in Kanto area after the Great Eastern Japan Earthquake in 2011, whereas there was surplus electricity available in the neighboring regions. Even electricity is run on different frequencies: 50 Hz in the east and 60 Hz in the west, making it impossible to transmit across borders without conversion.

#### **5.1.1.5 What are successful examples and failures in gaining support from citizens and confidence of investors in strategic frameworks in Japan? (Q5)**

The participation of general citizens in developing a climate and energy policy is still very limited in Japan. For example, the latest climate change mitigation policy of Japan, entitled the Plan for Global Warming Countermeasures, was approved by the cabinet in May 2016. This policy was drafted among the 52 experts of the relevant fields appointed by MOEJ and METI

and did not include the wider public in this policy-making process, such as by going through an interactive public consultation process. Instead, the draft was later disclosed for public comments and in total 244 comments were received. Only the summary of these comments and the governmental responses to the summary were shared.

One of the successful examples in building confidence of investors was the feed-in tariff scheme under the the Act on Purchase of Renewable Energy Sourced Electricity by Electric Utilities (Renewable Energy Act), which passed the Diet (bicameral legislature) in August 2011 and was enacted in July 2012. The Act requires electric utilities' operators to purchase all the electricity generated by renewable energy sources (solar, onshore wind, geothermal biomass and hydro smaller than 30MW at the start of the scheme, and offshore wind from April 2014) at fixed tariff rates for 20 years. Electric power utilities collect surcharges from electricity users to the costs of purchasing renewable energy-source electricity. The FIT scheme actually boosted renewable energy installation, in particular solar PV due to the high tariff rate (JPY42/kWh for 20 years at the start of the scheme), which was among the highest in the world (WWF Japan, 2012). In 2015, 10 GW of solar PV was installed. Tariff rates were revised several times in order to control the increasing procurement cost, adjust for the declining PV module price and achieve a more balanced deployment of renewable energy sources (see Table 7). The recent revision of FIT also set stricter requirements and deadlines.

**Table 7. Changes in Purchasing Prices of Renewable Energy Sourced Electricity (Nikkei 2016)**

Fiscal year	Solar PV		Wind	Geothermal	Hydro		Biomass	
	Residential	Commercial						
2012	42	40	22	26	24		24	
2013	38	36	22	26	24		24	
2014	37	32	22	26	24		24	
2015	33	27	22	26	24		24	
2016	31	24	22	26	24		24	
2017	28	21	21	26	20	27	21	24
2018	26	Bidding	20	26	20	27	21	24
2019	24	Bidding	19	26	20	27	21	24

Unit: Japanese Yen/kWh

Notes: Residential solar PV is less than 10kW. Commercial solar PV is less than 2,000kW. Wind is large on-shore wind. Geothermal is also large geothermal power plants. Regarding hydro and biomass power plants, after FY2017 new categories will be introduced: large (left row) and small (right row) in terms of generation capacity.

Since the original FIT program did not fix the deadline for operation after operators get certificated, and set high prices at which the utilities were required to buy electricity from solar power suppliers, many of the certified operators postpone installing solar panels until the cost of panels goes down so they can maximize their profits. Fewer than 30% of the certified solar power generation facilities have so far gone into operation. To fill this pitfall of the original FIT program, the government revised the FIT and set the deadline for grid-connection arrangement after operators get certificated. METI estimated that 456,000 certifications, or 27.7 million kW, would be expired, since they cannot get connected with grid by the deadline. It is expected that this measure will wipe out inactive solar power projects and reduce possible financial burden on electricity consumers.

#### **5.1.1.6 Are the targets, strategies and strategic framework conditions sufficient for achieving energy transition in Japan? (Q6)**

Climate change policy, in other words, policy for energy transition toward decarbonization is not set as a priority issue in current administration. There is therefore no strong political leadership. Under the lack of political leadership, poor coordination among related-ministries and agencies makes it difficult to design comprehensive, cross-cutting strategies and policies that transform the whole society and energy system. The current tension between MOEJ and METI indicates deep gap between the two main ministries regarding the long-term low GHG emission development strategy. Ministry of Land, Infrastructure, Transport and Tourism and Ministry of Agriculture, Forestry and Fisheries have not been sufficiently engaged in domestic discussion over decarbonisation in general, and the long-term strategy in particular, while they are starting discussion.

Triggered by the second oil crisis, Japanese industries made great efforts to improve energy efficiency, and some of them are the most efficient in the world (e.g., the steel and iron, and cement sectors). However, any additional climate mitigation policies, including one to improve carbon intensity of energy, are still perceived by energy-intensive sectors as cost-increasing factors. These energy-intensive sectors dominated the largest industrial association in Japan, Keidanren, and they are reluctant to agree with such policies. There are new business groups which are pro-climate policy including carbon pricing. The Japan Climate Leaders Partnership (J-CLP) consisting of 14 membership companies is one of the examples. Despite these development, the majority of the Japanese industry and business is still not one of the driving factors of an energy transition.

In sum, it is difficult to see that the current targets, strategies and strategic framework conditions are sufficient for achieving energy transition in Japan.

#### **5.1.1.7 What has been the role of science in generating knowledge on technologies, potentials, feasible scenarios, policies, and impacts? What has been its role in creating a consensus or not on the feasibility of an energy transition in Japan? (Q7)**

The role of science is to transparently consistency check and feasibility check the proposed options. The integrated assessment model is regarded as a core tool to bridge between science and decision makers.

Open discussion based upon scientific energy-economic modelling was rather limited in Japan. There was no open discussion on emissions reduction target, and energy-economic models were not officially used for calculating emissions reduction target under the Kyoto Protocol. 6% reduction target (against the 1990 base year levels in the first commitment period of the Kyoto Protocol or 2008-2012) was adopted as a result of international negotiations, and lacked scientific rationales. As a result, some domestic constituency, in particular the industrial sector, claimed that the Kyoto Protocol was “unfair”.

It was in 2009 that an open discussion process was held for the first time in Japan to discuss a 2020 emission reduction target by inviting three research institutes and one university. The Government led by the Liberal Democratic Party (LDP) established the Mid-term (2020) Target Committee where several emissions reduction options were discussed openly, based upon four energy-economic models.

At COP15 of 2009 in Copenhagen, the Japanese government, led by the Democratic Party of Japan (DPJ) pledged a new 2020 target, to reduce its GHG emissions by 25% from 1990 levels. This 25% reduction target was decided by the government on a top-down basis. In 2011, using energy-economic models, the feasibility of the 25% reduction target was discussed at the Mid- and Long-term Roadmap Subcommittee of MOEJ. In the wake of the Fukushima nuclear accident, furthermore, the Energy and Economic Council and the Cost Verification Committee were established to discuss the role of nuclear power in Japan’s future energy mix.

After change of government in December 2012, however, the new government led by the LDP announced a complete revision of energy and climate policies. The Long-term Energy Supply and Demand Outlook of July 2015 indicated the energy mix for 2030, which in turn became the basis for bottom-up calculation of emissions reduction target for 2030, i.e., Japan’s nationally determined contribution (NDC) under the Paris Agreement. The energy mix for 2030 and NDC were calculated internally within the government, and there was no public discussion on numbers and assumptions.

In sum, there was no systematic process to reflect the results of scientific, energy-economic models and get the public actively involved while the government was considering emission reduction targets. Scientific, energy-economic models were rather used in an ad-hoc manner. Various challenges were identified when such tools were used in the public discussion. First, macro-framework (e.g. GDP and steel production) and other assumptions (e.g.) were largely provided by government’s targets as well as industries’ expectations (Kuramochi and Asuka 2012). Therefore, such figures tended to be optimistic numbers, i.e., higher economic growth and larger production activities. Second, there were various limitations of the energy-economic models used. For example, positive feedbacks of policies and measures, co-benefits of mitigation action, cost of inaction were not taken into account, except for some models. Thirdly, these assumptions as well as limitations were not necessarily well explained when the results

of the energy-economic models were disseminated. Specific “numbers” were discussed without explaining the context of such numbers (JUST 2017). Thus, the role of scientific, energy-economic models in creating consensus on the feasibility of an energy transition has been limited.

## 5.1.2 TC I: GERMANY

### 5.1.2.1 Which targets, strategies and strategic framework conditions for an Energy Transition are already available or planned in Germany? (Q1)

In regard to emission targets, a series of policy targets apply to Germany. The first emission mitigation targets were passed by the conservative government under chancellor Kohl in 1990. The targets, adapted in 1994, were aimed to 25% by 2005 with the base year 1990.<sup>15</sup> The government failed to pass any relevant policies to actually achieve these targets. In the Kyoto-Protocol the government only committed to a reduction of 21% for the time period between 2008 and 2012 (Quaschnig, 2003).

In 2005, policy makers pretended that the original emission mitigation target of 25% never happened. Germany had reduced its emissions by 21%, largely as a result of the complete de-industrialization of Eastern Germany following the re-unification rather than any significant structural adjustments (Fraunhofer ISI, SPRU & DIW, 2001).<sup>16</sup>

The SPD-Green coalition treaty of 2002 included the first 2020-mitigation target of 40% (SPD & Grüne, 2002).<sup>17</sup> The following CDU-FDP government accepted this target in its energy concept (2010), which foresees an unconditional reduction of GHG emissions of 40% by 2020 (Bundesregierung, 2010). The next targets are a reduction of 55% until 2030, 70% by 2040 and 80-95% by 2050. The German targets are embedded in EU targets for GHG mitigation and renewable energy shares. The EU 2020 package has three key targets: (1) 20% cut in greenhouse gas emissions (from 1990 levels), (2) 20% of EU energy from renewables, (3) 20% improvement in energy efficiency (EU, n.d.).

The Energy Transition is the key aspect of the overall climate change policy of Germany covering more than 80% of its direct emissions reductions. Other emission sources are the agricultural and the industrial sector. Sectoral emission targets (targets for agriculture included) were only introduced in Germany in 2016. Table 8 shows these sectoral mitigation targets. Germany also holds responsibility for the emissions as a final consumer of imported products, including large-scale indirect emissions from land-use-changes such as deforestation.

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<sup>15</sup> At the 1<sup>st</sup> COP in Berlin in 1995, the German environmental minister Angela Merkel was responsible for presenting the German climate mitigation targets to the other Kyoto members which motivated many to agree to binding emission targets.

<sup>16</sup> Fraunhofer ISI, SPRU & DIW (2001) derived in their calculations at a „Wall Fall Profit“ of 105 Mio. t CO<sub>2</sub>.

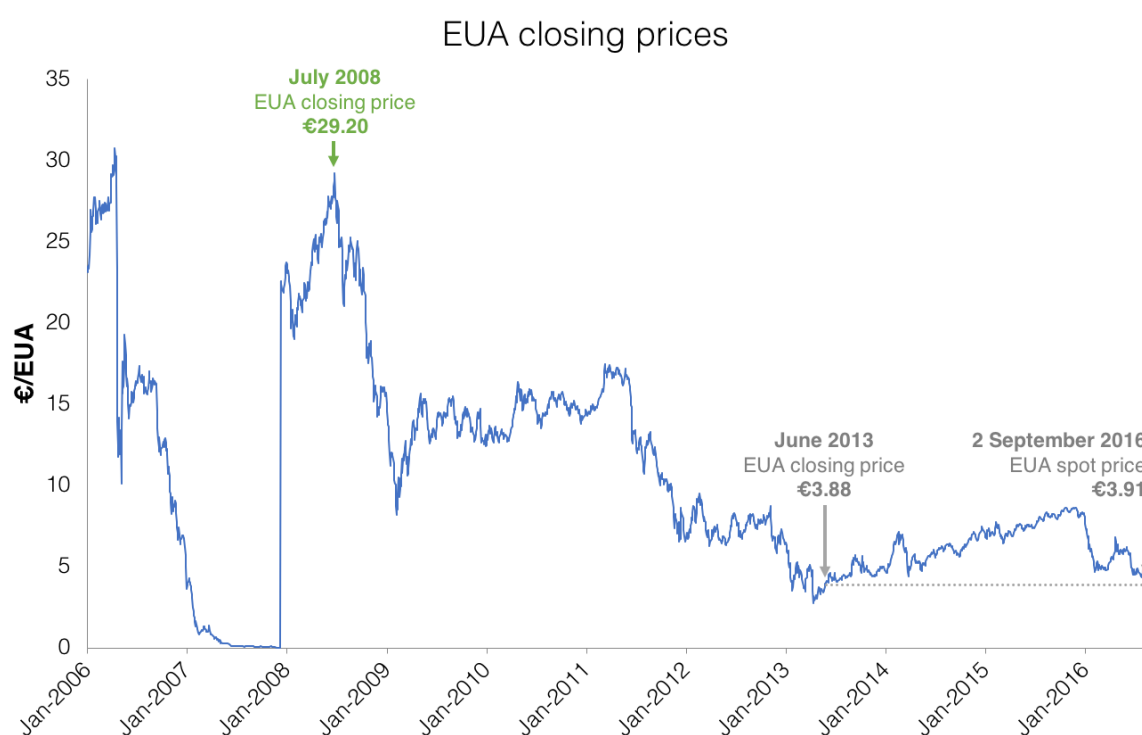
<sup>17</sup> This target was conditional to EU emission reduction of 30 %.

**Table 8. Sectoral GHG mitigation targets for Germany (BMUB, 2016b).**

Sectoral GHG mitigation targets	As of 2014	2030 Target	Reduction
	In Mio.tCO <sub>2</sub> .equ		
Energy	358	175-183	62-61%
Buildings	1199	70-72	67-66%
Transport	160	95-98	42-40%
Industry	181	140-143	51-49
Agriculture	72	58-61	34-31%

### 5.1.2.2 What is the role of the general policy landscape in Germany? (Q2)

A major determinant of German policy is the European Union. The European energy sector's emissions are limited by the European Emission Trading scheme. Due to large-scale free allocation of certificates and a lack of mechanisms to react to the economic slowdown since 2008, the European Emission Allowance (EUA) price has stabilized on very low levels which exert little if any influence on the market. Figure 17 shows the collapse of the EUA prices after its 2008 peak of 29 Euros.



**Figure 17. EU carbon price 2006-2016 (MacDonald, 2016).**

The EU institutions have not been able to successfully reform their emission trading system yet; this is partially due to the fact that its member states are far from sharing a common position on climate policy. Particularly the newer, Eastern European member states, led by Poland, have proven to be climate change sceptics with little support for strengthened climate change regimes (Neslen, 2017). This disagreement is reflected in the EU's 2030 climate change target which was criticized harshly by environmental groups for lack of ambition

(Carrington, 2014). The EU has committed to a reduction of 40% of GHG emissions in comparison to 1990.

### 5.1.2.3 How does the German government address possible carbon leakages of industry? (Q3)

Carbon Leakage policies took shape with the introduction of energy taxes and levies and the starting of the European Emission Trading System (ETS). German policies for these contexts are embedded in EU regulations. Table 9 lists several climate policy instruments and power price components, the regulatory level of the carbon leakage policy, the number of eligible sectors of the policy and the form of special treatment. The instruments are explained in more detail in the annex (pp. 137).

**Table 9. Overview of energy price elements and respective carbon leakage policies (own compilation).**

Climate instrument/ policy power price components	Level of carbon leakage regulation		Number and type of eligible sectors	Form of special treatment
	Germany	EU		
1. Emission certificates		x	176 sectors of the manufacturing industry	Free allocations of emission certificates of 100% of a product benchmark
2. Impacts of ETS on electricity prices		x	15 sectors of the manufacturing industry	Monetary compensation
3. Levies for renewable energies and CHP plants	x	x	65 sectors of the manufacturing industry	Reduced payments of levies
4. Energy taxes	x	x	Total manufacturing industry, agriculture and forestry	Minimum tax levels
5. Other power price components <sup>[1]</sup>	x		Specific manufacturing industries	Reduced payments/ Complete exemption of power price components

<sup>[1]</sup> Other power price components in Germany are: (1) network charges, (2) levies for flexibility options/load management, (3) offshore wind energy investment securities and (4) concession fees. Source:

The EU has established three different sector lists of industrial sectors at NACE 4 and Prodcom Levels,<sup>18</sup> which receive subsidies in form of exemptions or special treatment (climate policy instruments 1-3 in Table 9). The monetary compensation for impacts from the ETS (item 2) is financed from the German federal budget via the Energy and Climate Fund. Germany offers certain sectors and companies reduced payments or complete exemption from energy taxes and other power price components (items 4-5).

### 5.1.2.4 Q4 How does German/Japanese government handle possible losses of power companies that are transitionally caused by the energy transition? (e.g. early retirement of coal or nuclear power plants of private companies)

<sup>18</sup> NACE 4 refers to the Statistical Classification of Economic Activities in the European Community and differentiates 615 classes of industrial branches. PRODCOM data are detailed production data on an 8 digit level.



This question has been answered in the Narrative section.

