



Citizens in Transition

Final Report

Acceptance issues and challenges in the French and German Energy transition contexts

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The Future of Energy: Leading the change
Topic 3 - Energy Transition Technologies:
Consumer expectations and citizens' attitudes
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Executive summary

Societies and citizens are key for change: the energy transition reflects an ideal of society. Neither capitalistic projects alone, nor local potential resources are sufficient to enable a major shift in the energy mix.

They are essential actors of this transition process, willing to be more involved in the planning of energy transition projects and gathering in citizen initiatives. But in return the introduction of new energy technologies is deeply impacting citizens in their private life sphere (use of personal data, neighborhood and landscape transformation, change of energy consumption behavior). In this context, **acceptance has become critical to succeed in most energy transition projects.**

Based on a comparative French/German study on citizen acceptance and energy transition project development strategies, this study 1) structures the societal issues related to energy transition projects and their influencing factors, 2) provides a best practices document for coordinators of energy transition projects so that they can recognize citizens' societal issues in a project at an early stage and deal with them in an appropriate way and 3) conceptualizes two innovative solutions which aim at maximizing the citizens' acceptance.

Comparing the German *Energiewende* with the French *Transition Energétique* enable to understand the influences of different contextual factors, to gather a rich database of faced issues and best practices, and to get inspired mutually. However, it is also a delicate exercise in terms of complexity and comparability.

Municipal organizations, industry and energy market structures, research funding, history and heritages, landscapes, population density, natural resources, the role played by communities, the value of symbols, the relationship to money or technology are just some of the main aspects differentiating France and Germany. They deeply influence and connect with the dynamics and choices of the energy transition.

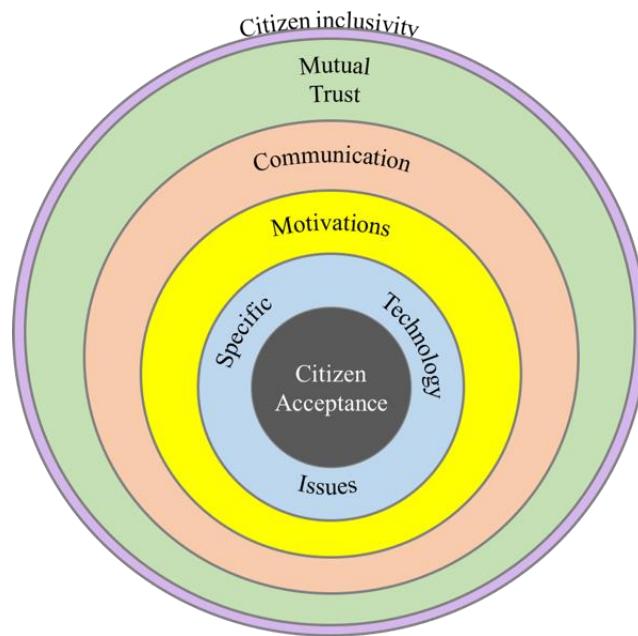
For instance, the comparison of smart meter deployment approaches in France and Germany reflect two radically energy transition strategies, based on "Grand Projet" in France, and social market economy in Germany. Decision-making stakeholders in the energy sector are also more numerous and diverse in

Germany than in France, with direct consequence on the plurality of technologies and the diversity of the energy mix.

Despite all these differences of contexts, surveys show that acceptance of both French and German Citizens reach a similar high level around 90%, both want to be more involved in the dialogue and funding models of the energy transition. In particular, citizen cooperatives represent the future of energy transition for four out of five citizens in both countries.

A major achievement of this study is a novel typology of citizen societal issues related to the energy transition, co-created between the project partners and French and German energy sector professionals during a binational workshop and a dozen of interviews.

It provides guidelines for energy transition actors in order to avoid possible friction points and maximize the chance of citizen acceptance before, during and after implementing new energy transition technologies.



24 societal issues related to citizen acceptance of energy transition could be collected, analyzed and classified into five main consistent categories: **Citizen inclusivity** was identified as the societal base of citizen acceptance. **Mutual**

trust as the necessary social capital to start any energy transition project.

An adapted **Communication** makes the difference in an Energy transition project, while **benefit and Motivation sources** enable to fairly balance drawbacks and risks and then trigger citizen acceptance. Finally, **Technology specific issues and risks** should be openly assessed, answered and supervised.

These five issue categories may be visualized as an onion layer: each layer represents issues to overcome on the way to the full citizen acceptance. For each issue, some best practices from project experiences in France and Germany are provided.

Finally, two solutions were conceptualized to answer these issues:

- **A Citizen Information and Participation 2.0 platform**, aiming at transforming the relationships between citizens, their representatives, and project's owners as well as catalyzing bottom-up initiatives
- **An Experimental lab involving citizens** as beta users of the future energy transition technologies.

This report may also be used in the field of research for a more holistic or deeper investigation of citizen acceptance and energy transitions in Europe.

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Welcome to Citizens in Transition

To reach the objectives of the COP21, a widespread replacement of fossil energies by carbon-free energy and the overall reduction of energy consumption through efficiency gains, is highly required. However, this Energy transition will largely depend on the attitudes of consumers and citizens, in particular in terms of acceptance and participation. Understanding the different factors and contexts influencing citizen acceptance, predicting this citizen acceptance and the related attitudes before adapting project developments at an early stage, is therefore a major stake of Energy transition.

The originality of the study "Citizens in Transition" is to analyze and evaluate citizen acceptance and Energy transition project development strategies from both French and German venture points. Indeed, comparing France and Germany - two countries committed to similar goals with different energy systems and approaches¹ - provides exceptional insights to understand the transformation of societies in this global context. In this way, "Citizens in Transition" aims at giving some findings and recommendations for Energy transition projects, function of the political, cultural and social contexts and the project types.

A binational and multidisciplinary (engineers, political specialist and sociologist) consortium has been gathered to realize this intercultural study and bring these different perspectives

Aim of the study

According to Gaël Giraud, research director at the CNRS, "The Energy transition is an ideal of society"².

Neither capitalistic projects alone, nor local potentials resources are sufficient to enable a major shift in the energy mix: societies and citizens are key for change. They are essential for the development of affordable transition technologies. But in return the introduction of new energy technologies is deeply impacting citizens in their private life sphere (use of personal data,

¹ Rapport du Projet Interreg-IV (2015) « Accélérer ensemble la transition énergétique dans le Rhin supérieur » L'acceptabilité des énergies renouvelables: les acteurs locaux organisent la transition énergétique http://www.plan-ee.eu/images/AK/Accesptabilite_energies_renouvelables_Juin_2015.pdf

² Interview for Mediapart (2015): Gaël Giraud: «La transition énergétique est un idéal de société» <https://www.mediapart.fr/journal/france/130315/gael-giraud-la-transition-energetique-est-un-ideal-de-societe-0?onglet=full>

neighborhood and landscape transformation, change of energy consumption behavior). In this context, acceptance has become critical to succeed in many Energy transition projects. The challenge is to encourage a large number of citizens to take into consideration local energy issues.

Adapting a project at an early stage needs a good understanding of the context and the different factors influencing and predicting citizen acceptance as well as their related attitudes. Based on a comparative French/German study on citizen acceptance and Energy transition project development strategies, this study targets three objectives which are firstly **to structure the societal issues related to Energy transition projects and their influencing factors**, secondly **to provide a best practices document for coordinators of Energy transition projects**, so that they can recognize citizens' societal issues in a project at an early stage and deal with them in an appropriate way and thirdly **to conceptualize two innovative solutions which aim at maximizing the citizens' acceptance**.

In addition to these three objectives, expected impacts of the implementation of this study are **to minimize risks of confrontation and delay due to conflict with neighbor citizens for coordinators of Energy transition related projects**, **to be better considered and involved in Energy transition related projects for citizens** and **to develop citizen acceptance management solution leading to new business models for innovative companies and start-ups**.

Study methodology

The social science community has already done a considerable investigation work to study citizens and new energy technologies, in terms of behavior, acceptance and participation. Social acceptance has been described among others by Wüstenhagen et all.³ as a triangle between community, market and social-political acceptance.

Our study is starting from existing works and includes international publications, public project reports, scientific press releases, journals in social science and energy policy, different types of media and the results of surveys conducted by relevant organizations. In particular, results from ongoing and finalized research

³ R. Wüstenhagen, M. Wolsink, M.-J. Bürer, (2007) Social acceptance of renewable energy innovation: An introduction to the concept.

projects conducted at the Wuppertal Institute (specialized in transformative research) and the Laboratoire LIVE (specialized in urban and territorial research) and related to transition phenomena and/or the field of energy were useful to specify the focus of the project.

The project consortium is gathering both academic researchers and independent experts with research (and/or R&D) experience to tackle the challenge of applied research, by crossing working methodologies and knowledges. The present report is the result of a common effort to combine data, scientific frameworks and field work, to turn returns on experience into usable information.

In the first phase, a bibliographic research was done to provide a common understanding required to conduct a binational investigation. The resulting state-of-the-art summary is addressing social and public acceptance, citizen participation, energy consumer cognitive processes and other factors relating citizens and the integration of new energy technologies both in France and in Germany.

A comparative study between France and Germany also appeared to be a pre-requisite to further steps: understanding and weighting the influence of different political, economic, cultural and local factors was necessary before comparing socio-technological dynamics (see part A).

A focus was made on two energy transition technologies and their deployment projects, for which the partners had the best level of expertise and usable information: smart grids/meters and wind turbines (see Part B)

For the selected Energy transition technologies, the project partners interviewed stakeholders in France and Germany. A quantitative interviewing approach was not an option for a project of this scale: the limited time-frame and the large set of differentiating factors between France and Germany required a qualitative approach (pre-existing quantitative information was however mentioned when available and relevant in this report).

For a return on experience and solution design oriented project, contributors (interviewees and/or round table participants) needed to be (1) experienced on the field of Energy transition, (2) familiar with citizens and acceptance issues and (3) representing the different parties on the field of Energy transition (citizen organizations, research, industry, smaller companies, project

developers...). This specialized panel allowed us to observe a broad-spectrum and to compare very different points of view. Closing the gap between experts and random citizens did not appear realistic within a limited number of possible talks: large-scale societal investigations assessing for example the penetration rates of energy knowledge in populations, or the ratios of active citizens according to different variables would be interesting complements to the project presented hereby.

In November, a round table was designed as a catalyst of experiences in both countries. The project partners invited selected experts, according to the criteria defined before.

Invited Experts		
Emmanuel Dufrasnes	ENSAS	France
Karl Schumacher	GbR Rutesheim-Solar-Aktiv-I	Germany
Melanie Peschel	C-Sells	Germany
Andreas Gißler	Heidelberger Energiegenossenschaft	Germany
Markus Jenne	Sterr-Kölln & Partner	Germany
Michel Benard	Consultant	France
Bernard Gsell	EDF Deutschland	Germany
Sabine Barden	Endura Kommunal	Germany
Vulla Parasote	TRION	France/Germany
Mathieu Terenti	Enedis employee	France
Jean-Alain HERAUD	Laboratoire BETA et association citoyenne	France
Michael Eggert	Aachen University	Germany
Christine Saincy	Linky	France
Philipp Meidl	Stadtwerke Düsseldorf	Germany
Project Partners		
Christoph Rat-Fischer	SynappCity	Germany
Marc Boillot	Algorus Consulting	France
Romain Nouvel	Kleinunternehmer	Germany
Sophie Buessler	Laboratoire LIVE CNRS/Unistra	France
Katrin Bienge	Wuppertal Institut	Germany
Marieke Schaden	Wuppertal Institut	Germany
Interpreters		
Regine Strauss		Luxembourg
Julia Barthel		France

Table 1: List of participants at the project round table (Nov. 14th, Strasbourg)

Eleven of the twenty participants have had activities or active contacts on the field of energy in both countries prior to the meeting. In parallel, three

participating companies have ongoing activities in both German and French markets.

Findings of the first project phase were compared with other study results from France and Germany, experiences and best practices discussed and innovative solutions to improve citizen acceptance have been co-developed at this occasion. The use of a real-time polling tool⁴ allowed a satisfying level of interactive feedback from the participants on different questions: the individuality of answers, their anonymity, the freedom of language and the direct exchange of this method showed better results than for example the more classical feedback discussion conducted at the end of the day (where participants answers were clearly influenced by previous comments).



Transformative research aims to impact the society directly from fundamental theories: we used our observations and data collection to develop a new typology, as an inventory and analysis of existing solutions to improve the citizen acceptance in the framework of Energy transition related projects (part C).

Based on this work, innovative solutions answering the societal issued studied with the aim of maximizing citizen acceptance were specified and conceptualized. These solutions shall enable the full use of community roles (family, friends, local and regional authorities), provide the right information at the right time and enable services/rewards identified as appropriate counterparts for citizens to open their private sphere to new technologies (see part D).

Citizens in Transition is not covering all aspects and questions about transition technology acceptance by citizens. To meet the expected level of quality, we

⁴ The tool www.mentimeter.com was used in this project.

chose to analyze citizen acceptance to energy transition through new energy technologies with a focus on electricity. Since electricity is directly linked to citizens as users and sometimes actors (e.g. PV), the subject is relevant with qualitative comparisons, based on sufficient data.

We highlighted two specific and controversial technologies: smart meters and wind turbines. Smart meters represent so-called “intrusive technologies”, linking the energy industry with citizens inside their homes and life. As such, smart grids and smart meter technologies are witnesses and rich indicators of citizens acceptance towards energy transition.

On the other side, wind power, is an energy source everyone has heard about and which sparks off a lot of debate and emotion around the world. For some people, wind turbines represent a prospect for the future while other people feel affected by visual and sound pollution. They are the first source of renewable energy in Germany while struggling to break ground in France.

Both technologies generated acceptance conflicts and well documented strong pro or contra positions, for which we could gather information from both literature review and from our contributors.

Citizens in Transition is providing insights about the differences between the French and the German Energy transitions and the technology acceptance issues related to it (part A and B). Its **typology of possible responses and its solution design** (part C and D) are **first practical keys** for project developers and decision-makers to improve their consideration of such issues. As such, this report may also be used in the field of research for a more holistic or deeper investigation of citizen acceptance and Energy transitions in Europe.

Structure of the report

This report is structured in 4 parts which can be separately considered.

In particular, Part C – “**Energy transition societal issues and best practices**” can be used as stand-alone guidelines for energy transition project developers and local authorities.

Part A – “Two different examples of Energy transition pathways” sets the scene analyzing the contexts of the German Energiewende and the French Transition Energétique. Their comparison is a delicate exercise in terms of complexity and comparability, but also necessary to understand the relationships between the

citizens and the local Energy transition process and stakeholders. It will be analyzed by means of a transition theoretical model.

Part B – “Citizens’ acceptance of energy transition technologies” focus on citizens and their acceptance / opposition of the energy transition technologies. What does citizens acceptance stand for in the field of new energy technologies? How do citizens accept energy transition? Is the acceptance higher in Germany than in France? These questions are treated here, in particular by the means of investigating two technologies: Smart Meters and Wind Turbines. Concrete examples support the reasoning.

In the Part C – “Energy transition societal issues and Best practices”, a new typology of 24 citizen societal issues related to the energy transition will be introduced, as a co-creation between the study consortium and professional partners. The goal is to support energy transition project developers and local public authorities to anticipate potential citizen issues, and reach the highest citizen acceptance, inspired by the on-site experiences and best practices listed in this part.

Finally, in light of the findings of Part C and based on previous projects, Part D – “Innovative solutions to improve citizens’ acceptance” aims at conceptualizing two solutions to improve citizen’s acceptance towards energy transition technologies and projects: a technology-based solution to inform and involve citizens into projects and a user-experience based solution which includes citizens into innovation processes.

Part A - Two different examples of Energy transition pathways

The attempt to compare the dynamics inside the Energy transitions between different countries requires a careful preparation and to pay attention to many aspects of the respective contexts. **The focus of the study presented in this report is citizens acceptance, not the assessment of Energy transitions.** Nevertheless, presenting some key figures and elements of understanding appears to be necessary before analyzing behaviors and best practice potentials. In this regard, comparing France and Germany is particularly challenging: the close neighborhood and decades of cooperation tend to overlay the fact that national structures, cultures, organization and approaches are very different on many topics. **Some of these differences are obvious**, such as the German decision to renounce to electricity production from nuclear power after the Fukushima accident in 2011. **Many others are less visible, but still decisive.** Municipal organization, energy market structures, history and heritages, landscapes, the role played by communities, the value of symbols, the relationship to money or technology are just some of the main aspects differentiating France and Germany.

Interestingly, energy is on one hand a topic most people do not easily connect to their everyday life, which is giving research and demonstration projects a hard time involving citizens and keeping their interest during their whole duration, as some of our interviewees told us. But on the other hand, when it comes to energy infrastructures and technology choices, **debates may rapidly become very emotional.** Arguments pro or contra the different types of energy sources are connected to point of views and personal or group values, leading to a range of clichés: the safety of nuclear power, the esthetics of wind turbines, the subsistence of coal power, the potential strong electromagnetic emissivity of smart meters, the insufficient productivity of solar power or the comprehensive life-cycle of electric vehicle batteries are some of the most popular sources of controversy. Consequently, discussions which compare not only cooperating, but also competing nations such as France and Germany are rarely free from judgement, ranking and personal emotions.

Even in the frame of a small-scale study such as « Citizens in Transition », conducted by experienced researchers used to intercultural studies, the construction of a common understanding as a basis for our research has proven to be more complicated than expected. The present chapter is the result of our discussions, meant to provide an introduction to differences between France and Germany in the field of energy and Energy transition. This first overview is the first step before analyzing returns on experiences, sharing lessons learned and understanding the potentials or limits of replication of acceptance in the field of Energy transition. For deeper insights in the energy systems of both countries and comparison studies, readers may refer to the bibliographic references and sources listed in this report.

A.1 Two citizens' perceptions in France and Germany

Before getting started, let us take a look at the story of two imaginary French and German inhabitants, telling about their perception of Energy transition. This storytelling is a simplified, non-holistic summary inspired by our interviews and experiences in both countries, designed to point out how different the contexts and the mental schemes can be.

Storytelling I: A Citizen from Central France

"I live in a middle town located in the center of France on the shores of the river Loire. My city lost a lot of industrial jobs during the last decades and the unemployment rate is relatively high. Four nuclear power plants stand at the outskirts of our municipality, employing several members of my family and friends. There are also wind and even photovoltaic installations. (related to Part A)

I prefer solar projects because they are less visible even if panels come from China and need a lot of coal plants' electricity to be made. I am concerned about nuclear power plants closing down around my home. This could lead to an increase in unemployment and a loss of economic activity. Doctors, schools and shops will disappear even if there are wind turbines. The state or local authorities should help us to revitalize our region. I like electric vehicles but they would need charging stations in all municipalities. (related to Part B)

In 2017 for the first time of my life, I've changed of electricity supplier: I choose to leave my EDF supplier, because I had an attractive offer from Direct Energie with fixed rates (-10% compared to the regulated tariff).