#### 5.1.2.5 Q5 What are successful examples and failures in gaining support from citizens and confidence of investors in strategic frameworks?

This question has been answered in the Narrative section.

#### 5.1.2.6 Are the targets, strategies and strategic framework conditions sufficient for achieving Energy Transition in Germany? (Q6)

The German government is embedded in three monitoring processes. (i) on international level, Germany, as an Annex I Party, is obliged to report annually its National communications and greenhouse gas inventories.<sup>19</sup> (ii) As part of the EU, Germany has to provide detailed biannual scenario calculations which show, to what extent its current policy instruments are adequate to reach its climate mitigation targets. (iii) On a biannual basis, the government is also running a domestic monitoring process which compares current achievement levels of 10 domestic energy transition targets. The monitoring report is analyzing trends for each target and is rating them with 1-5 stars which indicates whether the government is on track in achieving them. As shown in the government's Fifth Monitoring Report for 2015, 6 out of 10 quantitative energy targets for 2020 is rated with 3 out of 5 stars indicating that the target might be missed (BMW, 2016a).

**Table 10. Achievement status of official Energy Transition targets (based on BMW, 2016a).**

Government targets	As of 2015	2020 target	Trend*
1. Total GHG emissions (% in comparison to 1990)	908 Mio.tCO <sub>2</sub> -equ (-27%)	749 Mio.tCO <sub>2</sub> equ (-40%)	3/5
2. Renewables Energy share of the gross final consumption of energy	14,9%	18%	5/5
3. Renewables Energy share of the gross electricity consumption	31,6%	35%	5/5
4. Renewables Energy share of the in energy consumption for heating and cooling	13,2%	14%	5/5
5. Renewables Energy share in the transport sector	5,2%	10%	1/5
6. Reduction of primary energy consumption	13.293 PJ	11.504 PJ	3/5
7. Energy productivity	313,5 Euro/GJ	368 Euro/GJ	3/5
8. Gross electricity consumption	594 TWh	556 TWh	2/5
9. Reduction of primary energy consumption		No 2020 target	/
10. Final energy consumption for heating	3069 PJ	2761 PJ	5/5
11. Final energy consumption in the transport sector	2619 PJ	2.327 PJ	1/5

<sup>19</sup> The agency responsible for all international reporting is the Federal Environment Agency (UBA).

*\* The monitoring report is analyzing trends for each target and is rating them with 1-5 stars. In the table we colored trends that received less than 4 stars in the monitoring report with the color red.*

While the Energy Transition in the electricity sector has made significant progress (compare green trends in Table 10), policy makers have so far struggled to introduce functioning mechanisms to transform the heat or transport sector. Particularly in the transport sector, the German government blocked several EU attempts to tighten emission standards.<sup>20</sup> Chancellor Merkel also publicly questioned the feasibility of the government target of 1 million electric vehicles in the transport sector by 2020 in May 2017 (Mortsiefer, 2017).

Emissions in the heat and transport sector remain stable at high levels (Breisig, Claudy, Kohlmorgen, Tillner, Uhr & Zein, 2015) as a result. As of 2015, GHG emission levels were 27% below 1990 levels leaving a difference of 13 percentage points or 159 Mio. t CO<sub>2</sub>equ/a to the 40% target set for 2020.<sup>21</sup>

In 2016 the ministry of the environment admitted that Germany would not achieve its 2020 climate change mitigation goal.

#### **5.1.2.7 What has been the role of science in generating knowledge on technologies, potentials, feasible scenarios, policies, and impacts? What has been its role in creating a consensus or not on the feasibility of an energy transition in Germany? (Q7)**

Since the beginning of the FONA-framework program by the Federal Ministry of Education and Research in 2005 (BMBF, 2016), a focus on inter- and transdisciplinary research, sustainable development and Energy Transition topics has emerged. The framework program was established in 2005 and represents the implementation of the German National Sustainability Strategy and the Federal Governments High-Tech Strategy. Due to the UN World Decade of Education for Sustainable Development (ESD; BMBF, 2016), since 2005, not only research, but also education in sustainable development has received major stimulus. The UN Decade of ESD fostered many different educational activities and made education in sustainability issues more visible. Nowadays, the ESD-decade has become the Global Action Program on ESD and there are sustainability strategies in different federal states in Germany, municipalities have added ESD to their political agenda also representatives from academia aim to anchor ESD at universities or universities of applied sciences (Deutsche UNESCO-Kommission, 2011). The participatory approach, which is mainly adopted by the stakeholders has led to the launch of exchange platforms throughout Germany. Almost 2,000 “Decade Projects” attest to their widespread impact. This further resulted in thematic, structural and procedural interfaces between FONA and ESD. In 2012 the “showcase e-mobility” was established at inter-departmental level as well to bundle competencies comprehensively between different ministries (BuW, 2017). The shift from conventional mobility techniques, using e.g. oil, is also linked to the topic of Energy Transition as an extension of e-mobility sector and can use stored energy by renewable energy resources.

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<sup>20</sup> Two examples can be found here, one on Germany opposing EU rules for stricter vehicle emission testing standards (Balsler & Bauchmüller, 2017) another on Germany blocking CO<sub>2</sub>-vehicle standards (Brühl, 2013).

<sup>21</sup> Already in 2014, a study on behalf of the ministry of economics stated that emission levels would only reach 36% by 2020 (prognos, EWI & GWS, 2014).

The role of science has been decisive in the anti-nuclear movement and the energy transition. As explained in the nuclear narrative, anti-nuclear activists and engaged citizens, felt the urge to understand and study the risks and technological aspects of nuclear energy. Several very influential environmental think tanks, like the Öko-Institut have been founded to facilitate this.

Independent research has since become a crucial tool to drive the Energy Transition. Alongside individual researches, NGOs like Germanwatch, WWF, [ausgestrahlt.de](http://ausgestrahlt.de), Greenpeace or BUND and institutes like the Öko-Institut or the Wuppertal Institut have been driving the Energy Transition using academic studies and energy scenario techniques to create trust in the Energy Transition. It should be noted though that the academic discussion in the 1980s and 1990s was suffering from a heavy gender bias with most environmental activists and academics able to present their viewpoints being male.<sup>22</sup>

The role of official energy studies and scenarios also needs to be stressed. Energy scenario planning was at the heart of the 'Energiewende'-discussion from the start, but was first run from outside of the state-funded institutions. From the 2000s onwards official institutions like the Federal Environment Ministry (BMU), the Federal Environment Agency (UBA) and the German Advisory Council on the Environment (SRU) have funded highly detailed technical scenarios using modelling techniques. These scenarios addressed in particular:

- Electricity costs: costs per kWh and total system costs,
- Reliability of renewable electricity supply: year-round security of supply based on fluctuating renewable energy sources (SRU, 2011) the role of electricity exchange in Europe/ transmission grids (ECF, 2010)
- Policy scenarios on how to achieve the mitigation targets, e.g. the report "Germany a Greenhouse Gas-Neutral Country 2050" (UBA, 2014). EU member states are required to report annually their progress towards EU 20-20-20 targets.)

Since the early 2000er years data on renewable energy deployment has been made available by the independent, but publicly funded, working group on renewable energy statistics (Arbeitsgruppe Erneuerbare Energien-Statistik-AGEE-Stat) through official channels, including the website of the BMU. The annual data series "Renewable in Numbers" has become a key resource for energy transition communication and analysis.

There are also a number of outstanding research studies that have had significant direct policy influence: For example, in 1980, the Öko-Institut published a comprehensive concept for an alternative energy supply and demand system for Germany (Krause, Bossel & Müller-Reißmann, 1981) followed by a series of scenarios and studies published by environmentalists and independent institutes from the environmental/ anti-nuclear movement (see below: the role of science).

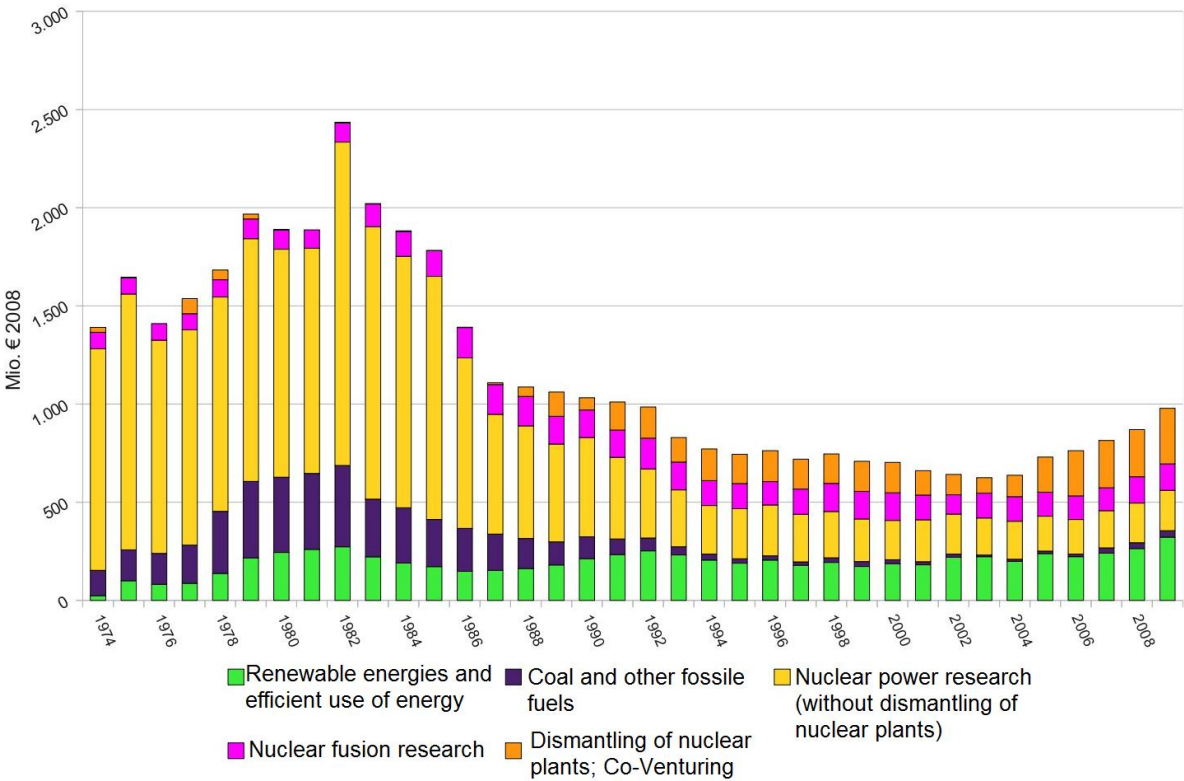
The energy activists became researchers and scientists themselves. They organized educational seminars.<sup>23</sup>

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<sup>22</sup> Key authors for energy transition research are Klaus Traube, Felix Matthes, Peter Hennicke, Jeffrey Johnson, Stephan Kohler, Dieter Seifried, Günter Karweina, Lutz Mez, Rainer Griebhammer, and Joachim Radkau. Also the expert commission undertaking the energy transition monitoring process has so far not included a female expert.

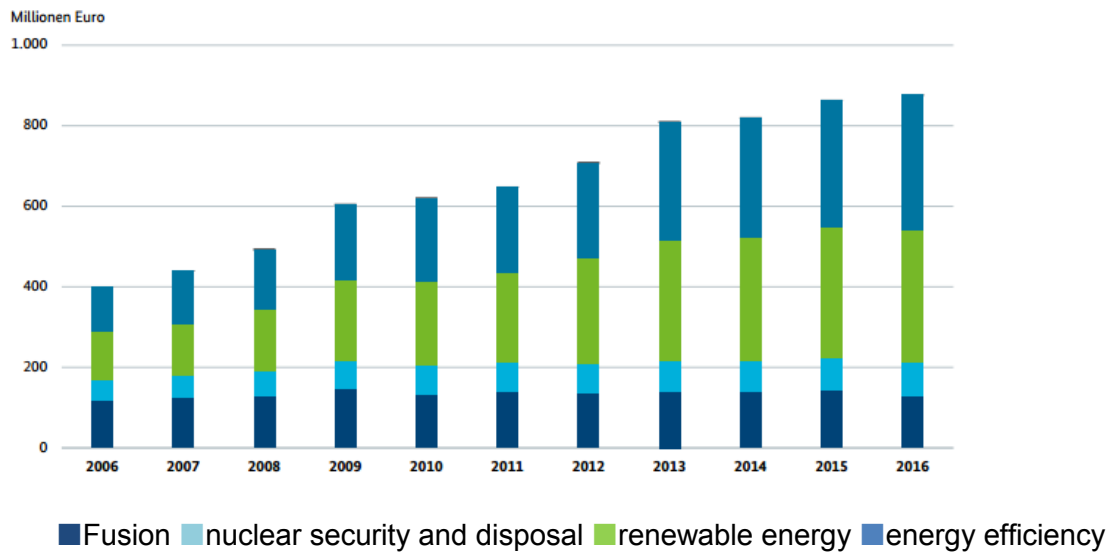
<sup>23</sup> Rebellenstrom (2009). Die Schönauer Stromrebelln Teil 1. [https://www.youtube.com/watch?v=K1UB72B\\_MSU](https://www.youtube.com/watch?v=K1UB72B_MSU)

State-sponsored energy research can also be seen as key element. After the oil crises, the West-German government started a program funding energy research. The vast majority of funds in the 1970s and 1980s were spent on nuclear power research. Figure 18 shows the cumulative research funding for individual technologies which mainly were directed at nuclear and coal. Renewable energy technology subsidies today are still nowhere near reaching these funding levels.



**Figure 18. Cumulated federal energy research 1970-2008 inflation-adjusted to 2008 (seisofrei, 2011).**

Renewable energy received limited funds as well. In 1980s, engineers constructed a first 100-meter-tall 3 MW wind power plant, which failed due to the lack of adequate materials to deal with such wind forces. Later, the first phase of the feed-in tariff law for Germany, the StrEG, was accompanied by a very important research program, that monitored the performance of the first 250 MW wind capacity deployed in Germany. This helped wind turbine operators and manufacturers to identify and improve technical and operational characteristics of the turbines. *Figure 19* shows the budget of the federal energy research program between 2006 and 2016 by topic. Today most research funds are directed at energy efficiency and renewable energy.



**Figure 19. Budget of the federal energy research program by topic, (BMW, 2017, p. 4).**

An important funding source is the Energy and Climate Funds with a budget of 3 billion Euros. It supports research on renewable energies, energy storage, grid technologies, energy efficiency, CO<sub>2</sub> building refurbishment, electric mobility, international climate and environmental protection.

The current German research landscape contributes to a system transformation and, hence, an Energy Transition, by establishing intertwined research fields and adopting systemic approaches. This can be seen within ongoing research policies. Different departments are responsible for the utilization and implementation of the results of socio-technical Energy Transition: The Federal Ministry of Education and Research (BMBF) intends to extend its role of knowledge mediator, facilitating the framework program Research for Sustainable Development (FONA) and thereby fostering inter- and transdisciplinary research regarding Energy Transition, sustainable city development (“Future Cities”) or interdependencies in shifting rural-urban relations (BMBF, 2016). Therefore, the high-tech strategy shall strengthen Germany’s position as a technological leader in the field of climate protection as well as adaption to climate change, sustainable resource management as well as innovative environmental and energy technologies. Hence, the flagship initiatives “future cities”, “Energy Transition” and “green economy” will play equally important roles. Further research on sustainable development shall foster climate protection, resource efficiency and the extended supply of renewable energies (BMBF, 2016). As part of the high-tech strategy, the Federal Ministry of Education and Research is funding ten-year-running Copernicus-projects since 2015. These projects are carried out by consortia of scientists, industry, business actors and civil society group to produce new energy concepts which might be more widely accepted by society as a whole.

Furthermore, the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) and the Federal Ministry for Economic Affairs and Energy (BMW), have systematically enlarged entire processes, from identifying research priorities, selecting and carrying out projects, right through to their realisation and application, also concerning topics of Energy Transition on different societal and technological levels, e.g. National Climate Protection Initiative since 2008 (BMUB, 2015), research programme “showcase intelligent

energy” (BMW 2017; also cf. Bundesregierung, 2017) or the “showcase e-mobility”, which has just been evaluated (BuW, 2017).

Besides generating new knowledge, developing technological innovations, and providing empirical evidence for public and political discourse, science can also play a role as an “innovation agent” for transition (e.g. Heinrichs, 2013): Science can initiate transitional development, can act as a moderator and multiplier or a practical show case, not only in research projects, but in shaping the universities themselves (e.g. by establishing a climate protection plans or sustainability goals) and thus providing the opportunity to sensitize students. Table 11 gives an overview of the activities in German universities.