I agree with Energy transition to fight against global warming, but only if it will not cost more. I agree with our government who's saying we cannot shut down nuclear power plants right away, before that new energy technologies have been developed enough. Anyway, I do not think the system can work with 100% renewable energy.

I agree to make energy savings if everyone does it and if it does not cost money. (related to Part C)"

Storytelling II: A Citizen from South-Western Germany

"I live in a village of Baden-Württemberg whose elected mayor comes from the Green Party. I am very proud to live in an ecological country, where the high renewable energy production covers 100% of the national electricity consumption during certain hours of the year. As energy consumer, I feel actor of the Energy transition, with a global impact on it : At home, I have the choice between more than 200 energy suppliers, all proposing different transparent contracts, from cheaper tariffs to "100% Ökostrom" (from renewable energy) including local investments. (related to Part A)

I think this variety of choice participates to the global citizen acceptance, by adapting to the different social contexts and affinities. Many of my relatives are ready to pay few Euros more per month to have a more environment-friendly electricity. "Greenpeace energy", which proposed a electricity "0% coal and 0% nuclear energy" is very popular in my neighborhood for instance. To follow my energy consumption daily, I've also invested in a mid-range smart meter, connecting to my smartphone through a nice application. It is part of many other technologies that equipped my home, most of them with a A-energy efficiency label. (related to Part B)

Since 10 years, I'm part of a local citizen cooperative which manages a photovoltaic installation on the sports hall of our public school. In parallel, my banker proposed me to improve my savings product by investing in an off-shore wind energy project in North See. It's a long time that economy and Energy transition are not opposite ideas. (related to Part C)"

A.2 Comparing key figures of French and German Energy transitions

The French and the German energy systems differ from each other, leading to various goals and approaches.

Official Goals	France	Germany
GHG reduction	2020: -20% 2030: -40% 2050: -75% (factor 4) (comparing to 540 Mio tons equivalent CO2 in 1990 excluding imports, 671 Mio teq in total)	2020: -40% 2030: -55% 2050: -80% up to -95% (comparing to 1250 Mio tons equivalent CO2 in 1990)
Intermediate result	-23 % from 1990 to 2014	-28,1 % from 1990 to 2015 (-349 Mio teq CO2)
RES development	Assigned by European Union: 23% of the energy mix until 2020 National: 32 % of the final consumption until 2030	Assigned by European Union: 18% of the energy mix until 2020 National: 30% of the final consumption until 2030
Intermediate result	15,2 % of the final consumption in 2015	14,8 % of the final consumption in 2016
Energy savings	Primary energy consumption Until 2030 : -30% Total energy consumption Until 2020 : 20% Until 2050: -50 % (Comparing to 2012)	Primary energy consumption Until 2020: -20 % Until 2050: -50 % (comparing to 2008)
Intermediate result	From 2002 to 2010: +0,2 % From 1991 to 2009: -5% Primary energy consumption savings: From 2005 to 2014 : -11%	From 2008 to 2017: -6% From 1991 to 2009: -7%

Table 2: Transition goals in France and Germany⁵

⁵ Based on data from French and German government and agencies (2018):
<https://www.ecologique-solidaire.gouv.fr/cadre-europeen-energie-climat>
<https://www.ecologique-solidaire.gouv.fr/loi-transition-energetique-croissance-verte>
<https://www.caissedesdepotsdesterritoires.fr/cs/ContentServer?pagename=Territoires/Articles/Articles&cid=1250278809705>
<https://www.bundesregierung.de/Content/DE/Lexikon/EnergieLexikon/C/2013-09-18-co2-emission.html>
<https://www.ecologique-solidaire.gouv.fr/cadre-europeen-energie-climat>
https://www.umweltbundesamt.de/sites/default/files/medien/384/bilder/dateien/2_abb_thg-emissionen_2017-03-17_0.pdf Umweltbundesamt, Nationale Treibhausgas, Inventare 1990 bis 2015
<https://www.umweltbundesamt.de/themen/klima-energie/erneuerbare-energien/erneuerbare-energien-in-zahlen#textpart-1>
<https://hal-upmc.upmc.archives-ouvertes.fr/hal-01276135/document>
https://www.bundesregierung.de/Content/DE/StatischeSeiten/Breg/Energiekonzept/Fragen-Antworten/4_Energie sparen-Energieeffizienz/4-Energie sparen-Energieeffizienz.html

Beside these quantified goals, the understandings of the Energy transition finality in France and Germany is relatively different: in France, the Energy transition main goal is the energy decarbonization, making CO₂ emissions the most considered key performance index. In Germany, CO₂ emissions is one index among others: politicians often mention the climate neutral society ("Klimaneutrale Gesellschaft"⁶) as the main goal to achieve, generally at the horizon 2050. This combines several aspects together, such as the development of renewable energies, the reduction of the consumptions and wastes (nuclear wastes included).

The political goals in France and Germany are parts of the common climate and energy strategies of the European Union, among others the "20-20-20 goals "⁷. National goals were agreed by all member states and adapted according to their starting situation, their financial capacities and single commitments. The deindustrialization of Eastern-Germany after the German Reunification is an important factor of emissions reduction after 1990. However, the result of single years must be considered with care, as seasonal effects (e.g. cold winter), macroeconomic fluctuations and other context elements can temporarily affect balances, leading to over-interpretations which cannot be confirmed by general trends.

As an example, in the period 2011-2013, a temporary rebound of CO₂ emissions from the Germany power generation mix was often seen as an inversion of climate protection efforts induced by the decision to quit nuclear power, whereas it rather related to the economic revival after the financial crisis. The graph below shows that such a disruption cannot be confirmed a few years later, as the trend towards less emissions goes on.

http://www.statistiques.developpement-durable.gouv.fr/fileadmin/documents/Produits_editoriaux/Publications/Datalab_essentiel/2017/datalab-essentiel-109-bilan-energetique-2016-mai2017.pdf

Bilan énergétique de la France métropolitaine en 2016, Paris, MAI 2017, MINISTÈRE DE L'ENVIRONNEMENT
<https://www.umweltbundesamt.de/daten/energie>

<https://hal-upec-upem.archives-ouvertes.fr/hal-01276135/document>

⁶ Website of the Federal Ministry of Environment (February, 2018)

<https://www.umweltbundesamt.de/themen/wirtschaft-konsum/konsum-umwelt-zentrale-handlungsfelder/klimaneutral-leben-verbraucher-starten-durch-beim#textpart-1>

⁷ 20% less CO₂ emissions, 20% less energy consumption and 20% more renewable energies until 2020.
Source: European Commission

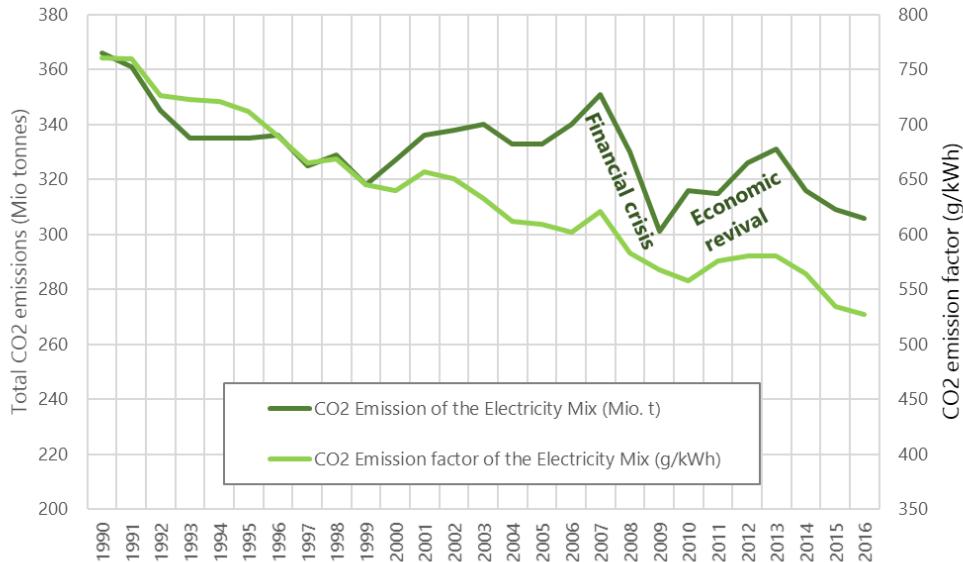


Figure 1: Evolution of CO₂ Emissions in Germany (1990-2016)

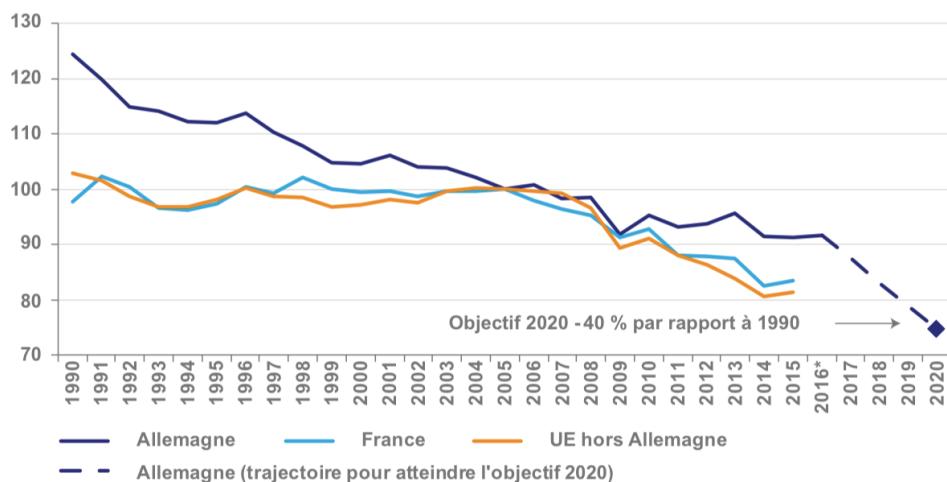


Figure 2: Compared Evolution of GHG emissions in Germany, France and European Union (compared to 2005)⁸

As a consequence of different geographies, organizations and industrial policies, the electricity grid design is not the same in France and in Germany. The physical boundaries for the development of intermittent and decentralized energy sources are not the same. In this report, French oversea-territories are not included, to keep comparability with Germany.

⁸ France Stratégie (August, 2017) : Note d'Analyse n°59 "Transition énergétique allemande : la fin des ambitions ?"

http://www.strategie.gouv.fr/sites/strategie.gouv.fr/files/atoms/files/transition_energetique_allemande_la_fin_des_ambitions_etienne_beeker_note_n59_aout_2017_0.pdf

Electricity Grids	France	Germany
Transmission	105 660 km 0,27 km/km ²	133 000 km 0,37 km/km ²
Companies	RTE (50,1% EDF)	Amprion, Tennet TSO, TransnetBW, 50Hertz Transmission
Main bottlenecks	Bretagne and Provence-Alpes-Côte d'Azur	North-South: planning of the additional “Südlink” trace is in the final phase
Distribution	1,3 Million km 2,48 km/km ²	1,7 Million km 4,79 km/km ²
Companies	95% by Enedis (100% EDF), 5% by 160 local companies	883 companies in 2017
Yearly outage average	51,5 minutes/customer (2014)	13,7 minutes/customer (2014)

Table 3: Electricity grids in France and Germany⁹

The gross power production mix of both countries is their most obvious difference on the subject of Energy transition. Their trends are similar in the intention (less fossil energy dependence and more renewable energy sources), but the production volumes at stake and the development trends are very different in terms of quantities

⁹ Sources: French and German government and agencies, RTE and DENA (2018)

Gross power production mix	France		Germany	
	TWh produced in 2017	%	TWh produced in 2017	%
Fossile Energies				
Nuclear	379,1	71,6	75,9	11,6
Trend	Shutdown of the Fessenheim Plant (1,8MW, 8,4 TWh average) in discussion (original dates were postponed) Construction of the EPR in Flamanville (1,65MW)	+	Final shutdown for all plants in 2022	-
Natural gas	40,9	7,7	86	13,1
Trend	Increase of 60,8% in 2016 (new plant in Bouchain)	+	9 new plants since 2011 (3,2MW in total), some were immediately shutdown (not competitive)	+
Brown coal	0	0	148	22,6
Trend	Not relevant		-22,9TWh since 1990 (170,9TWh), 18 blocks shutdown, 3 new blocks in operation 2,73GW (=12,26%) will be shutdown until 2023 (decisions finalized)	-
Hard coal	9,7	1,8	94,2	14,4
Trend	Final shutdown for all plants in 2022	-	-46,6TWh since 1990 (140,8TWh), 27 blocks shutdown, 8 new blocks in operation	-
Mineral oil	3,8	0,7	5,7	0,9
Others	0	0	27,7	4,3
Total fossile	434	82	438	67
Renewable Energies				
Hydropower	53,6	10,1	19,7	3
Wind offshore	0	0	18,3	2,8
Trend	First 2 MW windmill launched in October 2017 for a 2 years test-run 6 off-shore farms in planning (3,3 MW)		+5,3 GW installed since 2013 (+1,2 GW in 2017)	+

Gross power production mix	France		Germany	
	TWh produced in 2017	%	TWh produced in 2017	%
Wind onshore	24	4,5	87,2	13,3
Trend	+12 GW installed since 2002 Acceleration since 2013 regulation Increase of 14,8% in 2017	+	+50,6 GW installed since 1998 (+23,8 GW since 2011) (+ 4,75 GW in 2017)	+
Solar	9,2	1,7	39,8	6,1
Trend	550 MW installed in 2016, similar trend in 2017	+	+ 40 GW installed since 2004 (+18 GW since 2011) (+ 2 GW in 2017)	+
Biomass	9,1	1,7	45,5	7
Trend		+	+2,5 GW installed since 2011	+
Waste			6	0,9
Trend	Accounted in France under bio-energies (biomass)			
Total renewables	96	18	217	33

Table 4: Gross power production mix in France and Germany¹⁰

What do these differences mean for households? For example, electricity is known to be much cheaper in France, but Germans do not heat with it. Do the German households feel Energy transition too expensive? Not really, surveys show, even if energy costs are a general concern in both countries. The following table shows average values, which must be considered carefully, as regional differences (e.g. heating and cooling needs) or price competitions, lead to large variations for single households.

¹⁰ Sources: French and German government and agencies (2018)

Energy for households	France	Germany
Average electricity price (2016)	16,48 € cents/kWh	29 € cents/kWh (23% EEG)
Trend	+27% in 10 years (12 € cents/kWh in 2007)	+31% in 10 years (20 € cents/kWh in 2007)
Average gas price (2016)	6,97 € cents/kWh	6,73 € cents/kWh
Average energy bill (2015)	1683 €	1681 €
Part of electricity	701 € (4673 KWh, 41% for heating)	1020 € (3517 KWh)
CO2/KWh	80	527
Trend	-11% since 1990	-31% since 1990 -9% since 2011

Table 5: Energy for households in France and Germany¹¹

A.3 Two different Energy transition pathways

A.3.1 Applying the Geels & Schot Multilevel Perspective (MLP) model to Energy transitions

Comparing the German *Energiewende* with the French *Transition écologique et solidaire*, as well as their components, is a delicate exercise in terms of complexity and of comparability. Therefore, it makes sense to use a theoretical framework, in order to **facilitate the analysis of citizens acceptance independently from national contexts**. To this purpose, applying the typology of socio-technical transition pathways developed since 2002 by Geels and Schot¹² to this study seems to be an appropriate premise to define a theoretical set of definition for the notion of "transition" and its components. Geels and Schot are describing transitions as the rearrangement of an established starting regime into a new regime, under the influence of new technologies developed in niches. This model appears to be usable for Energy transitions for following reasons:

¹¹ Sources: French and German government and agencies, Statista (2018)

¹² F.W. Geels, J. Schot, (2007): Typology of sociotechnical transition pathways, Research Policy 36.

- (1) the choice of a **multilevel perspective** is relevant to describe **complex transitions such as Energy transitions**, including the consideration of international and national context elements
- (2) the **combination of technological, economic and social interactions** at stake in this study
- (3) the differentiation of two additional **key aspects of interactions: timing and nature**

The starting point of this definition of transitions, also used in the German federal research project *Transnik*¹³, describes a transition as the transformation of a regime into another.

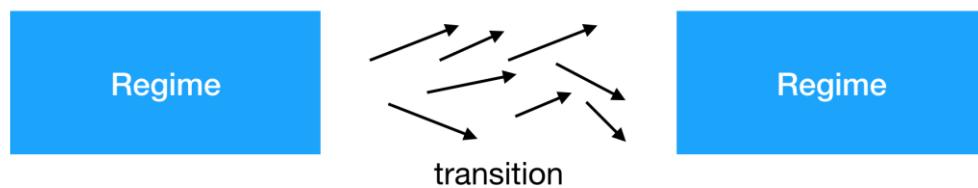


Figure 3: Definition of a transition after Geels & Schot (simplified)

This theorization is facilitating the comparison between the dynamics observed in France and in Germany, by defining the societal equilibrium of policy, technology, industry, market, citizens preferences, science and culture aligned in a stable system, the regime, which undergoes a transformation conducting to a new constellation, finally stabilizing in a new regime. This approach allows to consider the **different starting situation of the French and German energy system independently from each other, as well as the fact that they may reach different new regimes**, while both experiencing a transition process in close time frames, separated by a decade. Furthermore, the existing links between both transitions, such as international goals and commitments (United Nations, European Union, etc.), or technological evolutions can be integrated in the analysis (see below).

Figure 3 also shows the process of transition not as a single dynamic, but as a temporary disarrangement and rearrangement of existing balances, under the influence of technological niches, which penetrate the pre-existing order. **It shows how critical our focus on new technology acceptance is for the whole transition processes:** if new technologies fail being accepted and

¹³ www.transnik.de (2018)

used by citizens, they won't leave the niche level and have no impact at the regime level, which will not (or less) be submitted to a transition process.

The multilevel perspective is combining three levels and their interactions:

- (1) The landscape developments describe the **influence of the exogenous context** (international environment and climate talks, globalization, industrial disasters, economic patterns...).
- (2) On the **existing energy system** as a holistic socio-technical regime, (industry, infrastructures, political players, citizens, markets, research and culture).
- (3) The niche level is differentiating the incremental progression of the regime from its **transition into a new system under the influence of new technologies** and new developments. This third level is very relevant to highlight the conflicts of the historic energy industry (e.g. the big energy suppliers) or conservative societies (e.g. opposing to wind mills) struggling with new technologies and concepts developed and **adopted (or rejected) by parts of the citizens** without them.

Figure 4 is illustrating how this multilevel perspective can be applied to Energy transition.

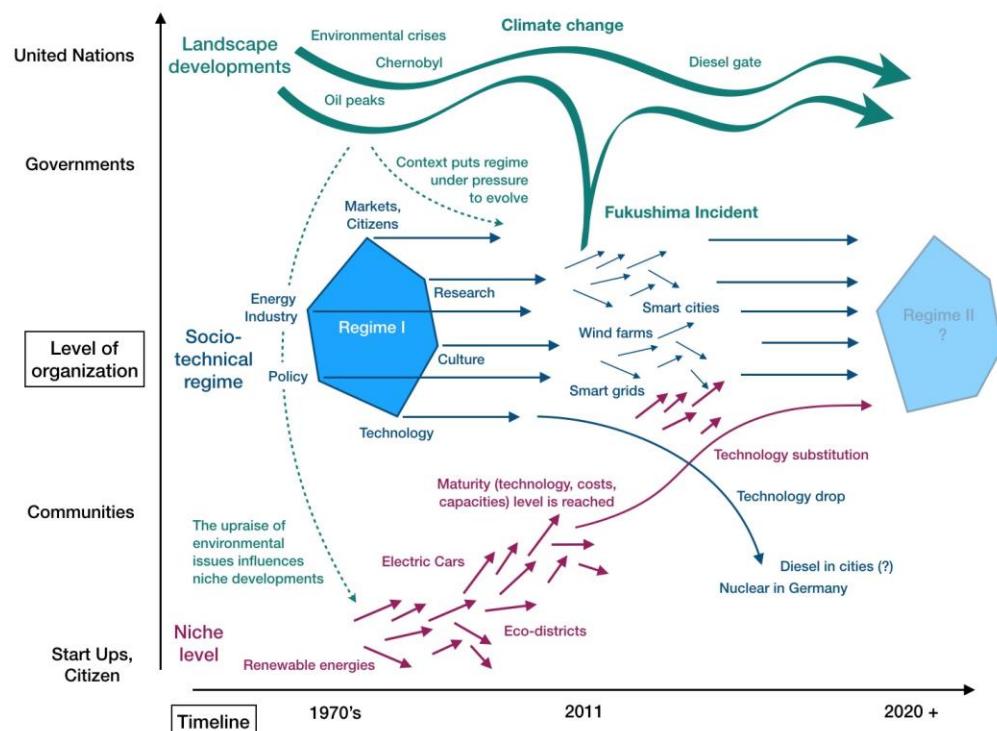


Figure 4: The Geels & Schot model applied to the Energy transition pathway

Geels & Schot have added two further aspects also helpful to understand Energy transitions: a timeline and a level of organisation, which both improve the analysis of interactions between the described dynamics, as timing and nature of these interactions can be differentiated.

Figure 4 demonstrates how well it can be used at a broader scale to explain the transformation of entire countries. In the case of the *Citizens in Transition* project, **the focus on the impact of new technologies developed in niches and their likeness to be adopted by citizens** and users makes a leaning to this model relevant. It is highlighting the role of the different players and situations, **allowing us to point out similarities and learning opportunities between the dynamics and interactions of Energy transition in two different countries.**

Citizens are part of the regime level: they are an essential pillar to be convinced when new technologies enter the system and they are influencing the dynamics inside the reorganizing regime. They also may reject technologies and changes in the regime or react differently to landscape changes.

Example: The nuclear accident of Fukushima in March 2011 creates a shock at the landscape level, impacting the regime and acting as a catalyzing moment for the transition in Germany, which suddenly decides abandoning nuclear power. Similar shocks occurred before (e.g. the nuclear accident in Chernobyl in 1986) without resulting in a similar transition, but this time:

- (1) at the timing of this shock, the regime is already experiencing turbulences (German Energy transition law from 1998 and first withdrawal from nuclear power, followed by a turnover in 2010) perfectly correlating
- (2) with a good level of maturity and diversity of alternative technologies and concepts (renewable energies, ICT developments, new battery generations, integrated building approaches, electric mobility...)

emerging from niches and already penetrating the old regime to establish themselves in a new regime.

The approach shows some limits which do not affect its validity for our purpose, but should be considered before starting deeper investigations. At first, the new regime supposed to come up is not known yet: analyzing a long-term transition before its end is questioning the relevance of using a model assuming the existence of a stable regime of beginning and another stable regime of arrival. A closer look may also be taken at the validity of separating a transition in phases of instability and phases of equilibrium (how long can instability last in an innovation-driven society? Will a new balance will be found?).

A transition phase is opening and closing windows of opportunity, each major evolution inducing a new state, which may lead to a new reaction¹⁴. Another point of attention remains the fact that the model was designed to describe an industrial environment, which is necessarily focusing on achieving bankable results. At the contrary, Energy transitions as we know them by now may be built around unclear goals, for undefined targets. The long-term dates set by the politics such as 2050 for results are too far away to measure the results of their own actions.

Nevertheless, **this dynamic model provides a satisfying frame of understanding to discuss citizens acceptance and subsequently the adoption potential of transition technologies by citizens** both as individuals as members of different - more or less - organized groups such as neighborhoods, communities and societies in two distinct countries exchanging with each other at various levels.

A.3.2 Soft energy path versus hard energy path

The empirical understanding of Energy Transition is strongly influenced by the *Energiewende*, which finds its origins in citizens movements around the 1970s (oppositions to the nuclear industry, development of ecological consciousness

¹⁴ For example, the very attractive feed-in tariffs for electricity from photovoltaic panels from the EEG of 2000 led to such a demand, that a photovoltaic industry quickly developed in Germany: the tariffs being refunded by the total electricity price paid by private customers, the explosion of installed PV overheated the price situation and created a social unbalance between users in capacity to invest and the others, conducting the government to decrease the tariffs and their attractiveness for newcomers drastically. After this change of course, the homeland PV industry collapsed, after a relatively short period of existence.

in response to large-scale pollutions) and becomes a national project in Germany at the end of the 1990s.

The conventional energy system of both France and Germany had been progressively developed, following the industrial discoveries to use fossil energies (*app.* Hard and brown coal: 1840 to 1940, oil: 1940 to 1980, gas since 1920). This evolution was also described as a *hard energy path* model¹⁵, based on four priorities:

- (1) Economic criteria (economies of scale),
- (2) an offer-based approach (continuous increase responding to a continuous increase of needs),
- (3) a centralized production system designed for the valorization of fossil energy deposits and fields concentrated on small geographic areas and generating energy for the consumption needs of large spaces¹⁶ and
- (4) considering the large investment needs, a market concentrated in the hands of a limited number of stakeholders.^{17 18}

In the 1970s, the development of renewable energy sources is sometimes considered as a totally different model: the *soft energy path*, in opposition to the conventional energy system, particularly for electricity. The model proposed by Amory Lovins (1977) relies on following priorities:

- (1) An energy demand reduction-centered approach enabled by both individual and community actions for more sobriety, as well as an improvement of more energy-efficient technologies,
- (2) a diversification of energy sources,
- (3) a use of energy sources developed according to environmental criteria (reasonable use of natural resources),
- (4) priorities (1), (2) and (3) leading to a decentralized production system (closeness of production plants and needs) and multi-stakeholder organization (everybody may become an energy producer).

This simplified classification is helpful to understand the challenges at stake, as well as some of the key differences between the options France and Germany

¹⁵ Aurélien Evrard (2013) Contre vents et marées, Politiques des énergies renouvelables en Europe, Presses de la Fondation nationale des sciences politiques, Paris.

¹⁶ Brücher Wolfgang, (2009). Energiegeographie : Wechselwirkung zwischen Ressourcen, Raum und Politik. Berlin, Borntraeger, 280 p.

¹⁷ Barré Bertrand, Merenne-Schoumaker Bernadette, 2011). Atlas des énergies mondiales : un développement équitable et propre est-il possible ? Paris, Autrement.

¹⁸ Gicquel Renaud, Gicquel May, (2016). Introduction aux problèmes énergétiques globaux. Paris, Mines ParisTech, 337 p.

are facing. Switching from a centralized electricity production and supply system to a decentralized system is not only a theoretical change of approach, it is depending on physical realities. The transport and distribution of electricity requires corresponding grid capacities at all levels, which themselves depend on territorial criteria such as distances, demographic sizes and densities, organization or investment capacities. While the most efficient way of developing an electric infrastructure for everybody in France after WW2 can be compared to the centralistic idea of the *hard energy path*, the full implementation of a *soft energy path* such as described by Amory Lovins requires a grid providing a high level of interconnections at the distribution level, such as available in large parts of Germany.

The differences in terms of urban density (France¹⁹: 116 inhabitants/km², Germany²⁰: 229 inhabitants/km²) conducted to different grid designs, different requirements to smart grids and finally, to different capacities to absorb decentralized energy plants. The geographical challenge and national histories also led to different market structures: in order to overcome the long distances of the French countryside and to secure a nation-wide modernization after war, national leading industries such as *Électricité de France* and *Gaz de France* (now *Engie*)²¹ were created by law, while Germany could still rely on its strong municipal energy suppliers (*Stadtwerke*) and keep a market still counting about 800 different suppliers to this day.²²

A.3.3 *Energiewende*, a German approach of change

The kick-off for the *Energiewende* is the renewable energy law of 2000 (*Erneuerbare-Energien-Gesetz, EEG*) decided by the coalition of social-democrats (*SPD*) and green party (*Bündnis 90 Die Grüne*). The replacement of the energy feeding-in law from 1991 (*Energieeinspeisegesetz*) refocuses the German energy supply strategy on the development of renewable energy and the shutdown of nuclear power plants. To achieve this plan, private investments are encouraged and guaranteed by a renewable energy feed-in tariff, financed by the mechanism of the *EEG-Umlage* which is dispatching the surplus costs on

¹⁹ Source : Insee (2011), Overseas territory not included.

²⁰ Source: Bundeszentrale für politische Bildung (2012).

²¹ Electricité de France and Gaz de France used to share a common nationwide distribution division.

²² Lewald & Rat-Fischer (June, 2015) "Comparaison entre les systèmes énergétiques allemand et français" TRION-climate – Réseau énergie-climat, N. Lewald, C. Rat-Fischer, Strasbourg

customers²³. The tariff is both attractive for individuals and companies: leading to a massive and continuous installation of renewable energy plants of all sizes across the country at the beginning.

The decision of 2000 is followed by a decade of intense controversies, the nuclear sector trying to save its assets finding many supports afraid by a possible loss of competitiveness for the German industry. In 2010, the coalition of conservatives (*CDU-CSU*) and liberals (*FDP*) decided to extend the lifetime of nuclear power plants by 12 years, postponing a radical transition beyond 2040. While this governmental decision was preparing to face a wave of legal actions from *Stadtwerke* fearing losses from their recent RES investments, the Fukushima accident in March 2011 was a point of no-return for Chancellor Angela Merkel who announced a new withdrawal from nuclear power until 2022.

This sudden decision was assured of the support of a public opinion worried to see that Chernobyl could happen again - even in technologically developed countries - and gathered an emotional majority across the German society, which could hardly be questioned by economic interests at first.

The freshly adopted *Energiekonzept 2010* had therefore to be corrected and adapted, but it was already defining nuclear power as a transitory bridging technology ("Brückentechnologie", the use of this term is now extended to brown coal power in the German political discourse). Accordingly, the goals of Renewable Energy Sources (RES) development (up to 80% of electricity production until 2050), of reduction of Greenhouse Gas Emissions (GHG) and to divide the use of primary energy by two until 2050 (comparing to 2008) were kept²⁴.

To tackle the challenge of asynchronous electricity demand and production through renewable sources, the German Energy Agency (*DENA*) defines the development of smart grids, storage (both physical and from future electric vehicle deployment) and a careful management of reserve capacities (coal and gas plants) as priorities to secure the new energy strategy²⁵.

²³ Electric heating is very unusual in Germany (less than 5% of households), which explains a lower sensitivity to electricity tariffs and variations, whereas larger companies do not pay the EEG tax.

²⁴ Source: Umweltbundesamt, BMWi (2018): <https://www.umweltbundesamt.de>

²⁵ Source: Deutsche Bundesnetzagentur (2011): Stephan Kohler, Das Energiekonzept der Bundesregierung - Herausforderung an die Netzinfrastruktur., 14. Dezember 2011, Berlin

A.3.4 An approach based on “Grands Projets” in France

The regime of property of power assets evolved from a concession regime by the Communes (law of 1906) to an almost complete control of the power system by the State (Nationalization law in 1946 and creation of *EDF*) with a quasi-monopoly of power generation and distribution in France. *EDF* becomes the obligatory concession contractor of the State for transmission and of the communes for distribution.

EDF, at this time the largest power company in Europe, will succeed in implementing the various Energy transitions in the following decades: transition to hydro during the reconstruction period post WW2, transition to oil power plants (to replace coal), and transition to nuclear after the oil crisis. The next transition to succeed for *EDF* is the transition to renewables.

In 1996 after the 1st European Directive was published, French citizens were skeptical: why changing? People were proud with the public companies, in particular with *EDF*, internationally recognized as a technology leader (nuclear).

In addition, tariffs were among the lowest in Europe.

Residential customers could start choosing a new supplier after 2007. By law all suppliers have access to nuclear production at an attractive cost (100 TWh at 42 €/MWh). Alternative suppliers become de facto nuclear energy vendors.

This phenomenon reveals clearly the way France deals with liberalization: people consider the State as the protector to call when things turn bad: “yes” to competition with low prices, “back” to regulated tariffs with high market prices²⁶.

Nevertheless after ten years of liberalization, one million residential customers renounced in 2017 to the regulated tariffs, with a total of around five million customers on the free market. There are different reasons for the customer to stay with his historical supplier: lack of information, habits, fear to pay extra costs when changing supplier, or simply because he’s satisfied with his present supplier. In addition, the State has control over regulated tariffs which will protect the customers.

²⁶ Transitions Electriques Jean-Pierre Hansen (2017), Jacques Percebois Editions Odile Jacob

People are satisfied with the « péréquation tarifaire » which guarantee the equality of service and tariffs everywhere in France but they think that liberalization was not profitable for them. They fear that prices will rise more and they are concerned that historical suppliers become fragile (they are very proud of *EDF* and *Engie*).

Engie was created after the merger between *Gaz de France* and *Suez* and the purchase of International Power. As soon as she was appointed as CEO in 2016, Isabelle Kocher gave a very strong impulse to the company: decarbonization, decentralization, and digitalization (3D). *Engie* sold most of its thermal assets in the world for fifteen billion euros and initiated a strategic move towards renewable energies, storage, microgrids, electric vehicle, hydrogen etc.

Engie is present in more than seventy countries where the pace of change is different and the possibilities to invest in local system more realistic and rewarding. The financial market does not fully recognize this strategic move (the stock remains very low 12.6 € vs 30 € at the merger) and it will take years until the « new » *Engie* generates cash from its 3D businesses.

It is not possible to understand the position of the French government on energy issues without taking into account its 83.5% shares (2017, formerly 84.7% in 2008) in *EDF*. It represents 1.7 billion Euros of dividends (in titles) for the French state in 2016²⁷: that is more than the half of its total share revenues in companies (3.5 billion Euros in total, excluding the selling of shares) and 0.7% of the total national budget revenue in that year²⁸. In comparison, the German government accounted a total revenue from its company shares of 390 million Euros the same year²⁹, none of it being energy producers or suppliers.

The French centralistic industrial policy is not only a regulation and legislation, as the government is keeping active interests in key sectors of the economy. This kind of steering and income policy also exist in Germany; at a municipal level with the Stadtwerke and at a regional level with the participation of regional states (*Länder*) in three of the so-called « Big four » (*EnBW*, *Eon*, *RWE*, *Vattenfall*).

²⁷ Source: Agence des participations de l'Etat (2018).

²⁸ Source: Ministère de l'Action et des comptes publics, Direction du budget, 2018.

²⁹ Source: Die Beteiligungen des Bundes, Beteiligungsbericht (2016), Bundesfinanzministerium, February (2017), Berlin

The key idea of creating and keeping *EDF*, beside modernizing the industry and securing the national energy supply, was a principle of territorial equality (equality of access to energy anywhere in the country) and of social equity (fixed regulated tariffs). Thus, the understanding of « public service » in the French welfare state is mixing typical governmental activities such as regulation with economical activities such as energy supply. This context conducts to major differences with the situation in Germany:

- (1) Most of the major decision-making for the energy sector, particularly in the case of electricity, is concentrated in very few hands, restricting contradictory positions.
- (2) The government has to find a balance between strong citizens expectations to keep the electricity tariffs low and industrial investment needs, leading to cautious - and therefore more conservative - choices.

Furthermore, a company that large (71.2 billion Euros turnovers, 584.7 TWh production volume in 2017)³⁰ is gathering a huge part of the employment in its branch: over 150 000 employees (domestic and international) and union interests have an influence on political decisions, even more when the public authority is the main shareholder.

The French government, through its interests in EDF, has assets in 58 nuclear reactors throughout the country, whereas its German neighbor had none at the time of the Fukushima event, making a decision comparatively easy to take. German regional and municipal shareholding in companies owning nuclear power plan was not comparable, even less in a country where the accumulation of regional and national mandates is unusual (even forbidden in some regions). In other words, the required political capital to abandon nuclear power supply would be much higher in Paris than it was in Berlin and no government has seemed to own it yet, as the many hesitations and contradictory decisions about the future of Fessenheim (the oldest nuclear power plant in France) indicates.

As a result, opposition and contradictory discussions about the future of nuclear energy, or the wish to improve renewable energy sources takes place outside the circle of decision making and seems to have poor influence on it - which does not mean that it is not existing. Even inside the French government, ministers in charge of environment and climate protection appear to have

³⁰ Source: Electricité de France (2018).

difficulties coming through and seem to have limited capacities to discuss nuclear options. The current French minister of ecology claimed at the beginning of 2018 the need of a "more mature relation between EDF and the State".

The defense of a complex social status quo on the employment and tariff side, combined with huge industrial estates is literally confining the French energy policy to marginal transformation steps in times of financial constraints. At the beginning of 2018, France still has not fully recovered from the economic crisis of 2008 and could not engage an adventurous transition in a way Germany did in the past decade.

The new elected President E. Macron has developed his own view which was expressed on December 18th, 2017 on a TV interview:

"Fighting against climate change is fighting against CO₂. My priority is to close down coal plants. We have too much energy supplied by nuclear. It creates an addiction (about 75%) to a single source of energy. (...) **We are very late on renewable and I want to develop renewable much faster.**"³¹

Interestingly, a comparable phenomenon can be observed in Germany at a regional level, where two regions struggling with the problems of European steel and coal industry, naming the Lausitz and the Ruhr keep defending the brown coal industry in the name of employment and municipal incomes (e.g. relying on *RWE*-shares). The situation in Nordrhein-Westfalen, the most important Land for the social-democrats (*SPD*), has a strong influence on the party and therefore on federal policies from time to time, helping the survival of a technology which is also criticized in Germany.