**Table 11: Climate protection concepts of universities**

University	Concept	Focus
Christian Albrechts University Kiel	Climate protection concept	building refurbishment, mobility, alternative supply, energetic lighthouses, climate protection management
Eberswalde University for Sustainable Development	Climate protection concept	sourcing, infrastructure, building refurbishment, use of renewable energies
University of Applied Sciences Biberach	Climate protection concept	
City University of Applied Sciences Bremen	integrated climate protection concept	building envelope and technology; mobility, sourcing, Green IT
University of Applied Sciences Bremerhaven	integrated energy and climate protection concept	refurbishment of interior lighting
Hof University of Applied Sciences	integrated climate protection concept	heating of buildings
University of Applied Sciences Osnabrück	Partial Climate protection concept	energy-saving measures (buildings and properties)
Trier University of Applied Sciences	integrated climate protection concept	mobility, meet energy requirements with renewable energy sources
Leibniz University Hannover	integrated climate protection concept	building, mobility, sourcing, expansion of renewable energies, participation, institutionalise the topic "Climate Protection"
University and University of Applied Sciences Flensburg	integrated climate protection concept	building, mobility, Green IT
University Bremen	integrated climate protection concept	mobility, waste, Green IT, building, use and supply of energy, sourcing, nutrition
University Marburg	Climate protection concept	use of renewable energies, building refurbishment, mobility, saving energy, anchoring into the university structure
Leuphana University Lüneburg	Climate-neutral-university	
FU Berlin	Climate protection agreement with the City (Berlin)	Use of renewable energies, Green IT, energy efficiency programmes, energy saving (10%)
University Freiburg	climate protection concept (planned)	

## **5.2 Topical Cluster II: Socio-cultural preconditions for a sustainable climate-friendly economic model (TC II)**

Content of this second Topical Cluster are the following ToR questions:

- Which socio-cultural preconditions are already in place for a sustainable and climate friendly economic model? (Q8)
- Which were the drivers, and which were the barriers for such a model to date in both countries? (Q9)
- What has been the role of socio-cultural movements and traditions in catalyzing a decision on an energy transition in general, but maybe also in hindering its implementation in practice (resistance against e.g. wind power or high voltage lines, cf. also question in acceptance below)? (Q10)
- Which conditions in economic structure (in general/in the energy sector; e.g. decentralized/municipal vs. centralized structures) support or hinder an energy transition? (Q14)
- What is the impact of the aging societies? (Q15)
- What is the influence of urbanization (regarding e.g. sustainable transport systems, lifestyles) but also rural development opportunities (e.g. with renewable energies but also difficulties of finance for public administrations)? (Q16)
- Which socio-cultural preconditions are needed or already in place for a sustainable and climate friendly economic model? (Q17)

### **5.2.1 TC II: JAPAN**

#### **5.2.1.1 Which socio-cultural preconditions are already in place for a sustainable and climate friendly economic model in Japan? (Q8)**

Economics and politics are centralized in Japan as a whole, but agricultural and mountainous fishing villages are originally economically independent. Today, attempts to raise local consumptions from rural villages are starting. There has already been interactions between urban citizens and rural villages since the 1960s and 70s.

#### **5.2.1.2 What has been the role of socio-cultural movements and traditions in catalyzing a decision on an energy transition in general, but maybe also in hindering its implementation in practice (resistance against e.g. wind power or high voltage lines, cf. also question in acceptance below) in Japan? (Q10)**

In the years since the Great East Japan Earthquake and the Fukushima Daiichi nuclear power plant disaster, there has been a greater push to expand the use of renewable energy resources in Japan. Regarding electric power sale, FIT was introduced after the Great East Japan Earthquake; as a result, the number of wind power generation projects increased. However, there are many projects currently at the stage of legal assessment due to the fact that the legal assessment takes time.

In relation to the improvement of transmission network in Japan, major electric power companies, such as TEPCO, pay the cost needed to improve the transmission network by a specific sum of money, and electric utility companies need to pay for the rest of the cost, which

is several hundred million yen. This is one of the barriers for companies to newly enter into the wind industry. METI considers doubling the cost of transmission network that the major power companies bear. As a result, burden of expenses of electric utility companies could be significantly decreased (Nikkei online, 26.06.2017).

While several policies were adapted, comparing to the introduction and usage of advanced renewable energy in other countries, Japan is still low (Nikkei online, 26.06.2017). Regarding economic model, most of renewable energy projects are operated by private profit-making enterprises which are from outside of the project sites, thus, economic benefits generated by the projects flow out from the communities (Renewable Energy Institute, 2015a). Potential effects on regional economies by renewable projects are limited under the current forms of ownership (Nishikido, 2015). Some people recognize that promoting renewable energy means non-nuclear power. This recognition disturbs supporting renewable energy in some cases because there is a conflict of government's attitudes between anti-nuclear-movement and supporting renewable energy movement.

#### **5.2.1.3 What is the impact of the aging societies in Japan? (Q15)**

First of all, the consumption pattern of energy is most likely to change. Although the declining population may reduce the total demand in Japan, several reports alarm that energy efficiency would decline in accordance to the decreasing number of people per household, a typical trend observed in the Japanese aging society. In the same line of reasoning, more electric devices and automobiles would be owned per capita. In addition, as elderly people are expected to spend more time inside home, energy demand per capita is expected to further rise. A research on the consumption pattern of electricity by Japanese aged households suggests that those older than 70 years of age use approximately 1800 kWh per person year, which is 1.6 times bigger than the amount consumed by those younger than 29 years.

As for the supply side, as human labor is likely to drop in the aging society, a more automated system of energy production and delivery would substitute this trend, which might increase energy and resource inputs per output of energy.

#### **5.2.1.4 What is the influence of urbanization (regarding e.g. sustainable transport systems, lifestyles) but also rural development opportunities (e.g. with renewable energies but also difficulties of finance for public administrations) in Japan? (Q16)**

In order to increase local benefits on regional economics, there are several projects such as regional cooperation between rural and urban areas. For example, four cooperatives in the metropolitan area cooperatively built a wind turbine in Nikaho City, Akita prefecture. It initiated the human interactions between Nikaho City and cooperatives and triggered the cooperatives to sell products unique to Nikaho City. In addition, there was a case where Setagaya Ward, Tokyo, purchased electricity from Nagano Prefecture. In collaboration between rural areas and universities, there are cases where seminars took place in rural areas where renewable energy facilities are installed and students sell the local products of that rural area at university's school festivals.

Regarding finance, in Japan, creditworthiness of financial institutions is unevenly distributed to major companies. An appropriate institutional design is required so that business operators will not be disadvantaged at the time of financing (Maruyama, 2014).



In some cases, local governments supported attracting companies to regions and implemented assistance measures for local companies in relation to renewable energy projects, and expanded renewable energy into the regions (Morotomi, 2015).

Scientific knowledge used in EIA process was shortened and adaptable management was introduced. In addition, a forecasting system of wind power generation has been developed by scientists. However, this has not been used up to the present time.

#### **5.2.1.5 Which socio-cultural preconditions are needed or already in place for a sustainable and climate friendly economic model? (Q17) and**

#### **To which extent does human capacity in science and education as well as in development and implementation of technologies and solutions need to be enhanced in Japan? (Q18)**

The frequent interactions between stakeholders and modelers are needed. Through the process, stakeholders can understand the roles of model, and modelers can identify the stakeholders' requests.

It is increasingly common for renewable energy projects to distribute benefits to local communities. While tax income is emphasized in most energy projects as a local merit, financial contribution from local people, local energy production for local consumption, branding of local specialties recently attract people. For example, in the case of a community power of Ajigasawa in Aomori prefecture, the initial cost of the project was funded by the investment of citizens (Maruyama, Nishikido & Iida, 2007), and a local agricultural product was promoted and branded with the logo of a wind turbine. In addition, in the case of an offshore wind project of Murakami in Niigata prefecture, financial benefits for a local fisherman's organization and local government were discussed (Yasuda, 2016).

### **5.2.2 TC II: GERMANY**

#### **5.2.2.1 Which were the drivers, which the barriers for such a model to date in Germany? (Q9)**

Achieving the German 'Energiewende' and national sustainability targets are imperative for mitigating the effects of climate change and, hence, designing sustainable climate-friendly economic models, which are one of the societal challenges in the 21st century (IPCC, 2014). Negative effects of climate change already impact livelihood of many people globally (WBGU, 2007). Main causes for climate change are inter alia energy supply and industrial production (IPCC, 2014), but also private energy consumption (e.g. Gilligan, Dietz, Gardner, Stern & Vandenbergh, 2010) or mobility (Hunecke, Haustein, Grischkat & Böhler, 2007). For the transition of the energy system it is, therefore, necessary to reflect the needs and expectations of the public in order to raise active acceptance for the "Energiewende" (Schweizer-Ries, Hildebrand & Rau, 2013). Regarding the preconditions for changing climate-friendly economic models, there are high compliances among the general public towards financial funding of the extension of renewable energies. 60% of the public believe that the renewable energy surcharge is suitable or could be higher (Agentur für Erneuerbare Energien e. V., 2016). For underlying drivers and barriers see also the narratives I-III above.

**5.2.2.2 What has been the role of socio-cultural movements and traditions in catalyzing a decision on an energy transition in general, but maybe also in hindering its implementation in practice (resistance against e.g. wind power or high voltage lines, cf. also question in acceptance below) in Germany? (Q10)**

„Socio-cultural movements“ were extremely important for the nuclear phase out and the deployment of renewable energies. This role is extensively described in the Narratives I (The paradigm shift away from nuclear power) and II (The shift from central to a decentralized energy system). In the current situation of the German energy transition, the socio-cultural movements can be overserved on both poles, on the one hand there is the opposition against new coal power plants, but on the other hand there is also a strong rejection of the transmission system expansion or local wind power plants. Independent from their respective position (pro/con an energy infrastructure), local movements can be seen and valued as an important way of civil engagement with has the potential to improve a planning process and which therefore should be used in a constructive, integrative way.

**5.2.2.3 Which conditions in economic structure (in general/in the energy sector; e.g. decentralised/municipal vs. centralised structures) support or hinder an energy transition in Germany? (Q14)**

Many of the factors that support or hinder the energy transition in Germany have already been described in the narratives (I-III) in chapter 4. The most important conditions that hinder the transition are:

- Urgency or other policy priorities (e.g. refugee crisis, EU falling apart, changes in international politics, e.g. new US administration)
- Resistance and inertia to change and innovation in big industrial and utility companies
- Fear of carbon leakage– justified or unjustified
- People’s reluctance to support renewable energy plants or transmission lines in proximity to their own living area due to several reasons (see 5.4.2.2)

The most important conditions that support the energy transition are

- Broad anti-nuclear sentiment and broadening anti-coal sentiment
- Participation of general public and perceived economic benefits
- Import dependence for fossil fuels

**5.2.2.4 What is the impact of the aging society in Germany? (Q15)**

Germany is an aging society. Scenarios estimate a population decrease by another 10 million people in Germany over the next 50 years. This poses general economic challenges like a lack of qualified workers and a weaker support structure for the pension system. Beyond that, it also has relevance for the energy transition, in several respects: energy demand, infrastructural needs, public finances.

The demographic development has the potential to reduce demand for electricity, water, sewage water, etc. which are correlated with the number of inhabitants (Tietz, 2016; Schlömer

2016). Empirical studies were unable to show that individual needs for electricity, heat or water depending on the consumer's age (Tietz, 2016). A reduced use of electrical devices will supposedly be balanced by more time spend at home. More influential on total energy consumption are the sizes of flats and houses, the installed heating systems or thermal insulations (Tietz, 2016). The development of household structures and the claimed living space per inhabitant have to be accounted for, since the living space per inhabitant is relevant to measure e.g. the demand for heat (Waltersbacher, 2016). Thus, if an older or shrunk population inhabits fewer total square meters (keeping living space per person constant), energy consumption might shrink. This will allow to reach the targets for total energy consumption more easily but will be insufficient. In addition, if the older people do not use the most modern appliances, the government's energy efficiency will be harder to reach.

The aging society will increase the demand for new mobility concepts and might also strengthen urbanization processes because of better health care serviced offered in urban areas. This internal migration leads to newly emerging shrinking and growing areas, which affects infrastructural, supply and collection systems (e.g. grid extension, energy storage options; cf. *influence of urbanization*) (Schlömer, 2016). Requirements in the health care sector and others, some aspects of changing societies play a subsidiary role, regarding the supply and collection system.

Aging societies will reduce financial flows to public budgets, which will hinder the public financing of supply structures (Tietz, 2016). Demographic change and the aging societies in industrialized countries affect the financial burdens for consumers: less people will have to provide financing, e.g. by paying taxes and infrastructure costs, for the transition of the current energy system (e.g. for grid extension, research in new technologies, ICT-technology, etc.).

#### **5.2.2.5 What is the influence of urbanisation in Germany? (Q16)**

In Germany, two-thirds of the population lives in cities and three-quarters of the energy produced is consumed here. 70% of GHG originate from cities (BMBF, 2015). Cities are places of constant change: Societal challenges, such as climate change, Energy Transition, but also the integration of refugees, require a transformation of the urban complexity within a relatively short time (BMBF 2015). The necessary and already ongoing changes in mobility patterns, the transformation of the energy system and urban infra- and settlement structures for CO<sub>2</sub>-neutral, energy- and resource-efficient cities can only be achieved with a broad societal consensus and a joint effort (BMBF 2015; Bulkeley, Broto & Maassen, 2011; WBGU 2016). For a successful transformation towards sustainability and Energy Transition, it is necessary to activate more civic stakeholders and to support local initiatives, e.g. energy cooperatives. According to Kristof's approach, change agents of such energy cooperatives act as professional promoters and include socio-political perspectives (Kristof 2010, p. 521). For the success of the 'Energiewende', sustainability in the field of energy production and consumption is of high significance, especially regarding urban areas. The transition of the energy system shall lead to energy sustainability, referring to an energy supply, which secures the present energy demand without limiting needs of future generations (Schweizer-Ries, 2013). Key components are the implementation strategies: *efficiency*, *consistency* and *sufficiency*. Within the energy sector, the question of how to achieve sustainability is no longer reduced to

technological problems, but tries to integrate systemic, inter- and transdisciplinary solutions to new ways of energy production and consumption.

Reaching resilience in cities is of particular importance in order to achieve sustainability and Energy Transition. Existing structures and systems therefore have to be changed with consequential impacts: Besides their technical robustness, resilient and sustainable energy supply systems demonstrate a high degree of reflectivity as well as a readiness for learning and innovation in terms of changing surroundings. This ability to adapt requires a corresponding culture of participation in order to involve and connect all relevant stakeholders. Furthermore, the various administrative responsibilities and structures of communication must be designed in new ways that require inter- and transdisciplinary knowledge, e.g. in different energy sectors. Interfaces between municipal administrations and communal as well as private companies are not yet well established.

Furthermore, the relations between cities and rural regions are shifting as a result of urban development and demographic change (linkage to ageing societies). Value chains, supply structures, area use, water and land management in urban and rural areas are interdependent. In order to promote sustainable development and Energy Transition in urban and rural areas, a deeper understanding of the multifaceted interdependencies within a region, in which cities and rural regions are considered as an entity, is essential. Current research initiatives of the FONA framework programme foster solutions for urban and regional expansion that facilitate sustainable development and Energy Transition, also taking demographic change into account.

#### **5.2.2.6 Which socio-cultural preconditions are needed or already in place for a sustainable and climate friendly economic model? (Q17)**

**and**

#### **To which extent does human capacity in science and education as well as in development and implementation of technologies and solutions need to be enhanced in Germany? (Q18)**

Energy transition in a sustainable and comprehensive way requires a shift in all sectors: power, heat, transport, consumption, agriculture etc. This can only be reached by addressing both cognitive and affective awareness as well as behavior. Additional strategies are needed focusing on establishing a sustainable culture with supporting social norms. In this context, it is evident that this cannot be achieved via federal policy making but has to take place on all levels of society.

### **5.3 Topical Cluster III: Lifestyle and behavior (TC III)**

Content of this third Topical Cluster are the following ToR questions:

- What approaches on changes of lifestyle and actors' behavior in the field of consumption, habitation, mobility, products, production, and services are in place for an energy transition? (Q19)
- How / why do German power customers accept current higher electricity prices due to German energy transition? (Q20)

- How do traditions, climate, and lifestyles influence the awareness of citizens, e.g. on thermal insulation of buildings? (Q21)
- How can shifts in lifestyle and actors' behavior encouraged and enabled by policies? (Q22)

### 5.3.1 TC III: JAPAN

#### 5.3.1.1 What approaches on changes of lifestyle and actors' behavior in the field of consumption, habitation, mobility, products, production, and services are in place for an energy transition in Japan? (Q19)

About the energy demand, assumption of the payback period is very important. In order to introduce the energy saving technologies, the long-term viewpoint becomes more important rather than the short-term benefits.