A.3.5 Two interacting regimes

It is no question that the French and the German Energy transition must be considered separately from each other: these markets are organized nationally (players, regulations, tariffs, infrastructures). Nevertheless, interactions and

³¹ « Lutter contre le réchauffement climatique c'est lutter contre le CO₂. Ma priorité c'est de fermer les centrales à charbon. Sur le nucléaire on a trop d'énergie électrique fournie par le nucléaire. Ça crée une dépendance à une seule source d'énergie environ 75%. (...) Ce sur quoi nous sommes réellement en retard c'est le renouvelable. Ce que je veux faire c'est qu'on développe beaucoup plus vite le renouvelable. » December 18th, 2017 on a TV interview.

influences are real: all components of these two regimes (industry, policy, technology, culture, science, citizens) are affected in a globalized context, through media, other sources of information (international fairs, publications, various networks), direct co-operations and common organizations (e.g. French-German office of renewable energies, *Eurelectric*), cross-border activities (e.g. Interreg projects), trades (SPOT markets), even if their direct connections are limited (e.g. only few common companies).

As an illustration³², at least 11 of the 20 participants at the Citizens in Transition round table have had activities or active contacts on the field of energy in both countries prior to the meeting. In parallel, **three participating companies have ongoing activities in both markets: the existing exchanges appear to be mostly information.**

The multilevel perspective gives the possibility to show how parallel regimes may influence each other, without direct contact (e.g. the French legislation is not applying to German citizens): the landscape level is not only impacting the regime level, it is also permeable to influences from the regime level (e.g. the German *Energiewende* is influencing discussions on energy issues around the world). As a difference to the Geels & Schot scheme, which foresees an influence of the new regime on the landscape developments, we consider the possibility for the transition itself to have an impact, before the form of the new regime is even known (Figure 5).

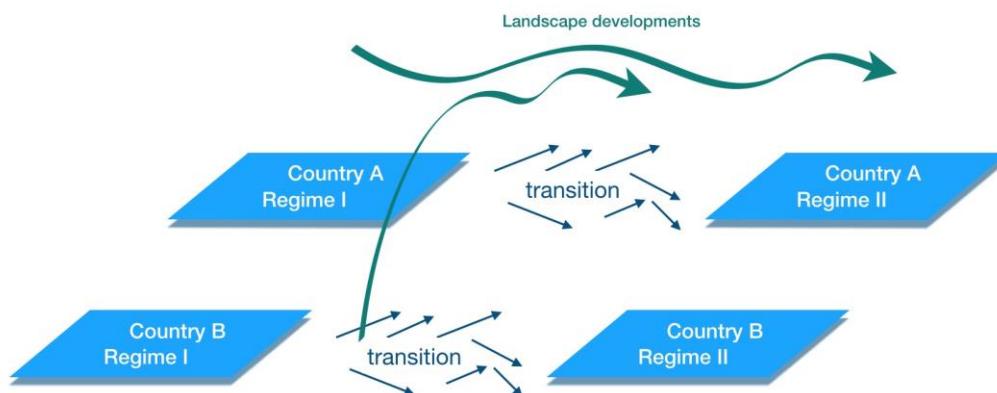


Figure 5: The influence of a transition on another transitions landscape

This representation shows the indirect influence of a transition phenomenon on another one (simplified for more readability, it works in both directions). The

³² And not as a fully representative sample: our experts were selected to discuss specifically our issues.

feedback/experience from one transition is adding up to the other components of the landscape, which is influencing the other transition. **The French and the German Energy transitions mainly influence each other indirectly**, information from one side becomes part of the other context. Consequently, citizens as well as professionals show heterogeneous knowledge about the transition across the border.

In parallel, the niche level could be considered as somehow connected or even common inside the European single market. Legally, a developing niche can choose to join a regime in another European country if it seems more promising or easier to access. Practically, export requires a certain degree of organization connected to a maturity of the new technology or concept worth the effort, which is a state closer to the regime level than to the niche level. Parallel development of similar solutions and approaches by start-ups all across Europe, for example on the field of 3D modeling, show that niches tend to develop themselves separately, by incubating in their own and therefore best-known context. However, some of them may join the regime level in different countries at the same time on their way up.

A.4 Two different Energy transition structures, actors and roles

A.4.1 Two radically different regime structures

In this part we will describe and enumerate how France and Germany differ from each other on many aspects, how far this is critically differentiating their energy systems and thus why *Energiewende* and *Transition Energétique* are not the same.

Sticking to the MLP approach, the landscape and the niche level can be considered as relatively similar for both countries. The global discussion on climate change, the European strategies, the environmental evolutions or the global pressure on resources are quite similar, sometimes the same. Both countries also offer a comparable ground-floor for niche developments relying on a solid network of universities, several dynamic metropoles and access to start-up funding and facilities. The main differences when describing the respective Energy transitions are to be found at the regime level. The empirical description below will emphasize following critical differences between the six regime components:

- (1) **Energy policy and national organization:** The French republic is the archetype of a **centralized national state**, providing a clear hierarchy of competencies to be carried out by national or local authorities. The German **federal republic** is built around a principle of subsidiarity, leaving to the federal government a limited set of competencies, which cannot be carried out at the local level³³. The geopolitical situation resulting from World War II and the following Cold War also leaves sustaining heritages³⁴ in terms of infrastructures³⁵ (e.g. 89% of the Upper Rhin hydropower is operated by *EDF*) and decision-making (e.g. no use or development of nuclear weapons in Germany).
- (2) **Supply and consumption technologies:** Technological choices for energy supply and use are the result of history and geography. A higher hydraulic power potential could be domesticated in France, while huge brown coal resources³⁶ were available in Western (Ruhr) and Eastern (Lausitz) Germany, leading to the development of large industries brown coal and steel industries. The low depth of the Northern and Baltic Seas were also more favorable to the development of offshore wind power than the French Atlantic coast. Heating and cooling needs are not the same from the Mediterranean to the Baltic areas and the spectacular development of electrical power as a pillar of the French post-war modernization led to a roll-out of electric heating at a far wider scale.³⁷
- (3) **Cultural factors:** Many studies show a higher German affinity to community organization (e.g. *Bürgervereine, Gemeinschaften*) and to technology, but a lower attachment to landscape heritage than in France (*Patrimoine*)³⁸. Socio-cultural dimensions adding up to different levels of (de-)industrialization and urban density are defining different settings. Regional disparities and more cultural aspects would need to be considered for a larger and more complete investigation.

³³ P. Pactet (1998): Institutions politiques, Droit constitutionnel, Paris.

³⁴ Europa Union Verlag (2000): 1948-1999, Les relations franco-allemandes, Chronologies et documents, Bonn.

³⁵ Convention franco-allemande relative à l'aménagement du cours supérieur du Rhin entre Bâle et Strasbourg (October, 1956).

³⁶ The less greenhouse gas emitting stone coal is mostly imported and therefore less used. In France the use of coal has retracted to mostly industrial processes requiring heat (e.g. tyre production).

³⁷ In 2017, electric heating was installed in 31% of households in France, 5% in Germany. The trend may increase with a majority of electric systems in new buildings in France. (Ademe, 2017)

³⁸ F. Dagognet (1993): Mort du paysage ? Philosophie et esthétique du paysage

(4) **Science:** While the scientific background is widely integrated inside the European Union, the linguistic barrier remains for the access to primary sources of information leading to insufficiently verified re-uses of figures: many studies comparing European Energy transition pathways could not be used in this chapter, because their numbers did not correlate with original statistics. The main difference, however, may be found on the research part, as German industries and energy suppliers tend to (co-) fund academic research, while French groups rather keep intern R&D capacities.

(5) **The energy industry and suppliers:** This difference may be the most obvious, with about 800 energy suppliers in Germany facing around 5 in France³⁹. Both the Stadtwerke (municipal companies) and the “Big four” are strongly connected to municipal and regional authorities, whereas EDF is directly linked to the national government as mentioned above.

(6) **Energy market and user preferences:** As a result, one market is fully open to competition and marketing efforts to stand out from the crowd, while the other one keeps his connection to its history as a public service with regulated tariffs. Best offer (annual “supplier hopping” is part of the business-model of energy advisers in Germany) or social equity are not the same paradigms, even if both are seeking for a best price. The German approach is here the social market economy (*Soziale Marktwirtschaft*) whereas France is preferring a welfare-state (*Etat providence*).

To sum up, the German regime is characterized by a higher number of decision-making stakeholders, reducing coordination and system control possibilities for specific players and increasing the dispatching between different technological and user decisions.

At the contrary, we have seen previously that the French regime shows a high concentration on a few decisive stakeholders, strengthening the control on interactions between the regime components, thus increasing the regimes structuration and its resistance to exogenous change.

³⁹ N. Lewald, C. Rat-Fischer (June, 2015): Comparaison entre les systèmes énergétiques allemand et français
TRION-climate – Réseau énergie-climat, N. Lewald, C. Rat-Fischer, Strasbourg

A.4.2 Bottom up versus top down: the role of municipalities

Cities are trend-setters of environment and climate policies, with ambitious goals⁴⁰, organized networks (*Ecocities*, the *Covenant of Mayors*, *C40...*) and critical issues to solve (air pollution⁴¹, resilience⁴², urban heat islands...). Their direct contact with environmental issues and the shorter distance between citizens and decision-makers (e.g. comparing to the national level) increases the pressure for them to develop responses.

Their large number covering every territory locates them in a very elusive category, which proves being hardly controllable, particularly for industrial lobbies. The swarm effect makes it impossible for companies to reach every city with marketing or attempts to keep new trends under control. Single cities or groups of cities may follow the pressure coming from a local company (particularly when providing numerous local employment) or from contractual obligations on some topics, while other cities not in contact with the same company will keep acting independently.

A local crisis resulting from a pollution, e.g. air pollution resulting from the traffic or from power plants, will sooner or later force the local municipality to look for solutions, may they be normative (driving interdictions), selective (toll systems), or creative (urban planning, commuting concepts, etc.). Even without the legal competences of the state or an industrial relationship, municipal innovations and the isomorphism inside city networks have yet set major trends such as climate plans or green districts.

Germany rationalized its number of municipalities by law in 1972 and counted about 11 165⁴³ in 2017, comparing to 35 416⁴⁴ in France the same year. In charge of a set of legal topics, many German cities still own their municipal workshops (*Stadtwerke*); which are multi-service companies in charge of energy, transportation, communications, water-management, waste management (the list varies from a company to another). These companies are probably the main difference to the French energy system. They provide

⁴⁰ e.g. Déclaration des Maires européens pour le Climat - « En route vers la COP 21 »

⁴¹ C. Payre, C. Rat-Fischer (2015): Comment intégrer la question de la qualité de l'air dans la planification urbaine ? L'apport de la modélisation, Environnement, Risques & Santé, Paris

⁴² F. Rapp, C. Rat-Fischer (2012): Worldwide City Concepts Analysis: Analysis mapping of over 30 city concepts dealing with sustainability issues, ICLEI Resilient Cities Congress Secretariat, Bonn

⁴³ Bundesinstitut für Bau-, Stadt- und Raumforschung (2018): www.bbsr.bund.de/

⁴⁴ Direction de l'information légale et administrative (2018)

municipalities with critically needed cash, offer local steering opportunities, provide packaged multi-sectoral local data and benefit from a public service image granting a certain market stability. After a wave of privatization of these companies following a neo-liberal debt management trend at the beginning of the 2000's, municipalities are now keeping their assets, or trying to reconquer them. To overcome the lack of scale effects, Stadtwerke created alliances, but also opened parts of their shares to larger utilities, in order to settle privileged supplying collaborations⁴⁵. Nevertheless, their access to research and innovation is limited.

Germany counts 1092 Stadtwerke, about 800 of them dealing with electricity and sharing about 30% of the national market⁴⁶, **comparing to 150 French Entreprises Locales de Distribution (ELD)** covering 5% of the population^{47, 48}.

Without such levers on the industrial side, French municipalities however managed to invite themselves in the national climate discussions, the *Grenelle de l'environnement* launched in 2008. Under the leadership of pioneer cities, such as Grenoble, Nantes, Mulhouse, Dunkerque or Lyon, supported by the national network of mayors of large cities (*AMGV*)⁴⁹ and with the support of the environment agency (*ADEME*), local energy agencies, climate plans, green districts, energy efficiency strategies, citizens information and company clusters were created across the country.

The European liberalization of grid operation concessions became a tool, less to (re-)create companies like in Germany, but rather to pressurize the usual players to do more to achieve the local energy and climate targets. Even in a historically grown top-down system, many mayors and their teams manage to surprise the established regime and to open the discussion to new fields. As such, **French municipalities can be partly seen as innovative actors** with limited means typically to be found at the niche level perturbing the existing regime, while German ones with their Stadtwerke definitely belong to the regime level and are often seen as poorly innovative⁵⁰.

⁴⁵ E.g. EnBW shares in the Stadtwerke Karlsruhe and Düsseldorf.

⁴⁶ Sources: Monitoringbericht (2016), Bundesnetzagentur, Bundeskartellamt, Bonn, (2016); <https://www.bundesnetzagentur.de>

⁴⁷ Source: <https://electricite.net/eld> (2018)

⁴⁸ Such numbers must be considered carefully: Electricité de Strasbourg for example, originally a German Stadtwerk created in 1899, is now an 88% affiliate from EDF and represents alone 10% of the total population covered by ELDs in France.

⁴⁹ Association des Maires des Grandes Villes de France

⁵⁰ Source: Projektträger Jülich, (2012)

A.4.3 The big players: *EDF* and the “Big four”

Major players are *EDF* on the French side, and its seeming equivalents *EnBW*, *E.ON*, *RWE* and *Vattenfall* on the German side. How far is it possible to see them on a comparable level? What do they have in common and what is differentiating them?

At first, these companies are obviously the main players in their countries, dominating respectively about 70% of the national electricity markets. Secondly, they own and operate all nuclear power plants in their countries and in general most of the main historic power plants. Thirdly, they used to manage the grids, now externalized in dedicated companies, with respect to the European competition regulation.

	<i>EDF</i>	<i>EnBW</i>	<i>E.ON</i>	<i>RWE</i>	<i>Vattenfall</i>
Year of creation	1946	1989	2000	1898	1909
Turnover 2016	71,2 Mrd €	15,3 Mrd €	38,2 Mrd €	45,8 Mrd €	15,4 Mrd €
Number of clients +/-	37,1 Mio	5,5 Mio	6 Mio	7,5 Mio	3,2 Mio
Employees	150 000	20 300	56 400	59 700	28 700

Table 6: Key figures about *EDF* and the “big four”⁵¹

If this was all to be said, a commonly seen observation - particularly in foreign media - worrying about the German *Energiewende* not to be economically viable, would make sense: companies losing more than half of their source of revenue⁵² on a governmental decision are mathematically in trouble and not likely to succeed with parallel investment needs to achieve nuclear dismantlement, renewable energy sources development and grid stabilization. But, many other aspects are clearly differentiating *EDF* and the “Big four”, assigning them different positions and meanings in a society in transition, which are often overlooked when observed from a foreign perspective and thus requiring a careful assessment.

⁵¹Sources for the table (2018): EDF, EnBW, E.ON, RWE, Vattenfall, BdEW, www.statista.com, www.energiedienstleisterinformation.de, www.stromauskunft.de, Wikipedia

⁵²Sources (2016): Bundesnetzagentur, Bundeskartellamt

The shareholder structure is certainly one of the most important points. As mentioned before, *EDF* is an 83.5% company of the French national State. The only other state-owned company at a national level on our subject is *Vattenfall*, a 100% property of Sweden. Following the foreign lead, only 37% of the *E.ON* shares are located in Germany: its institutional shareholders are a vast mix of investors, counting foreign states, banks, investment groups, etc. It is also massively developing its international activities, mainly in Brazil, Russia and Turkey where it has more clients than in Germany⁵³. *Vattenfall* and *E.ON* are considered in Germany as anonymous business and do not enjoy any positive image as carriers of a "public service".

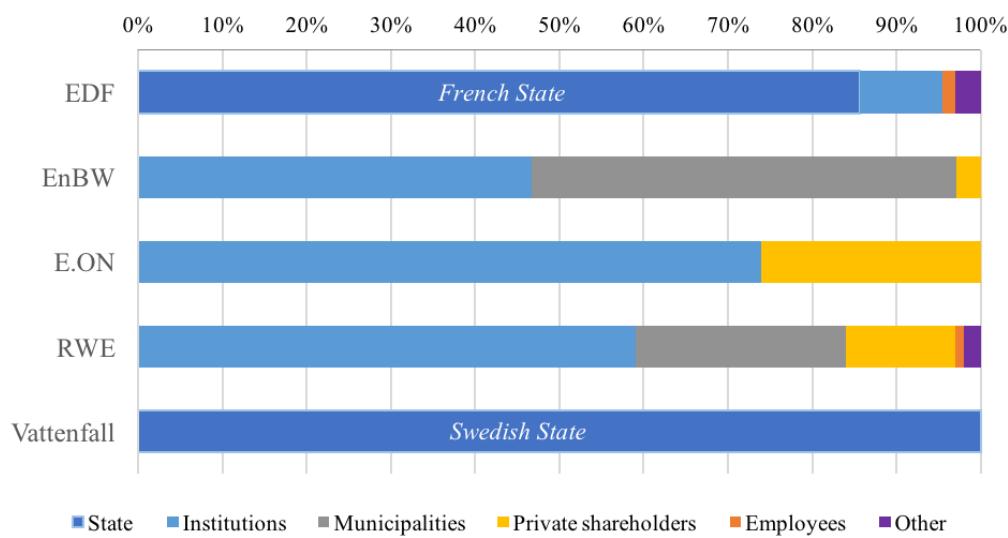


Figure 6: Shareholder structures of *EDF* and the "Big four"⁵⁴

For *RWE* and *EnBW*, the situation is different as their regional origin stills plays a key role in their shareholder structure and in their activities. These two companies result from the merging of different local energy producers (*E.ON* originally too) and municipalities as well as regional institutions (including local banks) are dominating their ownership.

RWE is very much connected to the mining history of the Ruhr and its brown coal & steel industry, explaining the remaining importance of coal extraction

⁵³ Source (2013): www.welt.de

⁵⁴ Sources for the graph (2018): *EDF*, *EnBW*, *E.ON*, *OEW*, *RWE*, *Vattenfall*, Wikipedia

and use in its working culture, whereas Vattenfall is trying to sell its brown coal power activities in the Lausitz since 2016.