As Japan has been enhancing energy efficiency thoroughly in response to the oil crisis of the 1970s, there is a belief that there is no room for further energy conservation (Renewable Energy Institute, 2015a). Recognition for energy conservation has recently been changing from "patience" to "comfort" or "profitable" (Nikkei, 2013). Because Japan has poor fossil fuels and nuclear fuel, it has a stereotypical view of Japan as a country with few natural resources; therefore, Japan has not taken full advantage of abundant natural energy resources. For instance, it is estimated that Japan has potential capacity of wind power in the amount of 1.33 billion kW available, which could cover more than 3 times as gross electricity production in Japan (Renewable Energy Institute, 2015a).

#### 5.3.1.2 How / why do Japanese power customers accept current higher electricity prices due to Japanese energy transition? (Q20)

We had better distinguish the long-term and short-term impacts of the electricity price increase. Moreover, the renewable energy cost will decrease.

#### 5.3.1.3 How do traditions, climate, and lifestyles influence the awareness of citizens, e.g. on thermal insulation of buildings in Japan? (Q21)

After the earthquake, various energy saving measures were taken due to the suspension of nuclear power plants. Immediately after the earthquake, energy savings were done by planned power outage and other methods requiring patience, but they were gradually shifted to smart energy saving such as optimization of use of energy equipment and introduction of high efficiency equipment which made it possible to reduce power consumption in Japan (Renewable Energy Institute, 2015b). Japan's electricity consumption in 2013 was reduced by 7.7% compared to 2010 (Renewable Energy Institute, 2015b). In addition, the maximum electric power in the summer of 2014 remained at only 152.74 million kW for the total of 10 electric power companies (Renewable Energy Institute, 2015b). It was 16.4% lower than the maximum electric power before the earthquake of 182.69 million kW 2001 and 14.1% less than the maximum electric power in 2010 (Renewable Energy Institute, 2015b).

In recent years, community power has become active all over the country. Moreover, local governments actively participating in the introduction of renewable energy are also increasing. For example, in Setagaya Ward, Tokyo, the ward and Setagaya Service Corporation attempted

to provide solar power generation to citizens at low cost by purchasing a large amount of solar panels in one payment (Nishikido, 2015). After the Fukushima Daiichi nuclear accident, community power stood up all over the country. The number of people who start a renewable energy project is increasing (Isep, 2016).

Furthermore, Environmental organizations and consumer cooperatives developed projects to enhance changing energy purchase behavior. For example, Friends of the Earth (environmental organization) and cooperatives carried out activities calling for institutional designs to promote the supply of renewable energy and encouraged switching of power contracts.

In addition, there are examples where the administration improved the distribution of wood biomass resources and secured stable supplies of fuels and raw materials (Morotomi, 2015), constructed power plants with consideration for the areas by creating ordinances, regionally diversified power plants (Renewable Energy Institute, 2015a). In terms of wind energy, zoning is being conducted experimentally (MOEJ), so that less conflicts occur regarding environmental protection and effects on local people, and wind projects can be smoothly implemented.

#### **5.3.1.4 How can shifts in lifestyle and actors' behavior encouraged and enabled by policies in Japan? (Q22)**

After the earthquake in 2011, energy saving with patience was necessary due to the suspension of an electric power supply by nuclear, however, smart energy saving through "comfort" was done. This means that there is no excuse for a belief that there is no room for further energy conservation. In addition, expansion of community power, projects such as switching power companies and local policies are enhancing change of lifestyle and behavior.

### **5.3.2 TC III: GERMANY**

#### **5.3.2.1 What approaches on changes of lifestyle and actors' behavior in the field of consumption, habitation, mobility, products, production, and services are in place for an energy transition in Germany? (Q19)**

The question of sustainable lifestyles has recently received some scientific interest in the field of (environmental) social science and has also been taken into account by environmental politics (e.g. Enneking & Franz, 2005; Scholl & Hage, 2004; BMUB & UBA, 2010; BMUB & UBA, 2014). More than just investigating the social distribution of resources and restrictions, lifestyle research deals with the question how people use their resources (education, property, status etc.) under the surrounding conditions (societal, political, economic etc.) to reach their individual goals and which kind of goals they have (Rössel, 2009). Despite some conceptual differences, the majority of lifestyle concepts have common indicators from three dimensions: social condition (e.g. educational level, occupation, income), performance (e.g. consuming behavior, leisure behavior) and mentality (e.g. attitudes, values) (Degenhardt, 2007; Scholl & Hage, 2004).

For a more differentiated analysis of environmental awareness and environmental behavior, social structure analysis models are applied in the environmental awareness studies, which the government carries out every two years in Germany. Over the years, different approaches have been used to investigate the environmental differences between different types of

lifestyle. Several times, the model of the SINUS-milieus has been used (e.g. BMUB & UBA, 2010) and more recently the quite similar model by "sociodimensions" ([www.sociodimensions.com](http://www.sociodimensions.com)) (BMUB & UBA, 2014; BMUB & UBA, 2016).

Lifestyles have a structuring function on everyday life and daily routines, they work as organizers of behavior (Deutscher Bundestag, 2013), including behavior with environmental impact, like consumer behavior. One major component of sustainable lifestyles (the plural form is used because in modern multi-optional societies, there will surely be not only one sustainable lifestyle) are consumption patterns, another one is social commitment, in terms of association membership, volunteer work and other kinds of (solidarity) civil-societal involvement (Deutscher Bundestag, 2013).

Sustainable lifestyles include the well-known three aspects of sustainability, namely efficiency, consistency and sufficiency (e.g. Degenhardt, 2007); these different strategies to realize a (more) sustainable lifestyle can be applied to various fields of behavior (mobility, nutrition, electricity, etc.).

Especially in the last few years, there is some discussion in the field of sustainability research that former work and most of the strategies to foster sustainability and sustainable lifestyles may have focused too strongly on efficiency and consistency, while nearly neglecting sufficiency; meanwhile this research gap is starting to be filled (e.g. Fischer & Grießhammer, 2013; Heyen, Fischer, Barth, Brunn, Grießhammer, Keimeyer & Wolff, 2013; Speck, 2016). To date, there is no universally accepted definition of "sufficiency", but most concepts share the critique of our consumer society (Speck, 2016). Many sufficiency concepts include several of the following aspects (cf. Fischer & Grießhammer, 2013):

- Renunciation
- Reduction
- Replacement
- Prolongation (of life cycles)
- Shared usage
- Self-production

Lifestyles are unstable and changeable, both at the individual level and at the social level. Individuals may choose their lifestyle as a consequence of extraordinary events and adapt them to new circumstances, either voluntarily or out of necessity (Jaeger-Erben, 2010). At the level of societies, the complete way of living - understood as a basic pattern of social and cultural norms (Degenhardt, 2007) - can change and also the distribution of various styles of life - in the sense of different individual manifestations of the predominant way of life - can change within the population.

At least since the dynamic development of the mass consumer society, which has been particularly active in Germany during the economic miracle ("Wirtschaftswunder") of the 1950s and 1960s, lifestyles are closely linked to consumption. The acquisition and use / consumption of goods and services has become a dominant form to express lifestyles (social-demonstrative consumption). The prevailing notion of prosperity and high quality of life involves that one possesses the means which enables to consume. Consumers acquire goods not only to meet basic needs, but also express a certain lifestyle through the purchase and possession of

products and realize a certain lifestyle. Consumption is the current means of demonstrating and self-asserting social status (Grunwald & Kopfmüller, 2012).

Even though the social (and perhaps even the political) consensus continues to be that material prosperity, economic growth and high consumption conditions are essential for a good quality of life, other voices are getting louder (e.g. Linz, 2012; Sachs, 2015; Schneidewind & Zahrt, 2013; Seidl & Zahrt, 2010). Consumption-critical perspectives, expressed in the form of more sustainable, less energy and resource-intensive lifestyles, have experienced a certain upswing in parts of society in recent years. Looking at the entire theme of sustainable consumption and lifestyles, some developments in recent years indicate a tendency to spread conscious consumption patterns and sustainability-oriented lifestyles. Some examples for Germany are:

- A growing proportion of consumers prefer foods that have been cultivated organically, is regionally produced and fairly traded (partial double-digit annual sales growth in organic food in recent years [BÖLW, 2016], ever increasing share of fair trade products [Deutsche Bundesregierung, 2015]).
- The share of households with green electricity increased from almost 9% between 2010 and 2015 to a good 19% (BNetzA & BKartA, 2016).
- Still in a (growing) niche and so far particularly observable in young urban population groups (BMUB & UBA, 2014) is the use of exchange and sharing offers in the sense of "benefit instead of owning", which effects a reduction of the acquisition of material goods or replace these by the use of services (e.g. Car sharing: 2017 approx. 1.7 million registered users [Bundesverband carsharing, 2017]).

In the light of such trends, some social and market researchers have been talking about a new consumer group called LOHAS (lifestyles of health and sustainability) since the beginning of the 2000s. LOHAS have different living conditions and come from all social classes; they are thus less a homogeneous consumer group, but rather representatives of a certain lifestyle. They orient themselves in their actions to health and sustainability, but without compromising comfort or enjoyment (Köhn-Ladenburger, 2013). LOHAS want to consume healthy and morally responsibly, but they do not want to consume less; the existing level of consumption should be maintained while at the same time reducing the problematic side effects (Grunwald & Kopfmüller, 2012). In fact, the consumption level of the LOHAS is often higher than the average, as they are people with a medium to rather higher income and thus a high purchasing power (Mert, Klade, Seebacher & Müller, 2010). In absolute terms, their ecological footprint is often quite large, e.g. because they inhabit large apartments and are very mobile, among others they do many air travelling. The view that LOHAS could be a pioneer of a broad social change to more sustainable consumer and lifestyles is also criticized (for example, Grunwald, 2012; Kopatz, 2016). In fact, members of the LOHAS group show similar consumption practices, as they are generally seen to be increasing and which contradict the goal of more resource-efficient lifestyles, including e.g. the following:

- People live in increasingly larger dwellings and houses with higher energy requirements (for heating, etc.); since the beginning of the millennium, Germany's per capita living space has grown by more than 7 m<sup>2</sup> (Umweltbundesamt, 2016).



- Households are equipped with an increasing number of electrical appliances, which create ecological (and sometimes social) problems not only by their operation, but even more by their production and disposal; especially the number of consumer electronics products has increased.
- There is a tendency towards bigger, heavier and more powerful cars, which reduces or even overcompensate technical efficiency gains in fuel consumption and increases CO<sub>2</sub> emissions (e.g. SUVs: currently annual growth rates of about 25% [KBA, 2017]).
- More (vacation) trips are undertaken, in particular more long-distance trips and air travel (the annual growth rates of air traffic in Germany is 4-5% [BMUB, 2007]).

It is true that there is an increasing debate on the lifestyles and patterns of consumption, which are aimed at not only qualitatively "better" consumption (more sustainable, ecologically and socially compatible) but also quantitatively reduced consumption. But this theoretical and academic discussion only shows scarce impact on practices of the broad population (Fischer & Griefshammer, 2013; Linz, 2012; Speck, 2016; Stengel, 2011). The fact that efficiency gains are insufficient to curb the negative effects associated with consumption is only hesitantly accepted by decision makers. However, e.g. the final report of the *Enquete Commission of the German Bundestag for growth, prosperity and quality of life*, states that a critical examination of our lifestyles and our welfare concept is required (Deutscher Bundestag, 2013). And the National Program for Sustainable Consumption of the German Federal Government also states that "a broader national debate on lifestyles and values is to be stimulated, which also takes into account regulatory and economic aspects" (Deutsche Bundesregierung, 2016a).

### 5.3.2.2 **How / why do German power customers accept current higher electricity prices due to German Energy Transition? (Q20)**

A nationwide project like the current Energy Transition ("Energiewende") in Germany involves high costs.

The transition of the power sector is partially financed via higher electricity prices. Electricity users need to pay a certain power price components to finance the transition of the power system, among them: (1) the renewable energy levy, (2) the CHP levy, (3) network charges, (4) levies for flexibility options/ load management, (5) offshore wind energy investment securities. Whether household consumers accept these price increases has been investigated for several years, e.g. by the REA (Renewable Energies Agency). The results of these surveys show a stable, or even growing, approval for the renewable energy levy (the highest price component).<sup>24</sup> In 2013, results of another survey found that a majority of respondents are only willing to pay more for electricity if the exemptions for energy intensive companies were to be limited (TNS Emnid & AEE, 2013). Although in general the support for the Energy Transition is quite high (as can be seen in the number of 73% of respondents which say that it would not be good to stop the expansion of renewable energies in order to avoid higher prices for private households), this shows some perceived injustice, because private households might pay more for the Energy Transition than industrial consumers (TNS Emnid & AEE, 2013).

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<sup>24</sup> In 2012, 47 % found the RE-levy "appropriate" or even "too low", in 2014, the corresponding rate was 59 % and in 2016 it was 60 % (TNS Emnid & AEE, 2012, 2014, 2016).

Other surveys focus on the willingness to pay higher prices for 100% Renewable power tariffs, compared to standard power-mix tariffs. Results by the GfK (GfK Global Green Index) show that the willingness to pay more for green power decreased between 2011 and 2014 (from 56% to 46%). Especially among elderly people willingness decreased from 66% to 40%.

Other results by GfK show that, during the period of only one year (from 2011, shortly after the Fukushima event, to 2012), the approval for a faster expansion of renewable energies, even if it causes higher costs for private households, decreased from 60% to 50%. The rates of acceptance or rejection partly correlated with income level, age and economic outlook expectations (GfK Global Green Index).

### **5.3.2.3 How do traditions, climate, and lifestyles influence the awareness of citizens, e.g. on thermal insulation of buildings in Germany? (Q21)**

Biannually the Federal Environment Ministry and the Federal Environment Agency commission a representative population survey on environmental awareness. The 2010-survey showed that more than 40% of respondents were in favor of government subsidies for investments that contribute to energy savings in residential buildings. The same applies to the question of much better thermal insulation of houses (BMUB & UBA, 2010). Better insulation is advocated above average by members of the social ecology, the adaptive, pragmatic and expeditive milieus, but also by persons from the middle of the community (roughly speaking groups in middle to high social situation and predominantly modern / open basic orientation). Support from "traditional" population groups (lower to middle social situation, traditional basic orientation) and the "liberal intellectual" milieu (upper social position, modern basic orientation) is lesser (BMUB & UBA, 2010).

In the population survey of 2014, almost 80% of homeowners stated that they had already taken measures for an environmentally friendly heat supply at home (e.g. insulation, heat protection glazing, efficient heating system, renewable energy). Of those who have not yet taken such measures, a majority expressed interest to undertake them in the future (BMUB & UBA, 2014). In addition to ecological awareness, this should also include measures that are expected to be financially viable in the medium term and contribute to the value / increase of the property.

So far, there seem to be no scientific studies dealing specifically with the influence of traditions or climatic conditions on attitudes towards energetic building renovations or their implementation rates. The present research results, to support and inhibit factors for the energetic rehabilitation, strongly indicate that economic considerations regarding the cost-benefit ratio (investment requirements vs. energy saving, value of the house etc.) are generally a very important factor (e.g. Gossen & Nischan, 2014). A specific reason for rehabilitation is often new statutory requirements, tax incentives, etc., as well as acute events (damage to the building, relocation / new acquisition etc.). Sociodemographic factors, such as age, income and educational level also exert significant influence (e.g. Stieß, Van Der Land, Birzle-Harder & Deffner, 2010). In addition, however, subjective situational perceptions, expectations and attitudes play a role (ibid.). These last-mentioned variables seem to affect rather the nature and scope of the restoration measures than the basic decision for or against a rehabilitation (ibid.). A typical finding is that older homeowners are deterred by expensive redevelopment measures with a longer amortization period, which is related to the limited use perspective (e.g. Beyer, Hermelink, Klaus, Kleßmann, Krechtling, Müller & Palenberg, 2010).

Regional differences in rehabilitation rates are mainly related to characteristics such as the situation of the respective real estate / housing market, the home ownership rate and country-specific or even municipal promotion programs (for example, Michelsen, 2009). In some cases, insufficient capacities in the regional construction industry and handicraft companies can hinder the redevelopment activities (Hoier, Erhorn, Pfnür & Müller, 2013). A case study on regional differences in the perception of energetic rehabilitation provided little evidence for the existence of generalizable connections between regional economic development and the basic decision for or against energetic rehabilitation (Gossen & Nischan, 2014). Only signs of an effect of the regional situation on the type and extent of redevelopment could be found. The resulting trends are similar to the already mentioned connections between regional-specific usage perspectives and real estate market positions and rehabilitation motivation (ibid.).

To the degree that social norms can be considered a component of the formation and social reproduction of traditions, one can refer here to the results of a study on the diffusion of PV rooftops (Müller & Rode, 2013). A clear peer effect (imitation effect) could be detected: a high number of PV plants installations in the neighborhood signaled a still hesitant house owner that PV plants are compatible with prevailing norms and leads to an even more growing number of PV plants. The orientation of an individual's own actions to social norms is mainly useful in situations where uncertainty prevails (here, for example, regarding the reliability of the technology or the financial viability). In such cases, social norms can serve as a guide for correct, appropriate, or purposeful behavior (Cialdini, 2012). If social norms manifest themselves in actual collective action, they can contribute to the establishment of (new) social / cultural traditions (cf. Oevermann, 2001), which in turn are linked to the development of sustainable lifestyles.