The case of EnBW is different: its creation in 1989⁵⁵ was meant to prepare regional groups for European liberalization and competition. The selling of shares to EDF, which culminated at 46.75% of the total capital ended up in an adventurous reselling of the to the regional state (Land Baden-Württemberg).

The attempt from Minister president Stefan Mappus a political move as a temporary protector of regional interests backfired heavily against him: Fukushima and Mrs. Merkel's decision to abandon nuclear power followed just after and the temporary shares became unsellable. He lost the regional elections and was summoned in court about questionable negotiations. Several trials followed, some of which are still going on.

In just a few months, *EnBW* had changed from being a profitable nuclear industry seeking the prolongation of its most attractive power plants, to a shaken consortium at the hands of a green party government: it is both a company which needed to operate rapid restructuring efforts and a formidable tool for local politics to achieve their vision of the Energy transition. In 2017, it showed signs of recovery and signed a joint letter⁵⁶ of 50 leading companies (including *E.ON*, *Siemens*, *Deutsche Telekom*) urging the German government to fix a date for the end of coal power in the country⁵⁷.

⁵⁵ Originally as EBW

⁵⁶ Source (2017): Stiftung 2 Grad

⁵⁷ Sources (2017) : www.manager-magazin.de, www.zeit.de, www.tagesschau.de

Part B - Citizens' acceptance of Energy transition technologies

When a nation commits to the Energy transition, the citizens' acceptance and support are indispensable in many respects. Negative attitudes often slow down the transition process. For example, wind turbine projects were hindered many times by lawsuits from opposing citizens. If citizens have an indifferent behavior and attitude regarding transition technologies - no self-reflection or change of user behavior etc. - positive effects of a technology or measure are eventually not achieved. At worst, negative rebound effects such as a higher instead of lower total energy consumption occur because of unexpected user behavior or wrong application of innovations. For most researchers, the Energy transition can only be possible if it comes from the citizens and the society itself in a bottom-up way.

According to Gaël Giraud⁵⁸ who holds the position of executive director at the *Agence Française de Développement* and economy researcher at *CNRS*, the society model perspectives in France go now through the Energy transition. To him, the French citizens have to seize upon the topic and be part of the democratic dialogue to draw the future of the society for the coming twenty years. Through the Energy transition chosen scenario, he is seeing an ideal of society.

This chapter first presents the overall acceptance of citizens on the Energy transition and especially renewable energy technologies in France and Germany based on literature research and expert experiences. Renewable energy technology is one of the three pillars of the Energy transition which are energy saving, energy efficiency and renewable technologies⁵⁹. Further, the terms active and passive acceptance are defined and examples are given. In a next step, the citizens' acceptance of two representative technologies - smart grids and wind turbines - is detailed.

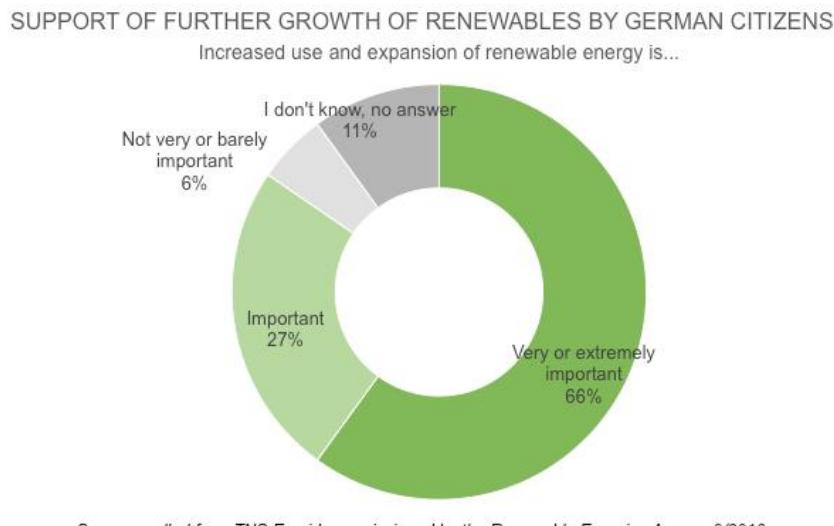
⁵⁸ Interview for Mediapart : Gaël Giraud: «La transition énergétique est un idéal de société» (2015) <https://www.mediapart.fr/journal/france/130315/gael-giraud-la-transition-energetique-est-un-ideal-de-societe-0?onglet=full>

⁵⁹ According to Negawatt's scenario : Réussir la transition énergétique en France (2017) https://negawatt.org/IMG/pdf/scenario-negawatt_2017-2050_brochure-12pages.pdf

B.1 Overview of the citizens' acceptance of Energy transition technologies

B.1.1 Citizens' acceptance of renewable energies in France and Germany

German and French population widely supports the expansion of renewable energies. Proponents in both countries are part of all political affiliations, educational levels, age groups and income classes. They are favored by 93% of the German population in 2015, remaining as high as the previous years.



Source : polled from TNS Emnid commissioned by the Renewable Energies Agency 9/2016

Figure 7: Support of renewables among the German population⁶⁰

Named advantages regarding the usage of renewable energies are foremost sustainability (77%) and climate protection (73%). Furthermore, the national energy independence (67%) and the opportunity to hold a stake in the energy supply (57%) are supporting reasons of German citizens whereas only a few (33%) see a benefit for customer to reduce costs over the long term⁶⁰

In France, 89% of the population thinks renewable energy technologies are the future of energy supply, according to an IPSOS survey⁶¹ conducted in 2012. Although 99% of them have heard about renewable energy technologies, only 52% think they know technically what they are.

⁶⁰ AEE – Agentur für Erneuerbare Energien e.V. (ed.) (2015): Akzeptanz für Erneuerbare weiterhin hoch. RenewKompakt, Ausgabe 27. Berlin

⁶¹ Ipsos realized this study for the Syndicat des Energies Renouvelables from the 3rd to the 10th of December 2012 on the internet and on 1000 French people through the quota methodology (age, living area, gender, profession)

<https://www.ipsos.com/fr-fr/les-francais-et-les-energies-renouvelables>

According to French citizens, renewable technologies aim first at saving the environment (82%), do not represent a risk for the security of citizens (75%) neither for their health (76%). They consider them as reliable (68%) and efficient technologies (64%), but a majority of citizens (52%) doubts the capabilities of renewables to provide electricity for all French inhabitants in less than 35 years. They also have doubts about their inexpensive costs (50%), their competitiveness (46%) and their esthetics (51%). In spite of that and as illustrated in Figure 8, the majority (83%) of the French population would like France to invest in renewable energy rather than in nuclear power.⁶²

SUPPORT OF FURTHER GROWTH OF RENEWABLES BY FRENCH CITIZENS
In which type of energy should France primarily invest in the coming years?

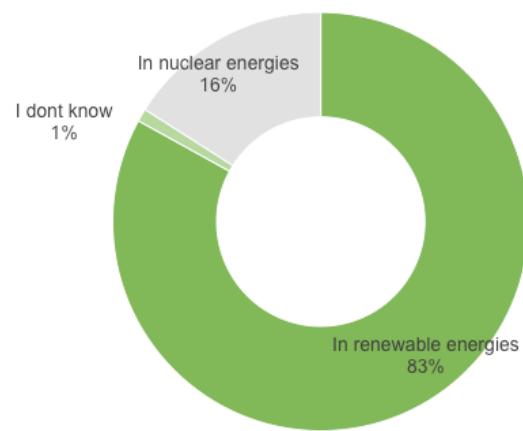


Figure 8: Attitudes of the French population towards the investment in energy technologies. Data source: Harris Interactive survey conducted for Heinrich Böll Stiftung

A large majority of French citizens approve concrete measures of the energy such as building renovation, citizen cooperatives and local self-consumption of energy, according to a recent survey of Harris Interactive (see Figure 9). People with low income and left sympathizers tend to have a higher approval rate than the average.

⁶²Harris Interactive survey conducted for Heinrich Böll Stiftung on 1004 French adult citizens in November 2017 through the quota methodology (age, living area, gender, profession)
http://fr.boell.org/sites/default/files/uploads/2017/12/rapport_harris_-_le_rapport_des_francais_a_lenergie_fondation_heinrich_boll_1.pdf

APPROVAL OF SPECIFIC ENERGY MEASURES AMONG THE FRENCH POPULATION

Are you in favour of the following proposals in the field of energy?

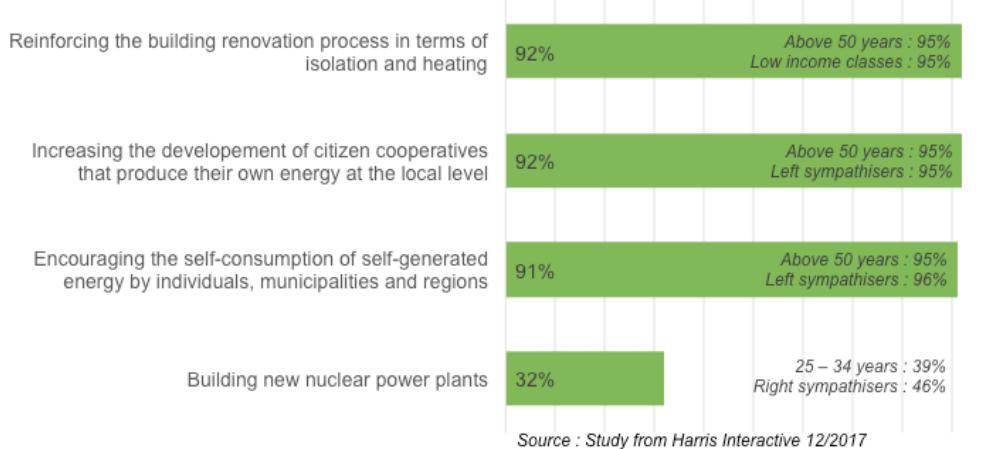


Figure 9: Attitudes of the French population towards specific energy measures. Harris Interactive survey conducted for Heinrich Böll Stiftung⁶²

Even if both transitions and regimes are significantly different as demonstrated in Part A, German and French citizens overall acceptance and wishes related to Energy transition technologies are closely comparable. The way to express this acceptance varies however in both countries.

B.1.2 Active and passive acceptance

The more experiences and touch points citizens already had with renewable energy technologies, the higher their acceptance⁶³. Thus, by dealing with such technologies and being involved in projects - meaning by active participation - the acceptance among citizens is strengthened.

Figure 10 illustrates both types of acceptance - passive and active - as well as their opposite concepts. Passive acceptance corresponds to the pure tolerance of projects without any supporting action. On the contrary, active acceptance is characterized by participation – e.g. financial involvement, commitment to the local Agenda 21 or energy cooperatives. The negative rating of a project can be passive or active as well depending on the way the citizens (re)act⁶⁴.

⁶³ AEE – Agentur für Erneuerbare Energien e.V. (ed.) (2015): Akzeptanz für Erneuerbare weiterhin hoch. RenewsKompakt, Ausgabe 27. Berlin.

https://www.unendlich-viel-energie.de/media/file/416.AEE_RenewsKompakt_Akzeptanzumfrage2015.pdf

⁶⁴ C.A.R.M.E.N. e.V. (ed.) (2014): Akzeptanz für Erneuerbare Energien. Ein Leitfaden. Straubing https://www.carmen-ev.de/files/Sonne_Wind_und_Co/Akzeptanz/Akzeptanzbroschüre.pdf

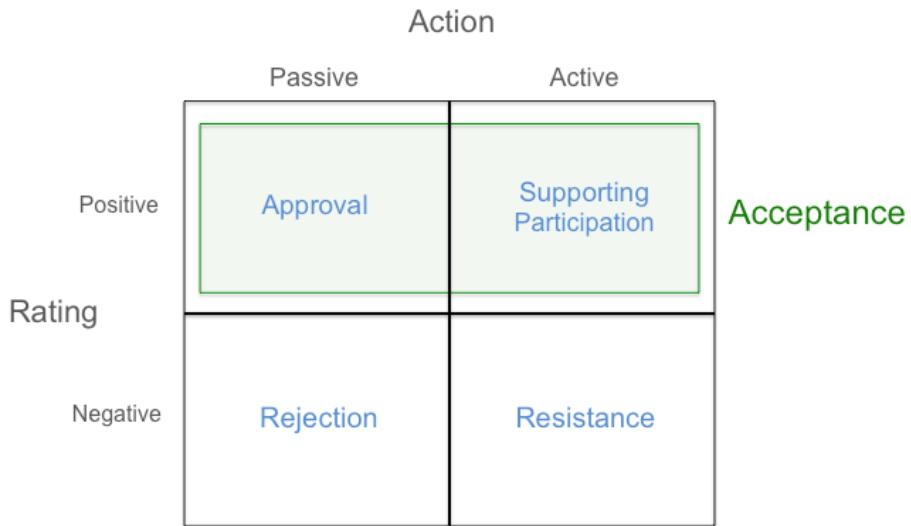


Figure 10: Dimensions of the term acceptance (in accordance with C.A.R.M.E.N. 2014 and Zoellner et al. 2009, derived from Dethloff 2004)

Regardless of the rating - positive or negative - active citizens are a minority in projects. According to a survey conducted in Germany 2012⁶⁵, only a few citizens already invested in large-scale solar installations (7%), wind turbines (4%) or biogas plants (3%) in the form of shares and funds, although the general readiness to financially support such plants is significantly higher (54% solar installations, 49% wind turbines, 35% biogas plants). In France, the *Dutreil Law* of 2011 encourages citizens to invest into renewable technologies and bestows a tax reduction of 25% upon the investment.

Active resistance is similarly very rare in practice: only a minority takes part to opposition actions, petitions or demonstrations⁶⁵. Nevertheless, their impact on projects is significant. They tend to make "more noise" than the supporters and often get a better coverage in the public debate.

B.1.3 Active participation and citizen cooperatives

For citizens who wish to actively support the Energy transition, different financial mechanisms enable them to invest in Energy transition projects: Crowdfunding, Crowddequity or Crowd lending etc. But the highest local

⁶⁵ Kress, M.; Landwehr, I. (2012): Akzeptanz Erneuerbarer Energien in EE-Regionen. Ergebnisse einer telefonischen Bevölkerungsbefragung in ausgewählten Landkreisen und Gemeinden. Diskussionspapier des IÖW. Berlin.

https://www.ioew.de/uploads/ttx_klioewdb/IOEW_DP_66_Akzeptanz_Erneuerbarer_Energien.pdf

participation level is certainly represented by citizen cooperatives, also called *RESCoop*, standing for Renewable Energy Source Cooperatives. They consist in the gathering of citizens, possibly together with local companies and public authorities to plan, finance, manage, and harvest the benefits of Energy transition installations.

The benefits of citizen cooperatives are manifold: they create a community feeling by integrating different local actors, the local citizens' awareness and information is greatly improved, they generate a high local Energy transition acceptance and face no opposition (zero appeal in Germany for such projects according to the *Institut du Développement Durable et des Relations Internationales (IDDR)*) and they make citizens benefit from the dividends of the Energy transition.

In 2015, there were 165 renewable energy cooperatives in France according to ADEME⁶⁶, while they were six times more in Germany (Figure 11). Such cooperatives are assessed to have leveraged more than 1.67 billion € investment from more than 130 000 private citizens in 2014, demonstrating that energy cooperatives democratize energy production. They make possible for everyone to benefit from the Energy transition, even without owning an own house.⁶⁷

⁶⁶ ADEME (January, 2017): „Les collectivités territoriales, parties prenantes des projets participatifs et citoyens d'énergie renouvelable“
http://www.ademe.fr/sites/default/files/assets/documents/projets_participatifs_enr.pdf

⁶⁷ Morris, C.; Pehnt, M. (2016): Energy transition. The German Energiewende. An initiative of the Heinrich Böll Foundation. Berlin

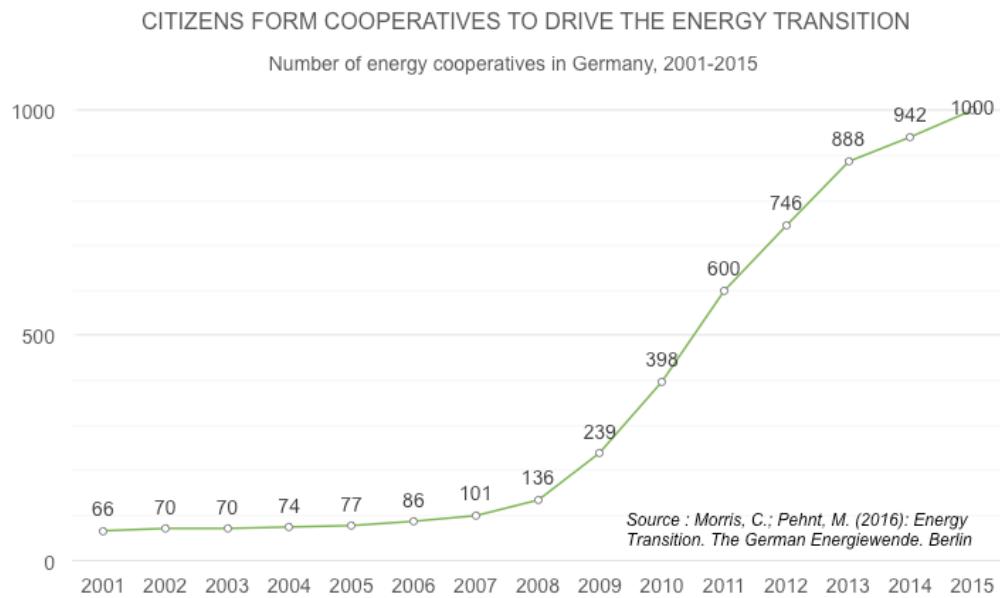


Figure 11: Numbers of existing energy cooperatives formed by German citizens

French and German citizens show a higher confidence in local cooperatives and associations than in big companies and public authorities to manage the deployment of renewable technologies. In France, 78% of citizens trust that local cooperatives are taking the right direction in the Energy transition, while only 46% believe the same from the conventional energy production and distribution companies⁶⁸.

B.1.4 Active resistance and NIMBYism

Local citizen opposition to Energy transition projects is often related to the **NIMBY** syndrome. This acronym stands for “Not-In-My-Backyard”, which originates from land use developments in the United States in the 1980s. This term is nowadays widely used in renewable energy technology siting to describe “people that combine a positive attitude and resistance motivated by calculating personal costs and benefits”⁶⁹. Although they are in favor of a certain technology they do not want them to be realized close to where they live.