#### **5.3.2.4 How can shifts in lifestyle and actors' behavior be encouraged and enabled by policies in Germany? (Q22)**

The German Sustainability Strategy (Deutsche Bundesregierung, 2016b) stresses the need to change current lifestyles and economies with reference to the United Nations Sustainable Development Goals (SDG), especially SDG No. 12 (Responsible Consumption and Production). Measures for the necessary (political) framework will include better availability of environmentally and socially acceptable products and their clear and reliable labeling. The labeling of sustainable products is intended to enable consumers to better align their purchasing decisions with criteria such as energy- and resource-conserving manufacturing. The aim is to create transparent market conditions for responsible consumer decisions.

For example, there is the intention of further development of the state eco-label "Blue Angel"<sup>25</sup> (taking into account additional aspects of sustainability, intensified public relations, increasing dissemination and acceptance). In addition to product-related information, it is also required to provide basic knowledge about the impact of consumption on the environment and society and about sustainable consumption options to the population (consumer information and education). Additionally, intensified research will be carried out "on the basis of societal behavioral changes towards sustainable lifestyles" (Deutsche Bundesregierung, 2016b).

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<sup>25</sup> <https://www.blauer-engel.de/>.

In February 2016, the Federal Government adopted the National Program for Sustainable Consumption (Deutsche Bundesregierung, 2016a). It outlines ways in which sustainable consumption can be strengthened, and how sustainable consumption pattern can emerge from its niche into the social mainstream. On the one hand, the program deals with overarching fields of action, such as education and research. On the other hand also certain areas of the consumption are addressed, e.g. mobility, nutrition, housing and household. The government calls some concrete courses of action: social discussion, education, consumer information, environmental and social signs, eco-design, public procurement, research, social innovation and monitoring.

In order to promote sustainable consumption a Competence Center for Sustainable Consumption was established.<sup>26</sup> In addition to the coordination of the thematic activities of the different government centers and subordinate federal institutions, its tasks include the promotion of public awareness of sustainable consumption, the promotion of professional exchanges between all relevant stakeholders and the creation of synergies for the realization of sustainable consumption patterns, lifestyles and markets.

Such a coordinated and multi-stakeholder oriented approach might indeed be useful, but as had been shown in the past, many policy measures to foster sustainable consumption are very unsuccessful. In 2003, a deposit obligation for disposable beverage packaging was introduced in Germany in order to achieve progress on waste prevention and resource efficiency. The deposit was set higher for non-reusable bottles (25 €ct) than for reusable bottles (15€ct). Since consumers perceive the deposit as a price component they will eventually get back once they return the bottle – the price difference has no effect on their consumer choice. The policy shows to have no effect and the market share of re-usable bottles keeps decreasing (Heinisch & Leighty, 2015).

The Council for Sustainable Development, a consultancy body of the Federal Government, which was introduced in 2001, publishes the shopping guide "Der Nachhaltige Warenkorb. Simply better shopping"<sup>27</sup> which is intended to be a guide for consumers in their daily purchasing decisions and the choice of products that are as environmentally and socially acceptable as possible.

The government is running a multitude of support programs as well as mobilization initiatives. The most prominent ones are the Energieeffizienzfonds at the BMWi, which doles out investment support to incentivize energy audits in firms, institutions and homes, and the replacement of energy-consuming components, and the National Climate Initiative at the BMUB, which supports events, public information campaigns and investments in homes and municipalities. Both are regularly evaluated, and considered to contribute meaningfully but insufficiently to changing lifestyles, attitudes and consumption behavior.

Special attention has recently been given to political measures to promote electro mobility. In 2016, the German federal government adopted a corresponding package of measures (BMUB, 2017). It includes, among other things, a purchase bonus for electric vehicles and tax

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<sup>26</sup> <https://k-n-k.de/Kompetenzzentrum>

<sup>27</sup> <https://www.nachhaltigkeitsrat.de/projekte/uebersicht/nachhaltiger-warenkorb/>

exemptions for private and commercial users. However, it is foreseeable that the government target of 1 million electric vehicles will not be reached by 2020.

In some cases, policy measures with targeted environmental governance seem to be second only to the pursuit of environmental policy goals, while other purposes are a priority. The so-called "environmental bonus" of 2009 is such an example. Although a hoped-for effect was the rejuvenation of the vehicle fleet on German roads and thus a reduction in the pollutant load on the air. But the real reason for introducing the premium was a sharp drop in the sales figures for new cars (as a result of the financial crisis starting in 2007). With the purchase incentive (2500 Euro for the purchase of a new car, when an old motor vehicle was scrapped at the same time), the demand for automobiles was boosted to support German car manufacturers during the financial crises. Whether the premium had the expected environmental-promoting effects resulted is controversial<sup>28</sup>.

National environmental policy measures in Germany are often the implementation of EU directives and regulations in federal laws and regulations. One example of this is the state label for organic food, which was introduced in 2001. Almost 5.000 companies now use this label for more than 76.000 products (Ökolandbau, 2017).



**Figure 20. EU label for organic food products and energy efficiency (Ökolandbau, 2017; UBA, 2015).**

It is considered to be the best-known organic label in Germany and the one that gives consumers the greatest confidence (Meyer-Höfer & Spiller, 2013). Another example is the EU Energy Consumption Label (UBA, 2015). The label was developed following the example of the Japanese Top Runner Program though suffering from a series of shortcomings since it did not include a mechanism to update the scale. The label, which was introduced in 1998 and has since been repeatedly revised, it provides information on the energy consumption of household appliances and entertainment electronics. According to a study by the Environment Agency, it is the environmental label that has the greatest impact on consumers' purchasing decisions (BMUB & UBA, 2014).

<sup>28</sup> [https://web.archive.org/web/20091007033714/http://www.bmu.de/files/pdfs/allgemein/application/pdf/ifeu\\_abwrackpraemie\\_bf.pdf](https://web.archive.org/web/20091007033714/http://www.bmu.de/files/pdfs/allgemein/application/pdf/ifeu_abwrackpraemie_bf.pdf)

## **5.4 Topical Cluster IV: Public discourse, acceptance and existing narratives (TC IV)**

Content of this fourth Topical Cluster are the following ToR questions:

- What has been the degree of acceptance for certain technologies such as high voltage lines, wind parks, utility scale PV parks, CCS, nuclear energy in both countries? (Q23)
- How is the energy transition perceived by the Japanese and German general public (e.g evidence based by polls)? (Q24)
- How do the German and Japanese governments communicate to the public about targets, technologies, measures, energy prices? (Q25)
- What needs to be done to enhance public acceptance? (Q26)

The different topics addressed are interconnected and therefore are not strictly separated in the following answers to the ToR questions.

### **5.4.1 TC IV: JAPAN**

#### **5.4.1.1 What has been the degree of acceptance for certain technologies such as high voltage lines, wind parks, utility scale PV parks, CCS, nuclear energy in Japan? (Q23)**

Under the current administration, Japan maintains reliance on nuclear power, but public opinion supporting nuclear power decreased after the Fukushima Daiichi nuclear accident in 2011 and shifted to renewable energy.

According to Kitada's research (Kitada, 2013), the respondents who approved use of nuclear power decreased from 20% in 2010 to 4% in 2011. On the other hand, the respondents who approved use of electric power other than nuclear power increased from 9% in 2010 to 29% in 2011. Likewise, according to the public opinion survey in 2016 by Japan Atomic Energy Relations Organization, the respondents who approved further use of nuclear power decreased from 36.9% in 2010 to 12.9% in 2016 and those who approved further use of renewable energy sustained high (see Table 12).

Still, there is a tendency that local acceptance toward renewable energy is low while general acceptance is high. Regarding wind energy, there are some cases where local stakeholders are against wind projects because they are not satisfied with consensus building process and distributive benefits to local communities.

Yamashita conducted research on troubles and corresponding policies in utility-scale solar PV project development in Japan. Along with increasing number of utility-scale solar PV projects, more troubles with local inhabitants have been reported. Yamashita listed 50 examples of these troubles in Japan and concluded that main causes of troubles as landscape preservation, disaster prevention, protection of the living environment, lack of consensus building with inhabitants and lack of a national policy (Yamashita 2016).

To enhance local acceptance, distributive benefits and participation were key factors. Following cases are contributed to gain acceptance from local people.

### ***Distributive benefits***

Generally, through the installation of wind power generation facilities, profits such as construction demand and fixed asset taxes are distributed to the local community where the site is located. Regarding the sharing of profit beyond this framework, there are two systems: capital participation in the project implementing body and project finance. Examples of the former are the establishment of a local capital-based enterprise, operation by the municipality, operation by an intermediate body (third sector), etc. For the latter, there is a system of Community Wind Turbine which raises investment also from the general public outside the region. There has been criticism of outside enterprises earning money from selling electric power by wind power generation and monopolizing the profits. On the other hand, this activity helps improve the distributional structure in the region as a solution to the problem of distributional justice.

### ***Participation***

There is a tendency to emphasize that, participatory consensus-building with local residents is required at planned sites during the process of introduction, while some residents are actually reluctant to be committed to the process. This does not mean that the best way is to make the procedures open and provide opportunities for residents to participate.

In the case of offshore wind projects in Japan, several cooperative works with local stakeholders are created.

In the regions of nuclear power plants, several discussions among citizens on energy and environmental policies started to take place. For example, comments were sought from the public, town meetings, and debate polls by the government, in order to discuss options for energy and environment in 2030. In 2012, Kashiwazaki City, Niigata Prefecture, the local government held a citizens meeting for city planning aiming at building an economic and industrial structure that does not need to depend heavily on nuclear power plants.

#### **5.4.1.2 How is the energy transition perceived by the Japanese general public (e.g. evidence based by polls)? (Q24)**

In Japan, the current status of energy transition in Germany has been reported by Japanese media after the nuclear accidents in Fukushima. These Japanese media coverages on German energy transition are often combined with the issue of increased electricity price for German households as a result of energy transition. According to a poll, 78% of Japanese citizens perceive that German energy transition makes good progress, while 11% see that German energy transition does not make good progress (Ichiyanagi 2016). If it turns into the question of energy transition in Japan, Japanese consumers are ready to pay max. 6% more for their electricity price in average in the scenario with 0% of nuclear energy and increased percentage of renewable energy in Japan's energy mix, according to the survey conducted by RIETI (Research Institute of Economy, Trade and Industry) (RIETI 2013).

As mentioned above, while acceptance of renewable energy is high, there are people who possess skeptical views on expanding the use of renewable energy. Because there are misunderstandings in Japan regarding German energy policies, that Germany is going to break with nuclear power. Some people believe that Germany is importing energy generated by nuclear power, coal and oil from neighboring countries and the household electricity charge rose due to the expansion of renewable energy (Renewable Energy Institute, 2015b).

### 5.4.1.3 How does the Japanese government communicate to the public about targets, technologies, measures, energy prices? (Q25)

In 2012, the Japanese government conducted a deliberative poll for discussing topics about energy issues, in which randomly selected 6,849 citizens participated. Their support for nuclear power phase-out and lower dependence changed from 41% to 61%. As they learned and discussed more with various experts and other participants, the majority has changed their mind from “don’t know” to a decisive position. The result of the deliberative poll composes one factor for changing nuclear energy policy in Japan, though it changed again after LDP won the election in the end of 2012. While further research is required to examine whether discussion and process were “objective” and whether the participants well represented society, this process indicates that potentially many Japanese citizens support public discussion of energy issues and want their voice reflected in national policy, although the energy issue has not composed a main topic in national elections.

Table 12. Overview energy sources in Japan

	nuclear	PV	wind	hydro	geothermal
2010	36.9%	82.4	61.5	45.5	31.8
2016	12.9%	78.8%	78.8%	52.8%	43.3%

Source: <http://www.jaero.or.jp/data/01jigyuu/pdf/tyousakenkyu28/section4.pdf>

### 5.4.1.4 What needs to be done to enhance public acceptance in Japan? (Q26)

*For energy transition as a whole*

*For single components (RES, efficiency etc)*

*For single parts of society*

*- How can positive energy transition narratives be established?*

The co-benefit, especially the enhancement of well-being, becomes important. From the previous viewpoint, the valuation of the environment is still weak.

Appropriate information and transparency becomes useful for the decision making process. One of the measures on climate mitigation is carbon pricing and visibility.

To increase public participation opportunities, to distribute local benefits and to build consensus in the way of fair process are needed. Recently, ripple effect is also focused as it contributes to enhance local development.



## 5.4.2 TC IV: GERMANY

### 5.4.2.1 What has been the degree of acceptance for certain technologies such as high voltage lines, wind parks, utility scale PV parks, CCS, nuclear energy in Germany? (Q23)

Renewable energies were the means to realize the nuclear phase-out and in this context were fundamentally appraised in a positive way (see also Narrative I: the paradigm shift away from nuclear power). With the introduction of the Renewable Energy Feed in Legislation, renewable energy power plants have mushroomed all over Germany and hereby become more perceivable for the public, with its different impacts. Biogas and bioethanol were the first renewables to be called into question, for the negative impacts energy crops have on international food prices. This "food or fuel" debate resulted among other reasons such as the cost efficacy and the CO<sub>2</sub>-foot print of bioenergy to a defacto hold on the further expansion of this technology. Today, especially wind power is often faced with public opposition on local level (see. 5.4.2.2), here the opposition groups show the highest degree of organization, in most Federal states there are institutionalized structures and the anti-wind organization additionally have the largest umbrella organizations. The fierce debate about transmission lines is addressed in the central-decentral debate (see Narrative central-decentral).

### 5.4.2.2 How is the energy transition perceived by the German general public (e.g evidence based by polls)? (Q24)

Looking at acceptance processes and relevant influencing factors, at least two levels should be distinguished: a) On the one hand, public acceptance at federal level (the "system level"). The focus here is on the extent to which the energy transition components (RES, grid, energy efficiency) and their respective sub-components are supported in principle, relevant criteria being, personal affectedness, the security of supply, the environmental impact and the associated costs.

b) In contrast, there are acceptance processes at the local level (the "power plant level") – this counts especially for energy infrastructure like RES and transmission lines. Each project has its specific decision-relevant variables and influencing factors, but there are elements or acceptance factors which are relatively general (risk perception, cost-benefit perception, transparent process design) despite the differences in the projects (expansion of the electricity grid, expansion of renewable energies) etc., however, each infrastructure and project has, of course, its specific characteristics, which ultimately require a specific on-site solution (Zoellner, Schweizer-Ries & Rau, 2011; Zimmer, Kloke & Gaedtke, 2012). Overall, it can be demonstrated empirically that psychological variables such as (inter-) individual processes play a role in local acceptance in the case of stakeholder relations and communication, local identity, risk perception, procedural and distribution justice, well-being (Zoellner, Schweizer-Ries & Wemheuer, 2008).

Changes in the landscape image, caused by the technology used, are often in the center of attention, which in particular leads to a very emotional debate with concepts such as "Verspargelung – wind turbines as asparagus" and "Monsterturme" (Weise, Allendorf & Koch, 2002). Even in the case of biogas use, changes in the landscape are caused by the substrate cultivation ("Vermaisung – domination of corn"). In addition, there are sometimes

nuisances caused by rotting odors or noise and / or exhaust gases caused by the increasing traffic during transport and transport of the substrates. (Rau, Walter & Zoellner, 2011).

Concerning potential risks and the negative effects of energy infrastructures on the local environment, health consequences must be mentioned. In particular in the area of power grid planning, there is a fear of critical consequences for health, especially by electromagnetic fields (EMF) and radiation or infrasound from wind turbines. Likewise, possible negative effects on nature, in particular bird strikes by wind turbines are in the public discussion. Indirectly, the respective negative effects and, above all, the changes in the landscape are also causing fears for local real estate prices and the tourism industry (Zoellner, Schweizer-Ries & Rau, 2011).

During the last years, the perceived fairness of planning and licensing procedures have become a further central acceptance factor (Rau, Schweizer-Ries & Hildebrand, 2012; Keppler, Zoellner, Rau, Rupp & Nolting, 2011). The degree of adequate information about the upcoming procedures and the planned technique, as well as about the background and the actors' interests and motives play a fundamental role here for the perceived fairness and transparency (Hildebrand, Rau & Schweizer-Ries, 2012). In addition, the participation and influence possibilities in planning and decision-making processes are of particular importance, both in terms of an active participation as well as a perceived control instrument of the perceived changes in the living environment.

Looking on representative opinion polls, the extension of renewable energies are assessed as important to exceedingly important by 93% of a German sample of 1.000 persons in a survey in 2016 by TNS Emnid on behalf of the AEE (Agency for Renewable Energies<sup>29</sup>). This is a steady result since 2013. Future viability and climate protection were named as the key arguments for renewable energies.

In the recent survey 62% appraised the construction of renewable plants in their own community as positive.

People having experience with a renewable energy plant in their surroundings even show a more positive appraisal than people without such concrete projects so far - 69% compared to 52% for wind energy and 90% compared to 73% for utility scale PV parks. Biomass plants are appraised as good or very good by 38% people (56% when they have a plant in the surroundings).

Gas power stations are evaluated as good to very good by 19%, coal plants only by 6% and nuclear power plants by 5%. Also for these technologies an increase in positive appraisal can be seen if the respondents have a respective plant nearby (40%, 30% and 17%).

The energy transition in Germany on the superordinate level is supported by 29% of the German population according to a survey conducted within the scope of a project (KomMA-P<sup>30</sup>) funded by the German Ministry of Education and Research (BMBF) in 2015 (2,009 respondents). Further 29% are ambivalent concerning the energy transition and the connected technologies and 27% have a disapproving position towards the Energiewende.

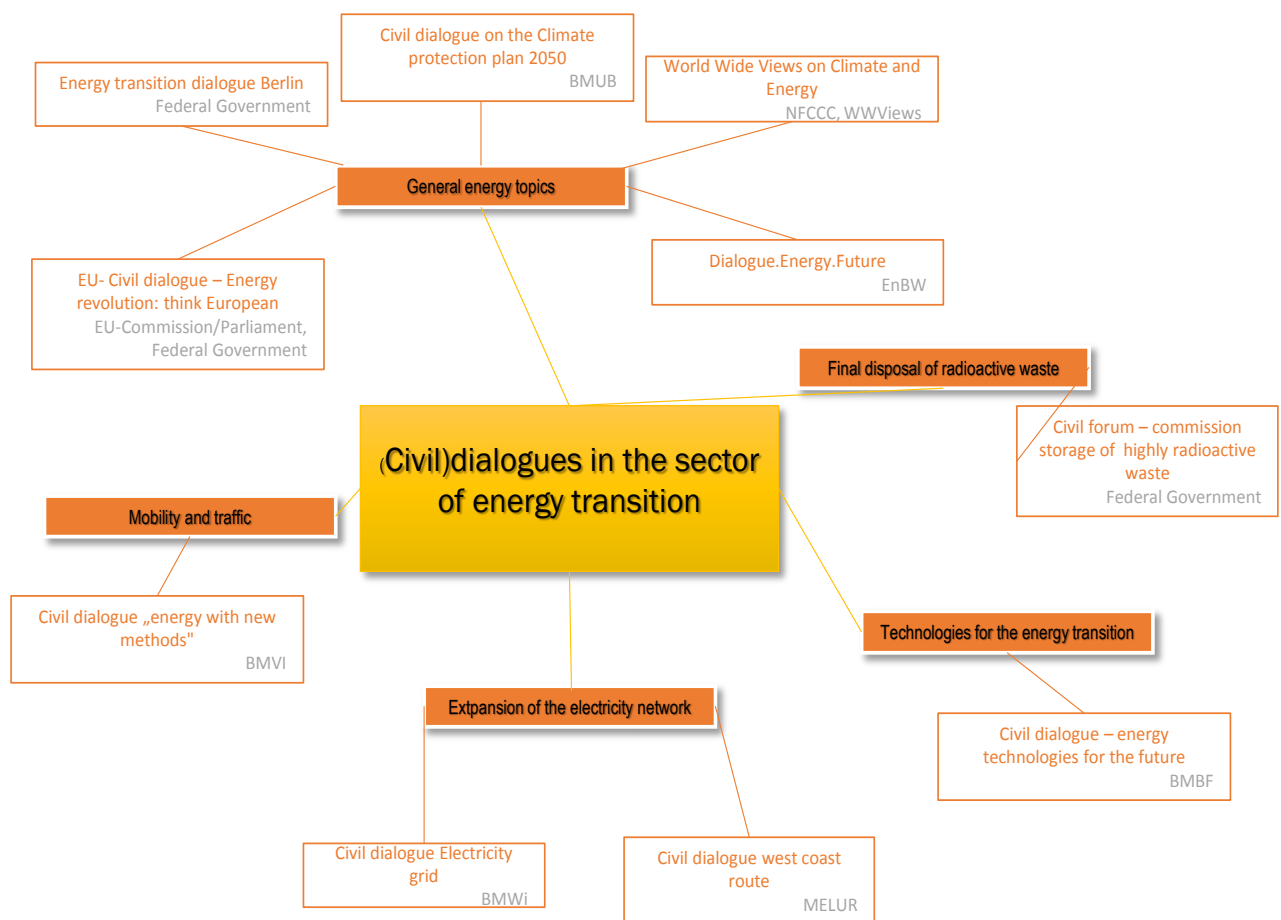
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<sup>29</sup> [www.unendlich-viel-energie.de](http://www.unendlich-viel-energie.de)

<sup>30</sup> <http://www.energiewende-akzeptanz.de/>

### 5.4.2.3 How does the German government communicate to the public about targets, technologies, measures, energy prices? (Q25)

During the last years there have been, besides the informational communication via websites and brochures, a broad range of public dialogues connected to energy topics, e.g. “Citizen Dialogue National Grid” by the Federal Network Agency, and scientific discourses e.g. within the framework program Research for Sustainable Development (FONA) by the Federal Ministry of Education and Research (BMBF), which aims to support inter- and transdisciplinary social-ecological research in Germany and, thus, considers different assumptions and visions coming from different stakeholder perspectives. Figure 21 gives an overview about dialogue activities during the last years.



**Figure 21. Overview about dialogue activities by Ministries / Governmental bodies or other institutions (own compilation).**

These dialogues are a response to the growing public demand to be heard and be involved in political decision-making processes (cf. narrative anti-nuclear). A significant shift occurred in 2013, when the CDU-SPD government moved the “Energy” topic to the ministries of Economics thereby separating it from climate change mitigation which is hosted by the ministry of the environmental. Naturally many federal Ministries, the ministry of transport, energy, the environment and research, deal with energy and climate protection issues. Due to a lack of coherence in their policies and little inter-ministerial cooperation there is no consistent public

communication strategy and sometimes the dialogues seem to be even contradictory. A relevant research question in this respect addresses the measurement and evaluation of effectiveness and range of the respective dialogues, which groups and levels of society have been reached.

#### **5.4.2.4 What needs to be done to enhance public acceptance in Germany? (Q26)**

The analysis of the current situation shows that there is still a high-level acceptance in terms of a positive attitude and also active support on the behaviour level for renewable energy production. Still, main data is existing in the field of power generating (RES, coal, nuclear) with the focus on technology acceptance, affected residents, participation procedures, compensation strategies etc. There is not the same attention and existing data in the efficiency (despite the efficiency first initiative) and mobility sectors.

The perceived justice - procedural regarding planning and decision-making processes but also distributional in terms of the cost debate and social inequity – seems to be a key issue for acceptance of all components of energy transition: RES production and efficiency measures likewise.

Additionally, for the future, both socio-scientific research and political measures, should pay more attention also to the other sectors like heat, traffic, consumption etc. – also in these areas a higher acceptance in terms of positive attitudes as well as concrete action (consumption behavior, sufficient lifestyles) are needed.

## 6 Comparative reflections (WP 2)

Building on the comprehensive results of chapters 4 and 5, Japanese colleagues commented the German parts of the report and vice versa. General comments and impressions regarding the topical clusters were combined with and based on details from specific ToR-questions, belonging to the four different topical clusters. The comments address similarities, differences, and synthesis to depict reciprocal learning potentials or transfer opportunities.

The discussion demonstrated that Japanese and German colleagues considered different topics as crucial for energy transition. This was observed on all levels that we have considered: *political framework, laws and political instruments, geographical conditions, stakeholder structures, cultural processes / values, spatial or time dimensions etc.*

WP 2 answers the **ToR questions ‘How does the geographical difference between the countries affect the public understanding about energy transition?’ (Q28)**. It provides a transparent display of the comparison on each of the four topical clusters. It also includes the comments provided by the Japanese colleagues to the German narratives. This supports the discussion of linkages as well as differences between the perceptions of the narratives. It also directly leads into a discussion of where the two countries can learn from each other.

The synopses of the four topical clusters and the intertwining narratives highlight learning potentials, and support the derivation of concrete recommendations in WP 3.

### 6.1 TC I: Targets, strategies, and strategic framework conditions

#### 6.1.1 Strategic and governance level - commonalities

The comparison of policy targets, strategies and strategic framework considerations demonstrates a significant level of convergence on the highest level of policy making: The basis for energy policy in both countries is what is known as the 3E principle in Japan, or the energy policy objective triangle in German: Energy security, economic efficiency or affordability and environmental compatibility are the overarching objectives. Japan’s framework in addition emphasizes safety, which is not explicitly part of the German objective structure.

On the institutional level, responsibility for energy and climate policy is split between different ministries in both countries resulting in several challenges. In principle, both parliaments take great interest in energy policy.

Both countries committed themselves to the first commitment period of the Kyoto Protocol (2008-2012) and also set short-term (2020), mid-term (2030) and ambitious long-term (2050) emissions reduction targets. Both countries have developed domestic and institutional frameworks to reduce GHG emissions, but climate mitigation and energy transition are not the highest priorities of either government. Both research teams find the targets, strategies, and strategic frameworks to be insufficient for attaining energy transition.

Both countries have established or are going to establish a PDCA cycle for their emissions reduction targets up to 2030, but have not yet established a mechanism or process to assess the current emission trends and their adequacy with long-term deep decarbonization pathways. However, the German government is running a domestic monitoring process which analyses achievements levels of energy transition targets. The German monitoring report

analyses trends for each concrete target such as renewable energy share of the gross final energy consumption and it rates them with 1-5 stars. In addition, Germany is obliged to report to the European Union on climate, renewable energy and energy efficiency targets, achievements, policies, and measures. Both countries also report to the UNFCCC. Japan could learn from Germany to set concrete targets of energy transition not only in short term, but also middle and long terms and to ensure visibility of their achievement levels for Japanese citizens through regular monitoring process.

In regard to renewable energy in both countries development, the Feed-In-Tariff Systems (FIT) succeeded in building confidence of investors and boosting investment in renewable energy in both Germany and Japan. Particularly the areas of offshore wind and solar PV provide interesting lessons in both countries that together would make for a textbook on feed-in tariffs for other countries. This comparison shows that specific policy details, like cost distribution for grid expansion, are highly relevant for the effectiveness of FIT policies.

In both countries, much attention has been given to the decarbonization of the electricity sector but emissions from the transport and heating sectors have remaining high. Both Germany and Japan have included in their NDCs sectoral emission reduction targets for these sectors towards 2030. But both are yet to implement concrete policy measures necessary to achieve these targets. It is important to note that these targets have relevance far beyond direct emission reductions as both countries have globally leading automotive industries, and these industries are dominant for both economies. The risk of ignoring decarbonization and technological trends in this sector has been recently illustrated by the German Diesel-Gate, where at least the German car industry has chosen to completely ignore political regulations and insist on flawed and criminal product design choices, resulting in permanent brand damage, unimaginable economic consequences for the companies participating in the scheme and a missed opportunity in maintaining technology leadership in relevant technologies. If Germany and Japan fail to provide a home market for decarbonized automotive technologies, their economies overall are at risk.

### **6.1.2 Strategic and governance level - differences**

However, there are also considerable differences. Most prominently, nuclear policies are diametrically divergent. Despite the fact that the Fukushima Daiichi nuclear disaster directly affected Japan, and only very indirectly affected Germany, the event resulted in a decided policy shift in Germany and retriggered the nuclear phase-out process already in place. The political consequences in Japan seem minimal in comparison.

Secondly, geopolitical framework conditions differ between the two countries. A major determinant of German energy and climate policy is the European Union. For Japan, no such supranational body influences Japanese policy. German federalism can be seen as one of the most important political framework conditions that enabled the early institutionalization of the phase-out of nuclear power in Germany.

Generally, the challenges of policy coordination are different. In both countries, energy policy as well as industry and trade policy are in the domain of the ministries for economic affairs (METI, BMWi). Climate is typically government by the environment ministries (i.e. BMUB in Germany, MOEJ in Japan). Energy as the major GHG emitter is influenced to some degree from the side of the environmental ministries, and clashes between the ministries and their

priorities are the rule rather than the exception. Surprising at least for German observers, these two ministries seem to have a significantly harder time to manage the conflict in Japan than in Germany.

The “recommunalization movement” has been one important driving force that further facilitated change in Germany. Under the new regulations, municipal utilities are again allowed to manage their own power grids and thus generating revenues to cross-finance other public services – constituting an important pull-factor.

### 6.1.3 Economic aspects

Both countries have a long tradition of high electricity prices for household consumers and these prices have risen in the last years. In Germany, industrial consumers enjoy lower power prices than household consumers, differences caused by regulatory decisions (different tax load and a skewed burden sharing for the renewable energy surcharge). This difference in treatment is considered unfair in the public opinion. In Japan, complaints about high electricity bills, including by industry, are an instrument to manipulate an image of expensive renewable energy, or argue against carbon pricing. Both countries are looking for ways to reduce the cost of FIT, and there are common interests in learning from each other.

The situation of power companies is different in the two countries: In Japan unbundling and privatization are still a process that companies are preparing for, and has so far not led to losses of the power companies. In Germany, power companies are struck by the changes imposed on them by unbundling but also by the Energiewende - they had not expected these changes to be so far-reaching and fundamental, they have failed to include the paradigm shifts into their corporate strategies, and they have underestimated the impact of renewable energy on power prices. With smarter long-term strategies, they would have participated in the economic benefits of the Energiewende from the start but inherent opposition to change prevented them from leveraging these opportunities – and by now they have missed the boat. In Germany, at least, this underestimation of the changes was also related to the power companies functioning as an epistemic community - the closeness to societal dialogue posed a significant risk for these companies which are now threatened by bankruptcy.

Both countries are thus witnessing a division of the business community, although this might be more pronounced in Germany than in Japan. While traditional, and in particular energy intensive industries are very vocal in the energy policy discussion, promoting change-averse points of view, arguing against costs increases and hindering progressive policies, new business groups which benefit from the energy transition are becoming more influential - e.g. the renewable energy sector and a vibrant start-up sector dealing with digitization and “smart anything”. These new businesses are providing income and jobs and thus refuting many counter-arguments.

Concerns over losing international competitiveness of energy-intensive sectors (causing “carbon leakage”) due to higher carbon prices are observed in both countries. However, the consequences are different: In Germany, such concerns led to the adoption of measures like the free allocation of emission certificates, monetary compensation, and minimum tax levels - to the degree allowed by the EU. On the other hand, in Japan, such concerns have been used for blocking the introduction of strict market-based mechanism at the national level. In Japan, the majority of industries, in particular energy-intensive sectors, tend to perceive any additional

climate mitigation policies as cost-increasing factors. This perception hinders the energy transition. Although it is not clear whether Japan will introduce a stricter carbon pricing policy in the near future, it is useful to get lessons from German experiences in introducing and implementing such measures. In particular, it would be valuable for Japan to examine how such measures have been designed and implemented, and how effective they are. In addition to carbon pricing, some voices in Germany are currently debating a general pricing mechanism for CO<sub>2</sub>, or a CO<sub>2</sub>-tax, that could replace some of the existing measures or exist in addition. The integration of the cost of CO<sub>2</sub> in the existing economic system could be another topic for a vital exchange between the two countries.

## **6.2 TC II: Socio-cultural preconditions for a sustainable climate-friendly economic model and TC III: Lifestyles and behavior**

Energy transition requires economy and society-wide transformation in all sectors. Therefore, socio-cultural conditions which enable the engagement of all levels of society are critically important.

### **6.2.1 Energy efficiency and sustainable lifestyles**

To reach climate mitigation objectives, decisive behavioral adaptations in different areas (consumption, mobility, housing, travel, etc.) are required, which can lead to more sustainable lifestyles and consumption patterns. Energy consumption behavior is different between the two countries: average power consumption per household in Germany is a multiple of households in Japan. This is facilitated by higher energy efficiency of appliances and more conscientious energy consumption behavior in Japan. Germany has a lot to do to catch up to that level. For instance in transport sector, Japan has introduced a so-called “Top Runner” fuel efficiency standard in 1999 to reduce automobile CO<sub>2</sub> emissions. It sets binding fuel efficiency targets for automobiles. After its introduction, CO<sub>2</sub> emissions from the transport sector have steadily declined since peaking in 2001. In addition, the rate of passenger car efficiency improvement has increased. The Japanese specific socio-cultural factor such as “Kaizen (continuous improvement)” of car manufacturers contributes to achieve the standard. Moreover, the public proclamation of car manufacturers as a part of Japanese sanction system, also known as “name and shame” is very effective due to an aspect of Japanese culture, “keeping face” (Dubbers et al., 2012). Generally, lifestyles are lush and comfort-oriented in Germany, and energy efficiency measures have a difficult standing as uncool and tedious. Expressed willingness to take energy efficiency action starkly exceeds actual activity and mobilization levels, even if costs for more climate-compatibly behavior would be tolerable and support programs from the government are available. Learning from the Japanese role model would be highly appreciated. Here, the immediate reactions to the Fukushima catastrophe and the subsequent temporary energy shortages by switching off nuclear power plants have made it clear that even if specific consumption is lower than in Germany, there are still possibilities for further energy saving, even if they are partially associated with restrictions in terms of comfort and convenience – an important opportunity for Germany to learn from Japan!