⁶⁸ Harris Interactive survey conducted for Heinrich Böll Stiftung on 1004 French adult citizens in November 2017 through the quota methodology (age, living area, gender, profession)
http://fr.boell.org/sites/default/files/uploads/2017/12/rapport_harris_-_le_rapport_des_francais_a_lenergie_fondation_heinrich_boll_1.pdf

⁶⁹ Wolsink, M. (2000) - “Wind Power and the NIMBY-myth: Institutional capacity and the limited significance of public support”. Renewable Energy 21, p.49-64.

Empirical surveys reveal that reasons for local opposition are diverse and cannot be simplified. Examples of reasons for "NIMBYism" are:

- Financial impact (decrease of house prices, fall in tourist revenues)
- Health impact
- Environmental impact
- Protection of aesthetic values
- Sanctification of one's home

General assumptions about selfishness and ignorance of these opponents are often countered by on-field investigations, which show that active opponents are often more informed about the project proposals than passive supporters are⁷⁰ ⁷¹.

Beside NIMBYism, there are other types of resistance labelled with other acronyms such as *NIABY* ("Not-In-Anyone's-Backyard") or *BANANA* ("Build-Absolutely-Nothing-Anywhere-Near-Anyone"). They characterize the attitude of people who do not only reject a technology in the own area but reject it at all. They are systematic opponents to a kind of development regardless of its site based on concerns about the general consequences.

NIMBYism is also a revealing of anxiousness and the fear of the unknown. In practice, citizens already surrounded by such technologies show a better acceptance: In Germany, population living close to energy plants are 17 to 24% more likely to approve these technologies, compared to the total population. This phenomenon is also observed with conventional energy plants⁷².

⁷⁰ Fischer, F. (2000) - "Citizens, Experts and the Environment Drake"

⁷¹ Hieman, M. (1990) - "From Not in My Backyard!" to "Not in Anybody's BackYard!" : Grassroots Challenge to Hazardous Waste Facility Siting". American Planning Association Journal, Vol.56, Pt.3. p.359-361.

⁷² Fachagentur Windenergie an Land e.V. (FA Wind) (ed.) (2016): Umfrage zur Akzeptanz der Windenergie an Land – Herbst 2015. Ergebnisse einer repräsentativen Umfrage zur Akzeptanz der Nutzung und des Ausbaus der Windenergie an Land in Deutschland. Berlin.
https://www.fachagentur-windenergie.de/fileadmin/files/Veroeffentlichungen/FA_Wind_Umfrageergebnisse_Fruehjahr_2016.pdf

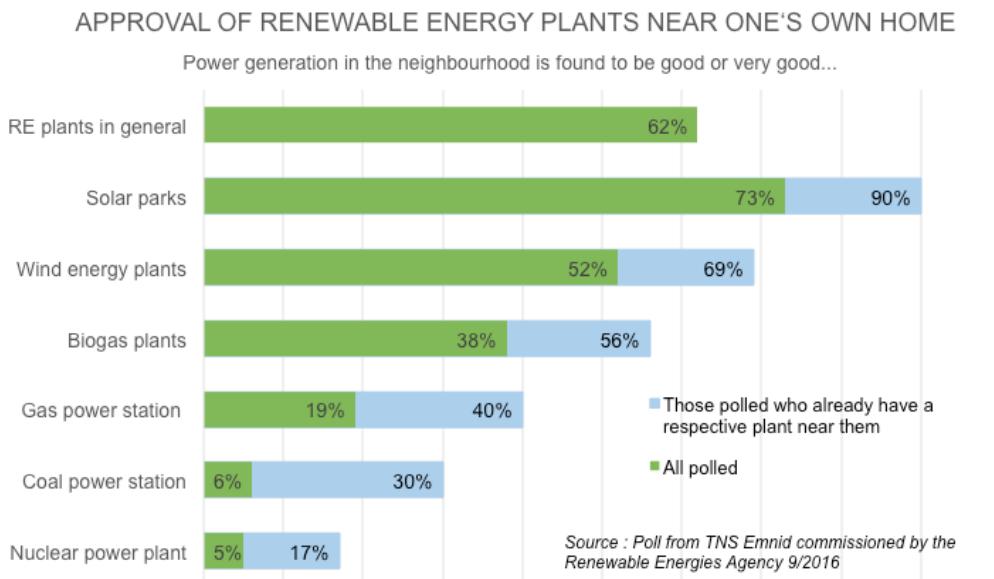


Figure 12: The Germans acceptance of nearby renewable Energy transition systems differentiated by their experiences with such⁷³

B.2 Smart grids and smart meters

B.2.1 Why Smart Grid?

In most countries, the concept of Smart Grids is getting increasingly significant, mostly driven by societal concerns such as reliability, cyber- and physical security of supply, transmission and delivery of energy, as well as climate change and aging assets. These concerns are expressed in terms of objectives such as those set by the European Union (EU) through the "Clean Energy for all Europeans" package⁷⁴ (cutting CO₂ emissions by 40% by 2030).

Making the consumer demand more responsive to the conditions of the power system is also needed in order to accommodate the anticipated changes brought about by larger development levels or renewable energy sources. As a result, a remarkable development of renewable energy sources has been observed worldwide, particularly for wind and solar energies. The plug-in hybrid and electric vehicles are also on the rise.

⁷³ AEE – Agentur für Erneuerbare Energien e.V. (ed.) (2015): Akzeptanz für Erneuerbare weiterhin hoch. RenewsKompakt, Ausgabe 27. Berlin.

https://www.unendlich-viel-energie.de/media/file/416.AEE_RenewsKompakt_Akzeptanzumfrage2015.pdf

⁷⁴ 2030 Energy Strategy, European Commission

<https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/2030-energy-strategy>

The vast majority of these sources are connected to the electrical grid, either to transmission (high voltage) or distribution (medium and low voltage). Electrical networks are undergoing tremendous changes to accommodate this evolution, that is in most cases very dynamic.

However, for some countries, a high percentage of wind and solar photovoltaic are located at the distribution level (covering 19,5% of the electricity production in Germany for the year 2016⁷⁵ up to 85% of it for some hours of May 2017⁷⁶) traditionally operated as a radial mode (unidirectional power flows) as little or no energy sources existed there in the past.

In fact, unlike transmission grids which are already “smart”, distribution networks have received far less attention in terms of “smart technologies”. However, with these ongoing changes, distribution networks are in the front line with the development of RES, electrical vehicles as well as end-users who are expected to play a more active role in this new energy paradigm. They are becoming “prosumer”, a contraction between the word “producer” and “consumer” of electricity.

Facing these changes requires the development and integration of technologies and energy services with IT and Telecom. The entire energy chain is at stake here: smart meters, demand response, storage, smart substations, self-healing, advanced observability and control functions, advanced communication and big data processing capabilities across the network etc.

Distribution companies and Distribution System Operators (DSOs) are facing unprecedented challenges in their network: they have to increase concerns of users of the network in quality of supply, fast development of new uses for energy supplies and effective management of aging electric utility assets occurring very often in an unstable regulation landscape. Citizens and user's acceptance is one of the main pre-requirements for developers, suppliers and DSOs to operate this network and energy management revolution.

With smart grids, citizens become key actors of the Energy transition.

⁷⁵ Umweltbundesamt, based on AGEE-stat data: <https://www.umweltbundesamt.de>

⁷⁶ Article “Germany Breaks A Solar Record — Gets 85% Of Electricity From Renewables”, Steve Hanley - Forum cleantechica.com

5.2.2 Smart meter: a key element for Energy transition

The rise of smart metering systems in Europe is fostered by the EU legislation. It is required that end users are provided with individual meters that are able to accurately reflect consumption and provide information of the actual time of use (80% of the customers must have a smart meter by 2020). Furthermore, they emphasize the adoption of smart meters as a tool both to enhance competition on retail markets and to foster energy efficiency.

Moreover, smart meters greatly contribute to the optimization of the network management: better fault identification ensuring faster interventions, detailed monitoring of power quality thus reducing the number of complaints, increasing capacity to act remotely in order to manage peak shaving programs, new tools to forecast constraints on the network and avoid local blackouts etc.

On the user side, smart meters allow to elevate the services related to power distribution to the same level as those prevalent in other sectors such as banking, telecom, etc. They have a significant influence on citizen daily life, including some related issues and risks:

Consumption awareness and feedback

With more detailed consumption data readily available, suppliers are able to offer citizens a series of information services, including a history of monthly consumption, consumption over the current period in euros and in CO₂ emissions... The customer benefits for more frequent information, alerts and personalized advices. With this information, citizens have a better control over their consumption profile and are able to decide when appropriate, to alter their consumption patterns.

Demand-side management and peak shaving

Demand side flexibility is based on the assumption that consumers are willing to engage in demand-response activities. Engaging customers require incentives and technologies (energy box for example). It is essential for demand-side flexibility to work effectively and deliver its full benefits, from basic passive techniques where the consumer has little to no control (load shedding and power modulation by the DSO) to more active techniques where the consumers take a hand-on role in determining the programs that they will

participate in. With the agreement of the customer, a supplier (or an aggregator) has the possibility to implement peak shaving programs. The consumer accepts to deter a certain level of consumption to another period of the day.

The peak shaving process can be remunerated. Peak shaving must be differentiated from load shedding and power modulation which aims to avoid local blackouts. With the French smart meter, it is possible, when needed in an urgency situation, to limit the capacity of each customer as an alternative to simply cut the supply. According to a survey conducted by *IFOP* in 2017⁷⁷, 87% of French citizens are ready to change their habits to adapt to the local renewable energy sources production which is possible through the use of smart meter.

Health risk and electromagnetic fields

The main potential health risk is related to the electromagnetic fields of the smart meters. To minimize this risk, national and European standards (in particular the recommendation of the EU relative to the limitation of public exposure to electromagnetic fields) fix an electromagnetic exposure limit to smart meters to be installed in both France and Germany. Electromagnetic emissions are also created by other technologies such as Bluetooth, 3G, WI-FI which use radio frequencies.

To answer this electromagnetic issue, the *Linky* system in France is operated with a Power Line Carrier technology (PLC). PLC communication uses a higher frequency, low energy signal, which is superimposed on the alternating electrical current at in the power network. Therefore, it does not use radio frequency emissions and the additional electromagnetic emissions are 24 to 200 smaller than the legal electromagnetic exposure limit (6.25 micro-Tesla) in the premises of customers, according to on-site measurement campaigns.⁷⁸

Data privacy

With the collection and transfer of individual energy consumption data between the smart meter and the DSO, the question about data privacy deserve to be

⁷⁷ Survey conducted on 1502 adults on February 2017 http://www.ifop.fr/media/poll/3661-1-annexe_file.pdf

⁷⁸ ANSES, (December, 2016): Expertise report "Exposition de la population aux champs électromagnétiques émis par les compteurs communicants" - Agence nationale de la sécurité sanitaire, alimentation, environnement, travail

asked. Even if only aggregated data are transferred, signal algorithms⁷⁹ enables to disaggregate and identify the different consumption usages. The time resolution of transferred data is here essential: by default, the *Linky* smart meter transfers only anonymized daily data, therefore without information about daily usages.

If the consumer wishes it and gives its written consent, he can receive or transmit to the supplier the load curve with a pace of 30 minutes. In Germany, smart meters in households are supposed to save data every 15 minutes for 24 months. However, even this high-resolution energy data can't be directly related with the building occupancy profile, since some appliances continue to work even though the customer is out, the water heater is charging during night time etc.

The French National Information and Freedom Commission (CNIL) has made extended audits of the *Linky* smart system and gave its recommendations⁸⁰.

Hacking risks

Lot of Internet of things devices show critical vulnerabilities in terms of hacking security and cyber-crimes, becoming a national security concern⁸¹. Therefore, hacking risks related to smart meters, with possibility to control remotely critical home appliances in the worst case, must be taken very seriously. Smart meters in France must be in full compliance with the security referential certified by the Security Agency *ANSSI* (*Agence Nationale de Sécurité des Systèmes d'Information*). Data must be in particular fully encrypted.

Costs and savings

Investment costs of a smart meter are related to hardware and its installation. Some data analysis or management services may be additionally paid by the user. The replacement of a conventional energy meter with a smart meter leads to different type of savings for the operators and users: since the meter reading and most services are done remotely, the operator on-site working hours reduce

⁷⁹ SmartX® from the company Smart impulse for instance <http://www.smart-impulse.com/en>

⁸⁰ CNIL (November, 2017) : "Linky, Gazpar : quelles données sont collectées et transmises par les compteurs communicants ?"
<https://www.cnil.fr/fr/linky-gazpar-quelles-donnees-sont-collectees-et-transmises-par-les-compteurs-communicants>

⁸¹ Public Service Announcement of US Department of justice (September, 2015) "Internet of Things Poses Opportunities for Cyber Crime"

dramatically. For the users, the subscribed power can decrease due to the peak shaving capability of smart grids, leading to a cheaper energy contract. Finally, smart meters would also lead to energy savings, in particular due to its real-time feedback capabilities. According to the results of the pilot projects *NiceGrid* (see text frame in B.2.4), residential users tend to realize an average of 20% energy savings and 10% for industrial customers.

In France, the development, deployment, and installation costs (five billion Euro for 35 million smart meters) are totally taken in charge by *Enedis*, which can amortize them thanks to the technical service savings previously mentioned.

B.2.3 Smart meter deployment, a two-tier approach between France and Germany

The comparison of smart meter deployment strategies in France and Germany is a very telling example of the two antagonistic ways to lead the Energy transition at the political level in these countries (see part A): A "Grand Projets" approach in France coordinated and financed by a state-owned company (*Enedis*) versus a softer deployment in Germany led by the private sectors and the citizens, where the role of the federal state is limited to legislate and foster.

As a consequence, the path of these deployments is very different: *Enedis* planned to replace all classical meters by the end of 2021, whereas this should last until 2032 in Germany. Investment and business models are also radically different.

Linky, the French industrial deployment strategy

In France, a generalized smart meter deployment strategy has been decided by *Enedis*, the public-owned DSO company *Enedis* in charge of the power distribution over 95% of the French territory, and backed by the French government⁸².

This five billion Euro program (development, deployment, installation) holds the name of the yellow smart meter which should replace until 2021 all actual electricity meters: *Linky*. *Enedis* is responsible for the roll out of all 35 million smart meters in France, mandatory for all households. The smart meter *Linky* is considered as the first "brick" of smart grids for the low voltage network. It

⁸² French Law n° 2015-992 of August 17th 2015 related to the Energy transition and green growth <https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000031044385&categorieLien=id>

should facilitate the data collection and distribution from smart metering for billing, switching and balancing purposes.

The objective of the deployment is threefold: allow the maximum number of customers to use *Linky* services as soon as possible, accompany territories in their development projects, look for technical and economical optimum at a whole for the customers.

Meters are simultaneously deployed in all regions, following a leopard zones logic to progress as quickly as possible in each region, develop local jobs, and favor continuity of the working load.

The *Linky* program started in 2006 before DSOs even existed. More than 100 meetings were held with the French regulator (*CRE*) and many other market participants. Meetings were organized also at the local level in villages and territories to present and discuss the *Linky* project with the population. A role of ambassador was created for young people and students to attend street markets and other public places and present the project, especially in rural areas.

A pilot project both in rural and urban areas was launched with 300 000 meters in 2010 and followed by the generalization decision. The deployment is progressive in order to secure the planning, give visibility and capability to adapt to the manufacturers and subcontractors. In January 2018, more than 8 million meters have been already rolled out. Replacement volumes are at their highest in the middle of the period (8 million meters per year in 2018 and 2019) and then decrease until 2021 when 90% of the total is reached (32 million meters on a total of 35 million are considered as accessible). So far around 0.6% of the deployment has been slowed down by oppositions⁸³

A gradual liberal deployment in Germany

Germany puts a great emphasis on the expansion of the grid. New power lines, substations and converter stations are planned as well as the reinforcement of power lines. One project is for example the corridor called *SuedLink*. Its high voltage direct current transmission lines aim at bringing the electrical energy generated by wind energy mainly installed in northern Germany to the southern

⁸³ La Tribune (February, 2018) : "Le compteur Linky ne tient pas ses promesses"
<https://www.latribune.fr/entreprises-finance/industrie/energie-environnement/le-compteur-linky-ne-tient-pas-ses-promesses-767572.html>

regions of Germany which have a high energy demand⁸⁴. Smart grids are not realized at great scales yet but only in a few pilot projects (e.g. micro-grids limited to a small area such as a parking garage). In this context, smart meters represent an interface between customers and supplier enabling to improve services and concurrence, rather than a necessary “brick” of smart grids.

Since the Federal Council passed the law on the digitalization of the Energy transition in July 2016⁸⁵, the transformations to smart grids and the installation of “advanced” meters in households are on the agenda. Firstly, remote measuring systems are exchanged in buildings with own renewable energy generation installation bigger than 7 kW_{peak}, as well as buildings with an electricity consumption over 6 000 kWh per year. From 2020 until 2032, all other meters shall be exchanged by smart meters in Germany⁸⁶.

The exchange of the meters shall be done by the net operators - not energy suppliers. After three years, every net operator has to have verifiably exchanged 10% of the meters. An authorization from home owners is not necessary for the exchange.

Contrary to France, citizens have the freedom to choose the smart meter they want among those developed by private owned companies, as well as the market party having access to their data. However, in practice, the number of certified communication unit manufacturers, called gateways, is currently very limited, which causes delay in the roll-out of smart meters. These gateways are central components that collect, save and process data. The law makes mandatory to have three independent manufacturers of these gateways

B.2.4 Citizen perceptions and acceptance

The population knowledge about smart grids, smart meters and their possibilities is currently very low both in France and Germany. Like for other new technologies, the fear of the unknown, combined with a relative disinterest

⁸⁴ Bürgerdialog Stromnetz GbR (ed.) (2017): Netzausbau vor Ort. Dialog in den Regionen. Berlin. <https://www.buergerdialog-stromnetz.de/assets/Downloads/BDS-Netzausbau-vor-Ort-Dialog-in-den-Regionen.pdf>

⁸⁵ Gesetz zur Digitalisierung der Energiewende vom 29. August 2016. Bundesgesetzblatt Jahrgang 2016 Teil I Nr. 43, ausgegeben zu Bonn am 1. September 2016

⁸⁶ Bundesanzeiger (ed.) (2016): Gesetz zur Digitalisierung der Energiewende. Bundesgesetzblatt Jahrgang 2016 Teil I Nr. 43. Bonn. https://www.bmwi.de/Redaktion/DE/Downloads/Gesetz/zur-digitalisierung-der-energiewende.pdf?__blob=publicationFile&v=4

of the population for smart grids, leads to a significant number of opponents (70% of the German population is opposed to the replacement of its electricity meter with a smart meter⁸⁷, while 1% of French mayors, pushed by some of their citizens, signed a decree to prevent their installation).