In Japan and Germany, the oil crises in the 1970s led to the first serious efforts to reduce energy consumption. At that time, even before renewable energies were technically mature and economically viable, both countries felt a particular pressure on energy saving, as both



are low in fossil raw materials and therefore highly dependent on imports. Japan took much stronger measures than Germany, leading to a situation where some people in Japan are still convinced that energy saving efforts and policies in the 70s have been so extensive that further reductions now are hardly possible. Hence, Japan has experienced a kind of temporary forced sufficiency, before enhanced smart energy saving and efficiency measures have been implemented to deal with the new situation after the earthquake and its consequences. Using this experience as a suitable learning opportunity can offer opportunities to build up and strengthen more sufficient and sustainable energy behaviors and lifestyles. In Germany, an increased debate has been taking place over the last few years on the need for more sustainable lifestyles (and, thus, a further prevalence of sufficiency practices). The actual consumption patterns and predominant lifestyles of the Germans are still far from meeting the criteria of sustainability. Although there are individual trends, pointing in this direction (organic food, fair trade products, green electricity, vegetarianism), these have not yet penetrated a broad majority. In fact, there are tendencies noticeable, pointing towards extended CO<sub>2</sub> footprints by using more resources (larger cars, larger apartments, more air travel, etc.).

To contribute to the success of the energy transition, increased efforts in the field of sufficiency seem not to be a priority issue, neither for the citizens nor for the majority of the enterprises and the government in Germany. In general, efficiency and consistency strategies are prioritized, but even these do not have the necessary impact. In order to increase the efficient use of heating energy, for example, a large number of subsidy programs have been set up for energetic building renovation. But in spite of such political incentives and a positive basic attitude of most people towards energetic refurbishment, the actual renovation rates are still quite low, about 1 % per year (UBA, 2014). One reason might be a focus on the economic amortization in relation to the expected period of own use and/or in combination with local real estate market conditions (which are very different in various parts of Germany due to factors like urbanization and demographic change).

### **6.2.2 Influencing factors: socio-cultural attitudes, demographic changes, urbanization, and geography**

The role of geographic conditions is limited to coining the views on energy security. Both countries are resource-poor and depend on energy imports. While Germany benefits from a close embeddedness in the European Union and good trade relationships with major energy exporters, Japan has gone through several traumatic episodes with respect to oil prices, shut-down of nuclear facilities, and energy scarcity. The influence on energy policy, however, is difficult to discern: Japan is still dependent on imports of nuclear fuel, Germany by now means self-reliant. But the geographic situation has certainly led to Japan being a role model for energy efficiency.

The aging society, urban development and demographical changes in rural area pose challenges in both Germany and Japan. The current trends in the two countries indicate that such changes contribute to increase in per capita energy demand and emissions in the household sector. How to reduce energy demand, while providing sufficient services under the aging and changing demography is a key question to the two countries.

Several socio-cultural shifts in Germany certainly contributed to an overall stronger transition compared to Japan – as described in the narratives. In Germany, a powerful coalition has

formed between a grassroots environmental movement, scientists and alternative think tanks, and a growing green energy sector. This coalition lent legitimacy to progressive policies, and opened the political process for a more sustainable, climate-friendly economic model. As the three narratives show, Germany has a long history in public opposition against nuclear power and centralized energy projects, complemented by a more common consensus for decentralized, renewable energy projects as well as an overall transition of the energy system developed. In addition, the parliament and its Study Commission took an active interest in climate and energy policy, nuclear phase-out laws, the EEG etc. Speaking in Geels' terminology: Starting from different social niche movements, the understanding that a transition of the energy system is unavoidable has become widespread in Germany, and the regime is now "Energiewende" - how to do it and how fast, however, is still highly debated.

### **6.2.3 Prosumerism and community energy**

In Germany and likewise in Japan (especially after Fukushima), there are some initiatives of environmental organizations and consumer cooperatives in developing projects to enhance changing energy purchase behavior (supply of renewable energy, switching of power contracts). In Japan, there is also an increasing number of community power projects in recent years (especially since Fukushima catastrophe), partly financially supported or co-owned by local governments.

A growing number of citizens in Germany have now become prosumers from pure energy consumers. For example, many homeowners have photovoltaic panels on the roof, which they use to cover their own electricity requirements or to feed electricity into the public grid. Or people are financially involved in civilian energy projects, e.g. the construction of a wind farm. However, the further extension of these developments can be scrutinized, since recent changes to the Renewable Energy Sources Act are partially detrimental to the framework conditions for such models (BEE e.V./IZES, 2014).

## **6.3 TC IV: Public discourse, acceptance, and existing narratives**

### **6.3.1 Acceptance of nuclear and renewable energy technologies**

In both countries, people consider energy transition desirable, and generally are skeptical of nuclear power. While in Japan the Fukushima Daiichi nuclear disaster has caused a fundamental change of public opinion, insofar as the support for the use of nuclear energy has dropped significantly, in Germany public support for nuclear energy was already very weak before the Fukushima Daiichi nuclear disaster (although it further declined after the catastrophe). Although public opinion does not support this decision, the current Japanese government does not want to abandon nuclear power.

There is difference in how to deal with ethical issues related to energy, in particular nuclear energy, between Japan and Germany. In Japan, anti-nuclear discourse tends to be regarded as an "emotional" response. Given the image of technologically safe nuclear power which has been promoted by the government and major power companies, therefore, these emotional arguments against nuclear power were seen less important than realistic and techno-engineering-based argument for nuclear power. In Germany, a discussion has been

established on the risk and ethical aspects, for example in the form of the Ethics Committee on Safe Energy Supply during the phase-out discussion.

In regard to the search for disposal sites of radioactive waste, Germany and Japan have followed different strategies.

Ever since the announcement of Ernst Albrecht, former prime minister of Lower Saxony, to set up a nuclear waste disposal site in Gorleben in February 1977, Germany has witnessed over 40 years of protest against nuclear waste disposal sites and the so-called “castor transports”. Following this legacy of resistance, Germany tried to enhance public acceptance and trust by setting up an impartial national monitoring council with citizens selected as members in 2016.

Looking at the degree of general acceptance of renewable energies, while the majority of German citizens finds the expansion of renewable energies important, acceptance of concrete local energy facilities often is not so high. The situation in Japan is very similar: local acceptance towards renewable energies tends to be low while general acceptance is relatively high.

Typical negative perceptions of renewable energy in Germany are high costs associated with renewables, and changes in the landscape. These regularly provide resistance to wind power plants and other renewable energy infrastructures. There is also a fear of critical consequences for health from e.g. noise emissions or bird killings by wind farms which has shown to be a barrier for renewable deployment. However, in Japan, the existence of unsatisfied local stakeholders in consensus building processes could be an obstacle to realize renewable energy projects. For example, in the case of wind power generation facilities, it has been criticized by the public that external enterprises monopolized the profits without distributing benefits to local communities. In both countries, there are cases in which wind projects were suspended and delayed due to negative campaigns against wind projects by local initiatives. Studies from Germany (and other European countries) indicate that people, having experiences with renewable energy plants in their surroundings, are more likely to positively appraise RET than people without concrete experiences (it is not clear, whether there are comparable effects in Japan).

It is interesting to note at this point that there is a set of negative perceptions about renewable energy that does not play a role in Germany anymore, most notably the perception that it is not possible to provide stable power based on fluctuating energy sources. This argument might have been overstretched by the German utilities at a time when managing system stability was only a small challenge. This was a risky strategy, as with increasing penetration of wind and solar electricity, the challenge in fact will become bigger, but the utilities might have lost their credibility on that complaint.

### **6.3.2 Measures to enhance acceptance**

As narrative II shows, another way to increase public acceptance of renewable energy projects in Germany was to increase community participation and realize economic benefits for all stakeholders. In Germany, private individuals and local initiatives were the driving forces behind renewable energy development in its early stage. The increasing development of large solar free field installations, or big commercial offshore wind parks that excluded local communities, lowered the overall acceptance of these technologies. As a result, many different

economic models of community integration exist in Germany to secure public acceptance and participation. Policymakers and developers need to ensure that economic benefits are distributed evenly and a mutual exchange on successful examples, best practices, and business and participation models would be advisable. Just as much as the increased ownership of RE by private individuals has increased their interest in the discussion around the Energy Transition in Germany and their backing of it, an increased ownership of RE by entire communities or other opposing stakeholders can also change their views. Even in some offshore wind farm projects in Japan, the local municipality and/or local government introduced a kind of “public tendering”, in which project developers are also requested to propose local benefit.

In order to enhance public acceptance, the adequate information on renewable energy projects and the participation of stakeholders in planning and decision-making processes are significant factors as it is seen in German cases. In recent years, the German government has set a broad range of public dialogues connected to energy topics. For improvement of local acceptance, ministry of environment and ministry of trade, industry, and economy collaborate for collecting scientific knowledge. They have already changed guidelines for infrasound of wind farms, stating that there is no specific phenomenon of wind turbine. Their trial continues in the issue of bird, ecosystem, and landscape.

Japan provides an interesting lesson of how deliberative poll could inform the public to take a decisive position. In 2012, the Japanese government conducted deliberative poll, in which participate randomly selected 6,849 citizens for discussing topics about energy issues. Their support for nuclear power phase-out and lower dependence changed from 41% to 61%. As they learned and discussed more with various experts and other participants, the majority has changed their mind from “don’t know” to a decisive position. The result of the deliberative poll composed one factor for changing nuclear energy policy in Japan, though it changed again after LDP won the election in the end of 2012. While further research is required to examine whether discussion and process were “objective” and whether the participants well represented society, this process indicates that potentially many Japanese citizens support public discussion of energy issues and want their voice reflected in national policy, although the energy issue has not composed a main topic in national elections.

It seems both countries would benefit from learning more about the approaches regarding public dialogues.

## **6.4 The role of science and education**

This is where the role of science and the scientific community is very important. One of the most important ways to improve social understanding and acceptance about energy transition is public debates based upon scientific, energy scenario planning and models. In both countries, such planning and models have been developed, but been used at different levels and manners. In Germany, energy scenario planning/models played a key role in the Energiewende discussion. Data on the status quo of renewable energy deployment and other policies fields were made available to broad tiers of the population, journalists, and scientific community, and provided for alternative opinions and analyses within the scientific community, as well as overall a comparatively high level of educatedness of the German public on energy issues. Such practices contributed to the formation of the consensus or mutual understanding

among stakeholders. This is complementing an increased level of understanding of energy issues by many participants in the energy markets: many hundreds of thousands of farmers and solar roof owners are formal participants in the power markets and the average level of knowledge of the power sector is comparatively high in Germany. In Japan, energy-economic scenarios and modelling were used for discussing national emissions reduction targets, but in an ad hoc way. This is an area where Japan can learn from the German experience, in particular, regarding how to use scientific energy scenario planning and modelling for public debate and improving public/stakeholders understanding about energy transition. This effect of data availability and transparency cannot be underestimated – scientists were able to provide technical and validated information to journalists and other public outlets. In various channels, data on many details of the power system are available and many people can use them to improve their information status.

Over the past decade, substantial changes also took place in the education sector that accompany the energy transition in Germany. Universities have developed new programs to provide for the increasing need for renewable energy and climate experts, and sustainable development has found its way into curricula and programs - due to a push from political stakeholders but also a pull from the new industries that are in need of qualified staff. The integration of these topics into standard and higher education can be seen as a result but also a precondition that contributes to the development of climate-friendly economic model.

A second important role of science is in a triggering and ex-ante support of the public discourse. Most political decisions can be based on data now that were unavailable earlier. Scenario assessments allow policy makers to choose between different options for the future, on the basis of data rather than gut feeling. As this has been used extensively and by a multitude of independent sources the understanding of power markets and technologies is very high with German policy makers – including parliamentarians. This limits self-serving influence by the power companies, and enhances the involvement of the Parliament in an informed discussion.

Social science also helps improve acceptance of the transition, e.g. by researching preferences and acceptance-determining factors. In Germany, there are some political and scientific efforts to extend the focus beyond (acceptance of) energy infrastructure and take a comprehensive perspective on energy sustainability (compare e.g. the FONA-framework program by the Federal Ministry of Education and Research in 2005 (BMBF, 2016)). Furthermore, an integration or at least a stronger intertwining of the topics electricity, heat, traffic/mobility, and consumption is targeted (cf. BuW, 2017).

## 7 Conclusions & Recommendations

The analysis is leading to the important conclusion that both countries share a large number of joint traits, and can improve their performance in economic growth and environmental sustainability through a structured collaboration and learning process. Each country has its treasure of experiences – in managing energy scarcity, acceptability challenges, and technological leadership – and sharing these will help both.

The following recommendations target various communities that are called upon to strengthen their collaboration and mutual learning (Q31 What can Germany learn from Japan in all the above-mentioned areas and vice versa?, Which sociocultural experiences can be transferred from the longstanding tradition of ecopolitical groups in Germany to the situation of Japan? (Q27) Recommendations looking at targets, strategies, and strategic framework conditions (Q29) as well as socio-cultural conditions (Q30)).

### 7.1 Policy makers

Based on the similarities of the policy challenges, the previous chapter has identified multiple opportunities for learning:

- Auction mechanisms,
- Energy efficiency policies, programs, and implementation
- Public dialogue and participation

For these – which will be explained in the following, it is highly recommended to create a bilateral policy research dialogue between the two countries. These two countries are natural allies, in particular with respect to the energy-related challenges: the third and fourth biggest economy, industrialized nations with poor energy resources, comparable demographic challenges, a large carbon-footprint, and an export- (and car-) oriented economy. A structured exchange between policy makers will be benefitting all, and – as this study shows - the energy sector is a well suited starting point for this.

Another similarity between current energy policy approaches in Japan and Germany is the introduction of auction procedures for the construction of renewable energy systems. As an alternative to fixed feed-in tariffs, this should reduce the costs of energy transformation. Whether this effect actually occurs is still unclear, and possible negative effects (renewed strengthening of large energy companies, higher hurdles for citizens' energy projects ...) are feared. In order to promote renewable energies as cost-effectively as possible and yet not to hamper the differentiation of the market participants, energy policy measures should focus not only on the design of feed-in tariffs but also on the shaping of the energy markets in a direction which corresponds to the goals of sustainable energy transformation (including pricing mechanisms, the role of capacity markets / mechanisms, grid development, etc.).

In the field of energy efficiency, the overall public in Japan is already well ahead compared to Germany in understanding the need but also the benefits of it. Being efficient in general is one of the highest goals in the German business community. Being energy efficient is however still associated with high investment costs and limitation. Germany could look to Japan for ways how to establish being energy efficient as “the smart and logical thing to do”.

In both countries examined, there is a trend that energy policy is increasingly being discussed in public space as well as outside political and economic circles. As a result of increasing decentralization, energy generation and distribution will become directly perceptible phenomena for more and more citizens, not least in the form of appropriate facilities and infrastructures. From this immediate concern, new needs arise for involvement and participation. In Japan and Germany, policy (at different levels) is interested in meeting these needs through new and extended participation procedures. For example, Japan once tried a “national deliberative poll” on energy issues, while several German local governments conducted participatory approaches over decarbonization transition and the Federal government also conducted stakeholder dialogues to develop long-term decarbonization strategies. Both countries should seize the opportunities to learn from each other which forms and procedures of participation are effective and efficient and are accepted by citizens. The specific advantages and disadvantages of different methods, as well as their specific effects, could differ depending on the socio-cultural field of application. However, too little is known about this and further research with intercultural exchange is desirable.

## **7.2 Multi-stakeholder Dialogue including the business community**

Recommendations that could help to enhance understanding and acceptance of the energy transition in different stakeholder groups for policymakers would be study trips and participate in exchange workshops on political renewable energy support mechanisms, including but not limited to offshore wind energy, FIT design, etc.

Different ministries concerned should cooperate to bring forth the topic unanimously. Public dialogues to support the dissemination of the importance of this national project and to involve the public are essential to develop a communal spirit of challenge. A communication strategy, that addresses the shared identity, communicates accomplishments and (traditional) values (and connected activities etc.) that prevent consumption makes visible the relevance of this challenge and helps combining facts and emotional elements. Through programs that activate all communities to make an extra effort in energy saving subordinate societal and administrative levels can be included.

While both countries have witnessed a separation of the business community into proponents of the transition as well as opponents, it is important to not push for a split, but rather unite the community as such and get also establish, energy intensive industries to see the benefits of an early transition. The chances of digitalization and innovation that an early transition holds need to be understood. As has been highlighted, the business communities in both countries need to understand that in order to maintain global technology leadership they will need to provide carbon-free technologies and products.

A cross dialogue between policy makers and businesses from both countries would help to improve the understanding of why and how an energy transition can work or not.

To receive more support for an ambitious sustainable energy policy (which contributes to enabling framework conditions), some changes within the business community are necessary and should be promoted: a strengthening of associations (especially “alternative” business community), business trips for exchange and learning from examples, collaboration with

“Renewables - Made in Germany”, the export initiative renewable energy and energy efficiency of BMWi.

### 7.3 Civil Society

Despite the above-mentioned similarities in energy policy in Japan and Germany, however, there are some striking differences, especially when looking beyond the sphere of political actors and taking into account other groups of actors. In Germany, there has been a well-organized anti-nuclear power movement, which is composed of civil society, scientific and political actors. This was a prerequisite for the ultimately very broad overall social and political consensus that nuclear power would no longer be used for energy supply in the future. In Japan, despite the Fukushima disaster, there has not been a strong movement to achieve a nuclear phase-out (as part of a comprehensive energy transition).

Through the comparison of the current process to search for disposal sites of radioactive waste between Germany and Japan, differences on the range of civil involvement become clearer. Germany has established in 2016 the so-called “national concomitant council (Nationales Begleitgremium)”, in which three of nine council members have been selected as citizens’ representatives to reflect societal voices into the discussion on disposal sites for radioactive waste. One of them takes role of the representative from the young generation (Nationales Begleitgremium, 2016). In addition, sessions of this council take place in various regions of Germany in rotation so that local citizens are able to get opportunities to come and follow the discussions. In contrast, the Japanese approach to determine final disposal sites is rather top-down. In July 2017, the Japanese government released the “Nationwide map of scientific features for geological disposal (Kagakuteki-tokusei map)” indicating areas suitable for the final disposal of high-level nuclear waste. Based on the map, the dialogues with local stakeholders will be done (METI, 2017).

The civil society is crucial for the energy transition as the main changes are going to happen on the local level and/ or make changes in personal behavior necessary. For the acceptance of renewable energy plants, it can be very helpful to provide those who will be affected by a potential construction of RES plants with possibilities to experience RE technologies in other communities and learn from those who live there and were involved in the planning processes. Addressing the relevant discussion about the distribution of costs and benefits it is important to allow local benefit for communities and people affected e.g. through local ownership models. High-quality participation in planning processes are fundamental with respect to procedural justice and hence the acceptance of the planning process itself and allows to integrate resident’s needs and expertise. Good professional planning also takes into consideration aspects of risk/health factors and visibility. Concrete projects create possibilities to experience accomplishments and generate confidence in a possible transformation. The public should be approached through dialogues in order to bring the energy transition into the public discourse and mindset of the people - this can be either initiated by the Government/ Ministries or other active stakeholders.

Therefore, potential recommendations for Japan might be to establish or to strengthen stakeholder-networks, including non-governmental-institutions, for example by providing public funding. A broad spectrum of stakeholders should be involved, for example, in the discussions at the councils to develop a new "Strategic Energy Plan" which started in August



2017. Also, the initiation of a public discourse by measures like agenda setting and social marketing could foster the energy transition discourse. Competence transfer and capacity building for a professionalization and institutionalization of forces which work for a (nuclear-free) sustainable energy system might be helpful too.

## **7.4 Research Community and Research Funding**

In Germany, independent research institutions played an important role in the overall transition process since they provided scientific backing for positions that did not represent the established structures or government positions. Diversity in the scientific community, was and is a cornerstone of democratic policy making, and a need for choosing the right path based on scientific evidence. Policy makers benefit if the scientific community is put in a position to provide different views – e.g. in favor or against the transition – or analyze pathways that have not been thought of by the policy makers. Funding, exchange, and research opportunities are crucial building blocks for that and need to be provided. Japan has until now not witnessed the contributions of independent research and policy advisory organizations supporting energy policy change and social movement such as in Germany (such as Öko-Institut). Such a force creating transparency and educating the general public more independently might be seen as oppositional but in fact enhances the room for maneuvering for all stakeholders. Also in the future, scientists will need to provide backing for subjects that will be well-received in the public, but also for those that will not.

A governmental commitment for the energy transition has to become visible and should be reflected in its scope of action. The alignment of research programs towards energy issues and its relining with substantial funding contributes to a continuous development concerning technical and societal questions. Regulations concerning the energy efficiency of domestic appliances permit to hold up the standards already achieved and foster new developments.

The education system is another access to this societal transformation. The energy issue should be integrated on different levels and fields of education in order to create a basis for future developments. Topics in the context of energy issues should be included in the curricula of different disciplines at school (politics, physics etc.) and allow practical experiences. Further training for teachers and educator on energy issues as well as linked to that the relevance of consumption (interdependencies/ consequences of behavior) should be offered. It is also possible to make children in kindergarten familiar with energy topics through experiments and other active elements allowing personal experiences and understanding of the relevance for the society. With regard to jobs in the energy sector training courses should adapt to new competences needed. This refers not only to technical knowledge but also skills for the implementation of participatory planning processes.

## **7.5 Trends and future research needs**

The comparison of the different pathways Japan and Germany have taken in the past raises new questions in regard to where these paths will lead to in the future. What are the overall visions of both countries – and can they be achieved with the measure in place today? Overall, the transition processes not only bring forward new forms of energy or new forms of governance. At the same time, older, now outdated industries, jobs or governance structures will need to be replaced – creating winners, losers.

Such integral change can be hard to cope with for the affected parts of society if no alternative vision is provided. The ongoing phase-out of coal energy in Germany and the effects it had is one side of the energy transition that has not been covered extensively in this report. A closer look at the phase-out could provide further learning material on how societies cope with inconvenient necessities. A recent study by one of the members of the consortium on employment in the lignite sector in Germany for example shows that coal companies, employees and political decision makers in the traditional German lignite regions have in fact already started to adapt. Companies diversify and offer their services such as mine operation and public works to other industries. Local chambers of commerce push politicians to create favorable conditions to attract new industries e.g. from the logistics, tourism or service sectors (Wörten et al., 2017).

Although Germany is on its way of phasing out nuclear power, as described in the German narrative I, and society in Japan is becoming more critical, a clear plan and vision for both phase-outs and what comes next is needed. How will the decommissioning of the plants look like? Without a solid, alternative vision of the future energy systems in both countries, the old system is harder to replace. In this respect, a comprehensive societal dialogue including various stakeholder groups and levels is needed (see also 7.2, & 7.3). As shown in chapter 5.4.2.3, there are already existing approaches of dialogues dealing with energy issues, which are in so far limited in scope as regarding only parts of the energy system, in addition they occur to be more or less unconnected or even contradictory, especially in Germany. In contrast, there exists a strong need for a broad public discourse for several reasons:

- A mandatory condition for a societal transition and corresponding behavioral change is a shared vision of the change's direction and a joint understanding and ideally consensus of concrete steps to reach this vision.
  - o The discussion cannot be restricted to only on one specific energy technology or infrastructure (e.g. grid dialogue) but should be more systemic and integrative to the whole energy system, i.e. to address the interdependencies.
- The increasing need in society of being heard and feeling of having control regarding the changes in the living environment as a megatrend.
  - o The rapid decrease of trust in political institutions, persons and procedures (the highly organized opposition groups are partly resulting from a significant lack of trust in public and political institutions which are associated with energy transition): Measures with trust-building potentials which provide positive experiences with the political system are needed.
  - o Currently, planning and permitting procedures are often covered with public concerns which are not part of the legal process, nevertheless, this shows the need for a place to discuss those issues.
- The question of distributional justice regarding the fair distribution of costs and benefits: the transition includes winners and losers, not only in an economic way, but also with regard to identities and social roles (e.g. lignite regions with their traditions and cultural self-concepts). These processes have to be taken seriously and should be addressed.

All these issues have to be taken into account by establishing a comprehensive dialogue which includes all stakeholder levels, not only the typical and powerful groups, but also those parts of society which are only insufficiently represented. The dialogue should enhance besides information and consultation on the national level also regional activation and regional debates

about specific decisions and alternatives in terms of the energy system – including inter-regional interdependencies as well as relations between rural and urban areas. Finally, the dialogue should bring forward clearing the question in which (energy) future does the society wants to live – and potentially activating new ideas like sharing and sufficient lifestyles.

In this context, it is important to state that a dialogue does not mean to hand over the responsibility of decision-making from experts or elected political representatives to laypersons. A societal dialogue about energy transition means to enhance the transparency and traceability of a process being fundamental for the whole society and the opportunity of consultation for the broad public instead of only small circles of experts. In addition, such a process can both benefit through local knowledge and provide an activation for civil engagement, e.g. energy cooperatives.

Nevertheless, a societal dialogue is connected to some relevant preconditions: A central precondition is the ability to participate constructively. This means, capacity building and competence development e.g. in terms of procedural knowledge and technical expertise are crucial first steps. The process of teaching relevant knowledge and skills about the energy system as well as sensitizing for the energy related issues should ideally start in school education. There exist some examples for projects on climate protection, renewables, and energy saving in education<sup>31</sup>. Still, both countries have high potentials for development in this context and it is advisable to strengthen energy-related education strategies, or embed this topic in a broader approach like education for sustainable development.

While Germany is seeing a shift from a central to a decentral energy system, as described in the German narrative II, policymakers also do not have clear answers, yet, as to how a more bottom-up, democratic decision-making can be reinforced, while securing the stability of the energy system. Both countries still search for the best model of how to achieve a stable, secure energy supply while allowing new forms of energy governance.

In regard to the socio-cultural preconditions analyzed in Topical Cluster II, the effects that demographic change will have on energy issues could only be covered briefly in this analysis (Q15). Researchers should take a closer look at the effects of an aging society in order to make more accurate predictions and models.

In regard to concrete exchange on policy design between the two countries, the biggest research is probably needed for CO<sub>2</sub>-policies and issues associated with it such as securing economic competitiveness and limiting resistance against CO<sub>2</sub>-taxes.

Both countries are facing big challenges, and have recognized the need to tackle them. Still, the vision of the future energy system is still blurred and will only become clearer on the way.

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<sup>31</sup> <https://www.klimaschutzschulenatlas.de/>; <http://www.fifty-fifty.eu/>

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## 9 Annex I: Abbreviations

Abbreviations	Original Language	English
<b>AGEE-Stat</b>	Arbeitsgruppe Erneuerbare Energien-Statistik	working group on renewable energy statistics
<b>BMU</b>	Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit	Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety
<b>BMUB</b>	Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit	Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
<b>BUND</b>		Friends of the Earth Germany
<b>CCS</b>		Carbon (Dioxide) Capture and Storage
<b>CDU</b>	Christlich Demokratische Union Deutschland	Christian Democratic Union of Germany
<b>CHP</b>		combined heat and power
<b>EEG</b>	Erneuerbare-Energien-Gesetz	Renewable Energy Sources Act
<b>ETS</b>		European emission trading system
<b>EU</b>		European Union
<b>EUA</b>		European Emission Allowances/ EU emission allowance
<b>FiT</b>		Feed-in tariff
<b>FDP</b>	Freie Demokratische Partei	Free Democratic Party
<b>FRG</b>		Federal Republic of Germany
<b>GHG</b>		Greenhouse Gas
<b>GJ</b>		Gigajoule
<b>GJETC</b>		German-Japanese Energy Transition Council
<b>MLP</b>		multi-level perspective
<b>MOEJ</b>		Ministry of Environment Japan
<b>MW</b>		Megawatt
<b>NACE</b>	Nomenclature statistique des activités économiques dans la Communauté européenne	Statistical Classification of Economic Activities in the European Community
<b>PJ</b>		Petajoule
<b>PV</b>		Photovoltaic
<b>RWE</b>	Rheinisch-Westfälisches Elektrizitätswerk AG	Rhenish-Westphalian Power Plant Company
<b>SPD</b>	Sozialdemokratische Partei Deutschlands	Social Democratic Party
<b>SRU</b>	Sachverständigenrat für Umweltfragen	German Advisory Council on the Environment



<b>Abbreviations</b>	<b>Original Language</b>	<b>English</b>
<b>StromEinspG</b>	Stromeinspeisungsgesetz	Electricity Feed-in Act
<b>ToR</b>		Terms of Reference
<b>UBA</b>	Umweltbundesamt	Federal Environment Agency
<b>WWF</b>		world wide fund for nature
<b>TWh</b>		Terrawatthours

## 10 Annex II: EU/ German carbon leakage policies

The EU has established three different sector list of industrial sectors considered at risk of carbon leakage. Additionally, Germany offers certain sectors and companies reduced payments or complete exemption from energy taxes and other power price components.

In the following, we will present these three EU lists and the other mechanisms utilized by Germany unilaterally.

### 1. EU List 1: Emission certificates

The latest carbon leakage list for the allocation of emission certificates for the years 2015-2019 was adopted in October 2014. Under the EU emissions trading system each installation – irrespectively of its carbon leakage risk – receives a free allocation of emission certificates. The free allocation is calculated based on a formula where its production quantity (in tonnes of product) is multiplied with the benchmark value<sup>32</sup> for that particular product (measured in emissions per tonne of product). For installations not considered at risk of carbon-leakage the free allocation is gradually reduced every year from 80% in 2013 to 30% in 2020.

Installations in sectors considered to be exposed to a significant risk of carbon leakage according to the criteria of the ETS Directive<sup>33</sup> are eligible to receive free allocation at 100% of the benchmark. The carbon leakage list (Commission Decision of 27 October 2014, 2014) for the period 2015-2019 includes 176 sectors at NACE 4 and Prodcom level.<sup>34</sup>

### 2. EU List 2: Impacts of ETS on electricity prices

The guidelines on certain state aid measures in the context of the GHG emission allowance trading schemes post-2012 allows for financial compensation for the impact emission trading has on electricity prices. Financial compensation can be paid by EU member states from their state budget to their most electro-intensive sector. This carbon leakage list Communication from the Commission, 2012) includes 15 sectors. In 2015 Germany paid 244 Mio. Euros in compensation to 330 companies (DEHsT, 2017).

### 3. EU List 3: Levies for renewable energies and CHP plants

The guidelines on state aid for environmental protection and energy 2014-2020 (Communication from the Commission, 2014) apply to levies imposed on final electricity

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<sup>32</sup> The benchmarks is based on the performance of the most efficient installations.

<sup>33</sup> According to the ETS Directive (Article 10a), a sector or sub-sector is deemed to be exposed to a significant risk of carbon leakage if: 1) direct and indirect costs induced by the implementation of the directive would increase production cost, calculated as a proportion of the gross value added, by at least 5 %; and 2) the sector's trade intensity with non-EU countries (imports and exports) is above 10 %. A sector or sub-sector is also deemed to be exposed if: a) the sum of direct and indirect additional costs is at least 30 %; or b) the non-EU trade intensity is above 30 %.

<sup>34</sup> NACE 4 refers to the Statistical Classification of Economic Activities in the European Community and differentiates 615 classes of industrial branches. PRODCOM data are detailed production data on an 8 digit level.

consumers to retrieve the costs for renewable energy or CHP subsidies. The EU has published a list of 65 sectors<sup>35</sup> that are eligible to be partially exempted from payments for renewable energy and CHP power plants because they are exposed to a risk of their competitive position.

All three EU lists utilize different criteria to define carbon leakage risk resulting in different number of sectors.

#### **4. Germany - Energy taxes**

With the aim to secure the competitiveness of the German industry, the entire German manufacturing sector receives a 25% energy tax reduction. Energy intensive industries receive a 90% reduction. The government does not apply sophisticated trade-intensity assessments as do the three EU Commission lists mentioned above. The EU has harmonized minimum levels for energy tax payments set out in the Energy Tax Directive 2003/96/EC which the Germany's energy tax law has to respect.

#### **5. Germany - Other power price components**

In Germany, electricity users need to pay a variety of power price components additionally to the renewable energy/ CHP levy, these are: (1) network charges, (2) levies for flexibility options/ load management, (3) offshore wind energy investment securities and (4) concession fees. Some of these components are not related to climate change policies but never the less the German government reduces the costs for large power consumers to give them a competitive head start. The criteria applied differ for each of the components and are not connected to an analysis of the trade intensity of a specific sector.

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<sup>35</sup> The EU applied the following criteria: a trade intensity of 10% at EU level and a sector electrointensity of 10% at EU level. In addition, a similar risk exists in sectors that face a lower trade exposure but at least 4% and have a much higher electro-intensity of at least 20% or that are economically similar (e.g. on account of substitutability). Equally, sectors having a slightly lower electro-intensity but at least 7% and facing very high trade exposure of at least 80% would face the same risk. Finally, the sectors have been included because they are economically similar to listed sectors and produce substitutable products.