The chosen deployment strategy, fast and mandatory in France versus soft and more gradual in Germany, may also exacerbate the oppositions, in particular the defenders of conspiracy theories or other persons which distrust public authorities. Thus, debates about *Linky* in France become sometimes passionate, leaving rational arguments aside.

Main acceptance motivations differ also from France to Germany: Expected financial gains and the opportunity to act collectively as a smart-grid are mentioned first by French citizens, whereas technology-related aspects like design, usability, feedback and visualization are of first interest for most German citizens.

In France

Several pilot projects ran locally during the last years to test the technical solutions as well as the population acceptance issues.

Even if it is well received by the green involved citizens, it sparked off a big public debate mixing the deployment campaign issues with the system operation itself. A number of citizens, among which several mayors, did oppose the deployment of *Linky*. In February 2018, 1% of French municipalities⁸⁸ had signed a decree preventing *Linky* meter installations on their territory, following a vote of their council. These votes were considered as illegal by different courts⁸⁹.

Many of these opponents put forward precautionary principles related to this new technology, and in particular the effect of its electromagnetic emissions and the risk of cancer. Some persons say to have an extreme sensitivity to power emissions due smart meters. Even if laboratory and on-site

⁸⁷ Verbraucherzentrale Bundesverband (2015): Bevölkerungsumfrage zum Thema Smart Meter. Berichtsgrafiken. TNS Emnid.

https://www.vzbv.de/sites/default/files/downloads/Umfrage-SmartMeter-Grafikreport-TNS_Emnid-vzbv-2015.pdf

⁸⁸ POAL: " Les communes qui ont refusé le compteur Linky"

<http://www.poal.fr/appfree/carte-france-communes-refus-anti-non-linky.html>

⁸⁹ ERD (2015): "Les textes juridiques encadrant le déploiement de Linky"

http://www.vaucluse.gouv.fr/IMG/pdf/Normes_et_textes_juridiques.pdf

electromagnetic measure campaigns have been previously performed by the *Agence Nationale des Fréquences* ANFR in May 2016⁹⁰ and the ANSES⁹¹ (*Agence Nationale de Sécurité Sanitaire*), ruling out any potential risk, this belief remain important in the population. When it comes to "religious" belief, it is particularly difficult to debate and bring scientific arguments such as: "Linky uses PLC to transfer data which is a wire technology, thus with hundred to thousand times less volumes of emissions than radio technologies such as WIFI or cellular phones"⁹².

Few negative experiences with a presumed relation to the *Linky* smart meter (not confirmed by *Enedis*), such as 10 starts of fire in France during the last months⁹³, reinforce the fear of some citizens about this technology.

Another worry about smart meters consist in data privacy and hacking issues. As mentioned earlier both the CNIL and the ANSSI have set recommendations to guarantee the customer both with protection of his personal data and security of the system. *Enedis* has implemented them. Nevertheless, "Big brother will spy you at your home" is still a conspiracy mentioned by opponents like Stephane Lhomme.

This is not only *Linky*, but many other societal developments as a recent poll published on January 7th, 2018 by the *Foundation Jean Jaurès* and *Conspiracy Watch*⁹⁴ which is showing the growing echo of conspiracy thesis and the distrust vis a vis the democratic structures. In particular public health is a field where distrust is highest vis a vis the government and the public authorities.

Finally, the cost of the project is another cause of opposition, even though it is fully supported by *Enedis*. Some persons believe they will still have to sign a check when they have the new meter or tariffs will increase. There is still a confusion between the tariffs for Transmission and Distribution (T&D, regulated) and the cost of kWh (suppliers, deregulated). Customers have

⁹⁰ ANFR (2016): "Rapport technique sur les niveaux de champs électromagnétiques créés par les compteurs Linky" https://www.anfr.fr/fileadmin/mediatheque/documents/expace/2016-05-30_Rapport_technique_compteur_vdef2.pdf

⁹¹ ANSES (June, 2017): "Exposition de la population aux champs électromagnétiques émis par les « compteurs communicants »" <https://www.anses.fr/en/system/files/AP2015SA0210Ra.pdf>

⁹² 60 Millions de Consommateurs (June, 2016): "Faut-il avoir peur de Linky ?" <https://www.60millions-mag.com/2016/06/15/faut-il-avoir-peur-de-linky-10483>

⁹³ TV-show "C Politique" - Emission "La France anti-Linky" on January 18th of 2018

⁹⁴ Ifop pour la Fondation Jean-Jaurès et Conspiracy Watch (December, 2017): "Enquête sur le complotisme" https://jean-jaures.org/sites/default/files/redac/commun/productions/2018/0108/115158_-_rapport_02.01.2017.pdf

difficulties to tell which part of their bill is affected with any announcement of tariff increase.

Facilitating citizens acceptance needs pedagogy, permanent efforts in the fields and modesty. Big companies, in particular in the energy field, are perceived as arrogant, anti-citizens, and promoting their own interests whereas local associations (such as *Robin des Toits*, derived from "Robin des Bois", literally "Robin Hood") develop false or partial truth arguments with more credibility.

Acceptance is also a matter of potential benefits for the citizen: smart meters are a tool for implementing the ecological transition. They are necessary for the deployment of renewable energy sources, for self-generation, for micro-grids, for energy efficiency, for electric vehicle, etc. Consumers can receive a real time signal from the meter, have a better awareness on their consumption and act on their behavior to reduce their consumption. It is specially adapted to "fuel poors" who have problems to manage their power consumption (about 5 million people in France).

On February 7th, 2018, the French *Cour des Comptes* released its annual report⁹⁵. A specific point is made on *Linky* emphasizing that "gains from *Linky* are inadequate for the consumer". The report estimates that *Linky* does not provide the consumer with enough information regarding his consumption. The Court deplores a "mismanagement" from the State and *Enedis* in terms of communication. Studies on health or data privacy were published too late to the public.

⁹⁵ Cour des comptes, Rapport public annuel 2018 (February, 2018): "Les compteurs communicants Linky : tirer pour les consommateurs tous les bénéfices d'un investissement coûteux"
<https://www.ccomptes.fr/sites/default/files/2018-01/07-compteurs-communicants-Linky-Tome-1.pdf>

The GreenLys Project in Lyon and Grenoble was a showcase of the city of tomorrow based on RES and Energy efficiency solutions tested with 400 consumers. The project was developed in a cooperative mode with 13 partners including local authorities and associations for a total cost of 43 million euros.

Although 1 000 customers were originally foreseen, only 400 volunteers accepted to test the smart meters which was implemented at no cost in the premises of the customers. The reasons of this relative lack of interest from the population are manifold: the global purposes and features of this technology (peak shaving) are complex to understand for non-professional. The perceived constraints were also more numerous than the expected benefits. It is important to work on a global energy service, not only dealing with the cost.

This project retrieved the 4 main user categories already detailed previously by specialists: greenophiles, technophiles (enjoying new technologies, despite their risks and drawbacks), energophiles (passionate on the energy topic) and econophiles (willing to make economy). Conclusions in terms of citizen acceptance were probably biased by the fact that customers embarked in the project were mainly part of these enthusiastic categories. However, the project also demonstrated a clear profitability of demand response and peak shaving solutions in the context of an urban zone with Linky.

Nicegrid is another pilot project at the South of France (Carros). 300 residential and 11 industrial consumers become prosumers generating and storing their own power. Local authority of Carros did participate into the project with the modulation of street lighting during peak hours. New technologies include the Linky Smart Meter, storage facilities and new prediction algorithms.

During peak hours participants have been encouraged to limit their consumption from 6 to 8 pm and to test the flexibility of their electric heating system. Results show a drop of power consumption: 20% for residential and 10% for I&C (10MW) consumers.

The two major reasons for customers to engage into the project were the expected financial gains and the opportunity to act collectively.

86% of residential customers participant to the tests in summer (solar bonus, smart water heater, PV and battery solutions) have a positive opinion: they consider their involvement as interesting, preparing for the future and with few constraints. 94% of residential customers participating to the tests in winter (voluntary gains, electric heating monitoring) have a positive opinion: they consider that their participation was useful for the region and easy to do.

In Germany

Among the German population, many citizens see the necessity to expand and transform the electricity grid but there are also skeptical voices about its expansion and transformation to smart grids⁹⁶ : required area, technology transfer technology, health risks and financial compensation are major aspects of discussion about grid expansion. Instead of large direct current cables, many citizens favor local solutions for the energy supply. Alternative solutions as storage systems and decentralized supply systems are also often suggested⁹⁷.

⁹⁶ Konrad, W.; Scheer, D. (2014): Das Smart Grid aus gesellschaftlicher Perspektive. InnoSmart-Arbeitsbericht 02. Stuttgart.

⁹⁷ Bürgerdialog Stromnetz GbR (ed.) (2017): Netzausbau vor Ort. Dialog in den Regionen. Berlin.
<https://www.buergerdialog-stromnetz.de/assets/Downloads/BDS-Netzausbau-vor-Ort-Dialog-in-den-Regionen.pdf>

Knowledge about smart grids and smart meters is still very low in wide regions of Germany⁹⁸. Only a third of the participants say to have heard about that topic. The numbers are gender- and education-dependent. More than twice as much men than women had heard about it and the higher the formal educational level, the better known is the topic.

An interview with Melanie Peschel, who contributes in a demonstrating project called C/sells, reveals that the citizens' knowledge and interest depend also on their residence status. In Munich, for example, where lots of citizens are tenants and can't decide about the installation of energy saving facilities, people are less interested in discussing this topic than people from rural areas living in their own houses.

Partly due to this lack of knowledge and fear of the unknown, seven out of ten German citizens oppose the replacement of all electricity meters to smart meters and want to decide about their meter on their own, while only 21% think this replacement benefits the Energy transition⁹⁹. Smart grid technologies are rated by numerous consumers as tools to control their loads and collect their private data.

Remaining in the full control of the technique and data streaming and being able to manually operate devices is indeed essential for them^{100 101}. Suspicion prevails especially against smart meter manufacturers and energy providers. These systems are also seen as complicated and error-prone by a large part of the population. Nevertheless, almost three-quarters of the population present a willingness to use smart meters at the conditions that they are enough informed and reassured. Significant citizen acceptance aspects are aesthetics, usability, feedback and visualization. For instance, an appealing and easily operable design is wished by most of customers.

⁹⁸ Hitschfeld Büro für strategische Beratung GmbH (ed.) (2017): Akzeptanz von Technik und Technologie. Welle 1/2017: "Smart Meter - Smart Metering".
http://www.hitschfeld.de/wp-content/uploads/2017/04/20170331_Studie_Akzeptanz_2017_Welle_1.pdf

⁹⁹ Verbraucherzentrale Bundesverband (2015): Bevölkerungsumfrage zum Thema Smart Meter. Berichtsgrafiken. TNS Emnid.
https://www.vzbv.de/sites/default/files/downloads/Umfrage-SmartMeter-Grafikreport-TNS_Emnid-vzbv-2015.pdf

¹⁰⁰ Appelrath, H. J.; Kagermann, H.; Mayer, C. (ed.) (2012): Future Energy Grid. Migrationspfade ins Internet der Energie (acatech STUDIE). Springer Verlag. Berlin, Heidelberg. doi:10.1007/978-3-642-27864-8

¹⁰¹ Konrad, W.; Scheer, D. (2014): Das Smart Grid aus gesellschaftlicher Perspektive. InnoSmart-Arbeitsbericht 02. Stuttgart.

The C/sells project

C/sells is a pilot project on smart grids conducted in Germany since 2017. The project is funded by the Federal Ministry for Economic Affairs and Energy with 50 Mio. € until 2020. Further partners from industry, science and economy support the project by another 50 Mio. €. An intelligent and decentralized energy supply system based on renewable energies is implemented in 10 spatially defined "cells" in southern Germany. These "cells" are cities, quarters or single objects as airports, which differ in their nature and structure. In these autonomously acting cells the usage and supply of electricity, heat, gas, and mobility is optimized. These cells are also connected and can interact flexibly with each other. The development of user interfaces as applications for smartphones and websites to offer and demand flexibilities is pursued.

Beside the cellular approach, the project also operates participatively. The aim is to motivate all kind of actors (citizens, private and industrial customers, etc.) to actively participate in the project and therefore in the Energy transition. Experts accompany these beta users with regard to integration, acceptance and motivation, analyze data regarding their knowledge, reservation, and openness, and examine further possibilities and incentives for citizen participation. A new district of Fellbach near Stuttgart is one of this demonstration cell: newly built houses are equipped with charging stations for electric vehicles, creating micro-grids. Charging habits, impact of mutual charging and willingness to change to a behavior that benefits to the grid balance are investigated.

Within the project, citizens from the different cells are also invited to group sessions to talk about the future of energy. First results from such group sessions show, that many people do not have great knowledge about smart grids and its possibilities. Other topics that are currently more present in everyday life as organic food or the change from car to bicycle area of greater interest. Since there is a lot of uncertainty, there is also a lack of trust regarding data security. Active supporters demand above all personal advantages.

B.3 Wind turbine installations

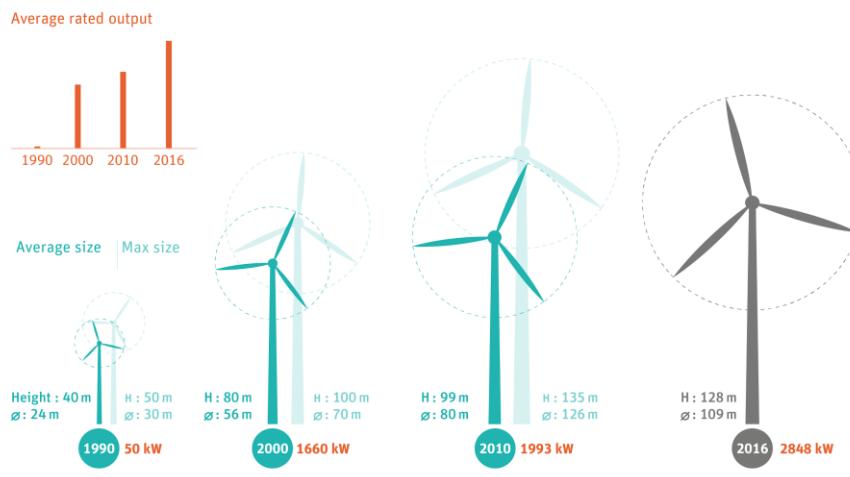
B.3.1 Wind energy projects

A wind turbine uses the kinetic energy from the wind to generate electric power. Wind turbines inland are called onshore, the ones in the ocean are called offshore wind turbines. Usually, they are built in wind parks where several turbines are operated in close proximity.¹⁰² Wind turbines installed nowadays are in average 128 meters high with a diameter of 109 meters for a capacity of 2.8 MW. This is 60 times more powerful than the wind turbines installed at the beginning of the wind energy growth in 1990.

Wind turbines 50 times more powerful today than 20 years ago

Development in size and power of wind turbines, 1990–2016

Source: DEWI



Energy Transition energytransition.org

Figure 13: Evolution of wind turbines' average size and capacity from 1990 to 2016.
Source: www.energytransition.org.

At the beginning of a wind energy project an eligible place is identified. The eligibility depends on the wind potential and the surrounding. Natural protected area is avoided (information often available on Geographic Information System, like in Baden-Württemberg¹⁰³). Then, it takes about one year to measure the local wind speed, to observe the local species and to assess environmental

¹⁰² Hirzel, S. (ed.) (2017): Energiekompendium. Ein Nachschlagewerk für Grundbegriffe, Konzepte und Technologien. Fraunhofer Verlag. Stuttgart.

¹⁰³ Web portal of the Regional Environmental Office of Baden-Württemberg (LUBW) : <http://www.energieatlas-bw.de/wind>

impacts. If these study results seem compatible with the installation of a wind park, an application for authorization is submitted to the relevant authorities.

Depending on the appeals of opponents¹⁰⁴ and the authorization process, a wind energy project, from the first meetings to the implementation, may last two to four years in Germany, and up to eight years in France.

The Figure 14 presents a timeline of a typical wind energy project in Germany.

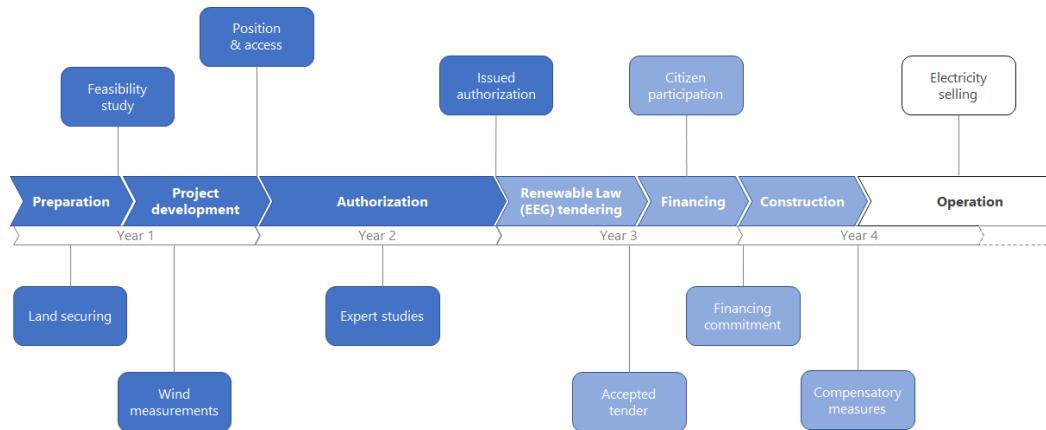


Figure 14: Typical project planning in Germany - inspired by website
www.windenergie-oberes-elztal.de

In France in comparison, three years would typically separate the building permit application ("*demande de permis de construire*") to the accepted authorization ("*Installation Classée pour la Protection de l'Environnement*") in the case of a wind energy project without appealing process. If the building permit application is contested, the appealing process would generally lead through the Administrative Tribunal, the Appealing Administration Court the "*Cour Administrative d'Appel*" and finally to the Council of State ("*Conseil d'Etat*"), blocking the project during 6 to 8 years.

As a result, and because of a later and more hesitant start of wind energy in France¹⁰⁵, Germany counted four times more installed wind energy capacity than France at the end of 2016 (50 GW against 12 GW in France¹⁰⁶).

¹⁰⁴ Newspaper Capital (Juilly, 2014): "L'éolien citoyen anecdotique en France, moteur en Allemagne"

¹⁰⁵ Boston Consulting Group (BCG), 2004. Donner un nouveau souffle à l'éolien terrestre, développement de l'éolien terrestre en France. Syndicat des énergies Renouvelables.

¹⁰⁶ Global Wind Energy Council - Global Wind Statistics 2016

Wind energy is a mature technology which has been already deeply investigated in the last decades. Its environmental influences are known, well characterized and controlled:

- **Sound emission:** Wind turbines generate aerodynamic and mechanical noise during their operation, in particular in the infrasound frequencies. The level of sound emissions depends, for instance, on the tip speed. For the approval of a wind turbine, a sound survey is required. This ensures compliance with the required limits. Limit values differ between day to night and are dependent on the site. In addition, a minimum distance between wind turbines and habitation is officially fixed (500 meters in France¹⁰⁷, between 500 and 2 000 meters in Germany depending on the Federal states)
- **Shadow casting:** The shadow casting of the wind turbine is stationary or periodically depending on the operating state. Periodic shadowing is caused by the rotating rotor blades and can lead to adverse effects on the environment. To get a construction permission in Germany as in France, the maximum shadow cast by wind turbines may not affect a surrounding building for more than 30 hours per year and 30 minutes per day^{107 108}.
- **Disco effect:** Disco effect describes the reflection of light on the surface of the rotor blades. Depending on the position of the sun, the surrounding might be affected. Modern rotor blades are covered with a dull color, so reflection is reduced, and disco effect is hardly noticeable.
- **Bird strike:** The collision of birds and bats with the rigid and moving components of a wind turbine is called bird strike. Usually, those animals avoid regions around a wind turbine because of the generated sound emissions. The risk of collision, however, increases especially for migratory birds due to bad weather conditions and the emergency lighting of wind turbines, which may cause birds to be attracted. As a consequence, flight routes of migratory birds and nature reserves are preventively taken into account when choosing the location for new wind turbines.¹⁰⁹

The wind turbine planning companies have understood that citizen communication is a key in a wind turbine project. Parallel to public investigations, officially called "*enquête publique*" in France and lasting legally

¹⁰⁷ Arrêté du 26 août 2011 relatif aux installations de production d'électricité utilisant l'énergie mécanique du vent au sein d'une installation soumise à autorisation au titre de la rubrique 2980 de la législation des installations classées pour la protection de l'environnement

¹⁰⁸ Defined by Working Group on Light Emission of the German Air Pollution Control Committee

¹⁰⁹ Hirzel, S. (ed.) (2017): Energiekompendium. Ein Nachschlagewerk für Grundbegriffe, Konzepte und Technologien. Fraunhofer Verlag. Stuttgart.

one month, companies often organize public exhibitions in the council and public exchange meetings (which often attract mainly pensioners and project opponents). Sometimes also, on-site walks with ecologists are planned to discuss about environmental impacts of future wind turbines on the local fauna and flora, while children of the neighborhood are offered to participate in Do-it-yourself workshops to build paper wind turbines and to learn playfully about the main principles.

B.3.2 Acceptance of wind energy

Wind energy is a mature technology which benefits from a high level of acceptance among the general European population. Acceptance rates in France and Germany are very similar, reaching 77 to 81% depending on the latest surveys. In both countries remain however a core of resistant individuals, representing approximately 5% of citizens. Some of them structure in organizations which struggle and appeal against wind farms. Although these organizations exist in both side of the Rhine, their nuisance impact on wind energy projects seems to be stronger in France.

In France

According to a survey realized by the French Public Opinion Institute IFOP in 2016¹¹⁰, three quarters of the French population has positive or very positive opinions on wind turbines, without sensible differences between wind turbine neighbors and the others (75% against 77%). Only 7% have a bad opinion, while half of the wind turbine neighbors have a very positive opinion about them.

¹¹⁰ French Public Opinion Institute IFOP realized in 2016 a qualitative (25 interviews) and quantitative survey (1500 answers) on wind turbine acceptability in France among the entire population, wind park neighbors and elected representatives <http://fee.asso.fr/actu/etude-ifop-2016-lacceptabilite-de-leolien/>

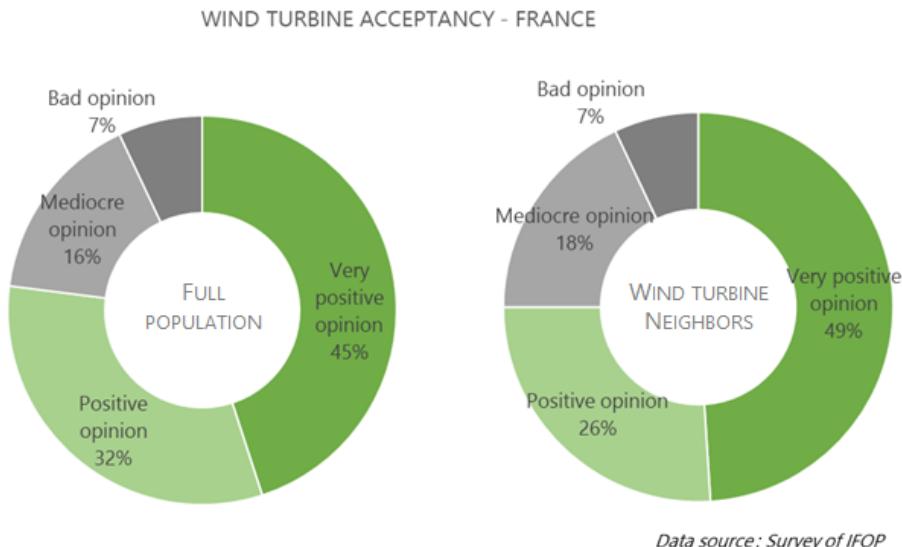


Figure 15: Acceptation of wind turbines among the French population in 2016.

Wind turbines are generally more accepted in rural areas (85% against 70% for cities over 100 000 inhabitants¹¹¹), where they are an important economical factor of development.

Different categories of reactions and behaviors among the wind park neighbors have been observed:

- The **Indifferent (44 %)**. They represent almost half of the population. Even if they may have been anxious initially, their fears have left them while wind turbines have been installed. Without loud defending wind energy, they are fully used to the situation. Wind turbines haven't entered their everyday life, they never discuss about them.
- The **Confident and convinced (34 %)**. Their proportion even grows to one half among the population which have been well informed early in the project. They are extremely positive about wind energy in general, and are convinced of the development of renewable energies. They do not feel any disturbances from the wind turbines.
- The **Enthusiastic (8 %)**. Their proportion is doubled among the population which have been well informed early in the project. Some of them become attached to "their" wind turbines, rambling among them in family
- The **Annoyed (8 %)**. Their irritation comes generally from an inappropriate project implementation (generation of degradations during

¹¹¹ Commissariat au développement durable (April, 2013). Baromètre d'opinion sur l'environnement et le climat.

the building phase, feeling of saturation). They refer generally to noise disturbances and redoubt a loss of their house value. They feel also an injustice, comparing their inconvenient situation with the benefits that other harvest. The most radical of them create often more noise than the 75% satisfied people.

- The **Anxious (2 %)**. They are extremely few, and become either convinced or annoyed while the wind energy project is realized.

Globally, a majority of wind park neighbors observe that the wind turbine impact on their everyday life is very low or non-existing, even if the visual impact remains a regularly mentioned negative point. The economic dimension of the wind turbine implementation is important to the local population but they rarely perceive the related local incomes and employments.

In Germany

In spring 2016, nearly 27 800 onshore wind turbines were installed in Germany¹¹², which means one per 3 000 inhabitants in average (against one per 10 000 inhabitants in France). As a consequence, a high proportion of the population, 39 % according to the *Fachagentur Windenergie an Land*¹¹³, has a wind turbine in their "direct neighborhood". This proportion goes up to 54 % in the northern regions where this technology is an important economical factor of development.

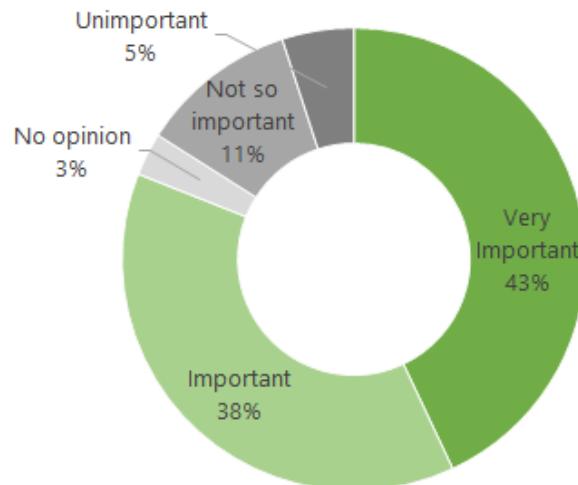
The expansion of onshore wind energy is widely accepted in the German society (second most supported renewable technology after solar roof systems). According to a survey conducted by the *Fachagentur Windenergie and Land* in 2016 with a number of 1 000 persons, 81% of the population have a positive picture about wind turbine technology, whereas only 5% are against it, reflecting the acceptance levels of France.

¹¹² Federal Institute for Research on Building, Urban Affairs and Spatial Development (November, 2016): "Wind energy in Europe 2016"

<https://www.bbsr.bund.de/BBSR/EN/SpatialDevelopment/SpatialDevelopmentEurope/AnalysesSpatialDevelopment/Projects/wind-energy-2016/wind-energy-node.html>

¹¹³ Fachagentur Windenergie an Land e.V. (FA Wind) (ed.) (2016): Umfrage zur Akzeptanz der Windenergie an Land – Herbst 2015. Ergebnisse einer repräsentativen Umfrage zur Akzeptanz der Nutzung und des Ausbaus der Windenergie an Land in Deutschland. Berlin.
https://www.fachagentur-windenergie.de/fileadmin/files/Veroeffentlichungen/FA_Wind_Umfrageergebnisse_Fruehjahr_2016.pdf

WIND TURBINE ACCEPTANCY - GERMANY



Data source : Survey of ifosa, contracted by Fachagentur

Figure 16: Acceptation of wind turbines among the German population in 2016.

Another similarity with the French population: the higher the age and the lower the environmental awareness, the smaller is the support.

83% of young people (18-29 years old) say to have nothing against a wind turbine in their direct neighborhood, compared to 73% of the entire population. The acceptance is even higher in northern Germany, where the most wind turbines are installed¹¹⁴. Regarding sex, education and income, there are only poor differences¹¹⁵. An environmental psychological study shows that the perception of wind turbines is very subjective and often related to emotions¹¹⁶. The support of nearby wind turbines increases with previous experiences, which indicates that pre-existing doubts and suspicions of residents are usually not confirmed.

¹¹⁴ Fachagentur Windenergie an Land e.V. (FA Wind) (ed.) (2016): Umfrage zur Akzeptanz der Windenergie an Land – Herbst 2015. Ergebnisse einer repräsentativen Umfrage zur Akzeptanz der Nutzung und des Ausbaus der Windenergie an Land in Deutschland. Berlin.

https://www.fachagentur-windenergie.de/fileadmin/files/Veroeffentlichungen/FA_Wind_Umfrageergebnisse_Fruehjahr_2016.pdf

¹¹⁵ Kress, M.; Landwehr, I. (2012): Akzeptanz Erneuerbarer Energien in EE-Regionen. Ergebnisse einer telefonischen Bevölkerungsbefragung in ausgewählten Landkreisen und Gemeinden. Diskussionspapier des IÖW. Berlin.

https://www.ioew.de/uploads/ttx_klioewdb/IOEW_DP_66_Akzeptanz_Erneuerbarer_Energien.pdf

¹¹⁶ Schweizer-Ries, P. (2008): Akzeptanz Erneuerbarer Energien und sozialwissenschaftliche Fragen. Projektabschlussbericht. Otto-von-Guericke-Universität, Magdeburg. doi:10.2314/GBV:612638286

Among the population with a wind turbine in the direct neighborhood, almost half assesses that these wind turbines give a positive image to their municipality, whereas 23% find that this image is rather negative¹¹⁷. Nearly every fifth of them thinks the rotor threatens bird strike and nearly every sixth is bothered about the sight of the turbine. Sound emissions and flashing lights disturb less in comparison¹¹⁵.

B.3.3 Organized oppositions to wind energy

In Europe, a social gap between the mentioned high levels of citizen acceptance for wind energy, and the low success rate in wind capacity planning applications is observable. In United Kingdom for instance, 80% of the population supports wind energy, but only 25% of contracted wind power projects are actually commissioned¹¹⁸.

The main reason for this gap comes from a minority of wind project opponents with a high nuisance power. These opponents may come from "inside" the project development area, among the local population affected by the project, or "outside", from regional or national associations. These often-self-called ecological associations are convinced of the necessity of a diminution of greenhouse gas, but invoke the defense of local species and biodiversity (insects, birds) to struggle locally against wind turbines.

These associations of opponents act at a regional level (for instance in the Black Forest in Germany) or even at a national level (like *Vent de colère*¹¹⁹ or *Fédération Environnement Durable* in France). Their strategy consists in systematically appealing authorizations of new Energy transition projects, setting a confrontation atmosphere in public concertation meetings, and trying to convince the local population against the project. They use for this purpose well-tested speech or flyers mostly based on the emotional register, which answer directly the worries of citizens.

¹¹⁷ Fachagentur Windenergie an Land e.V. (FA Wind) (ed.) (2016): Umfrage zur Akzeptanz der Windenergie an Land – Herbst 2015. Ergebnisse einer repräsentativen Umfrage zur Akzeptanz der Nutzung und des Ausbaus der Windenergie an Land in Deutschland. Berlin.

https://www.fachagentur-windenergie.de/fileadmin/files/Veroeffentlichungen/FA_Wind_Umfrageergebnisse_Fruehjahr_2016.pdf

¹¹⁸ Bell, D. Gray, T & Haggett, C. (2005). 'Policy, Participation and the 'Social Gap' in Wind farm Siting Decisions' Environmental Politics Vol 14, no.4 p460-477

¹¹⁹ Website of association "Vent de Colère" (January, 2018): <http://www.ventdecolere.org>

The *Fédération Environnement Durable*, which regroups 1 050 local associations according to its website, provides for instance guidelines to struggle against wind energy projects¹²⁰. These guidelines combine scientific, medical and economic statements in order to convince the local population of the harmful effect of wind turbines:

Example of Flyer

Fully useless and even harmful for CO₂ emissions: France is the European country with the lowest CO₂ emissions per kWh electricity, and does not need wind energy neither for its electricity, nor for its CO₂. In France, transports and domestic consumption are the true CO₂ emitters, not electricity. The new coal harbors of Le Havre and Cherbourg will be essentially used to feed coal plants that we'll be built for the mandatory support of wind energy, and that will emit millions of tons of CO₂

They will ruin our life during 20 years, because of their **noise**, their **infrasound**, the **stroboscopic effect** of their blades against the sun, **etc.**: There is a reason why the *Académie de Médecine* recommends a minimum distance of 1500 m from habitations (recommended but never applied!)

There are true "**tourist scarecrows**". Everywhere where wind turbines are installed, a tourist desertion is observed, leading to a negative impact on tourist and economic activities.

Disastrous for real estate. All recent tribunal judgements confirm a 10% to 50% loss in value for houses distant of less than 2 km from wind turbines. For the village X, this represent a total loss of Y million euros. Moreover, as soon as wind turbines are installed somewhere, new constructions slow down.

Municipal incomes already went down since the removal of the Professional Tax. All incomes from wind energy go to the council community and department. Municipalities have now only the drawbacks. Actually, **wind turbines make rich the developer and a handful of interested persons, to our detriment**

Figure 17: Example of a wind turbine opponent flyer, translated from French.

These flyers left in the local inboxes generally contain an impressive picture of wind park which disfigures the landscape, such as on Figure 18.

¹²⁰ Website of Federation Environnement Durable (January, 2018): <http://environnementdurable.net>



Figure 18: Wind turbines in the desert landscape of Banning Pass near Palm Springs - USA, extracted from a wind energy opponent organization flyer

Although none of these arguments is scientifically based, and several local statistics contradict the negative economic impact of wind turbines, for instance on the real estate value¹²¹ ¹²², their emotional register meet the worries of many local inhabitants, as well as some mayors and local deputies¹²³.

These wind energy opponent organizations appeal 60% of wind park projects in France, according to the *IDDRi*. Even if most part of these appeals are rejected before the court, their main impact for wind energy projects in France and Germany is a significant waste of time, according to the president of the syndicate *France Énergie Éolienne*.

B.3.4 Citizen wind energy cooperatives and financial participations

At the full opposite of the opponent organizations, some citizens want to take ownership of wind turbines and reap its benefits. Indeed, the new energy market transformation together with the current capital low cost allow more citizens to own decentralized renewable energy production systems, instead of a few companies owning a small number of large power plants.

¹²¹ Fachbereich Geoinformation und Bodenordnung of City Aachen (2011) Hat der Windpark „Vetschauer Berg“ Auswirkungen auf den Grundstücksmarkt von Wohnimmobilien in den Ortslagen Vetschau und Horbach?

¹²² Federal state North Rhine Westfalia (2015). Nachrichten aus dem öffentlichen Vermessungswesen Nordrhein-Westfalen

¹²³ Aubetin Environnement Blog : <http://aubetin.environnement.over-blog.com/>

Crowdfunding, Crowddequity or Crowd lending are different financial mechanisms which allow citizens to invest in wind energy projects or SME supporting them. In Alsace, *Alsace Eoliennes* and *EDF énergies nouvelles* led together a wind energy project where two wind turbines out of height have been financed by a crowdfunding campaign.

The necessary investment costs have been quickly gathered entirely thanks to an efficient online communication and crowdfunding platforms like lendosphere.com or enerfip.fr. Most of private investors were living outside the region, without direct contact with the project.

To become closer actors of these wind energy projects, some citizens choose to form citizen energy cooperatives to plan, finance and manage wind turbines in their territory. In Germany, such structures are common: 50% of wind parks belong in majority to private citizens¹²⁴.

They are rarer in France, although their number increases rapidly, often initiated by municipalities or Energy Syndicates. The "*Sociétés d'Economie Mixte*" are plebiscited juridical forms for this purpose: they allow to gather the different local territory actors such as public authorities, local companies and citizens¹²⁵. In Germany, the "*Gesellschaft bürgerlichen Rechts (GbR)*" are often used to provide a modular and simple juridical frame to these groups of citizens.

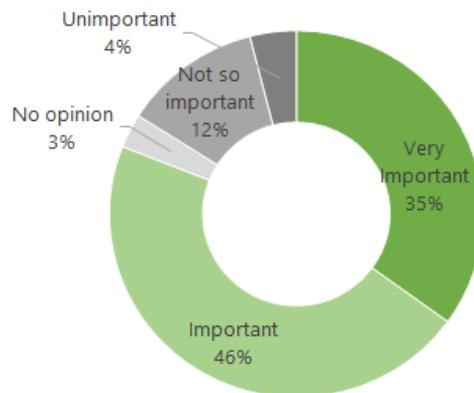
These citizen initiatives as well as small local company initiatives are assessed important or very important by 80% of the German population¹²⁶.

¹²⁴ Newspaper Capital, (July, 2014): "L'éolien citoyen anecdotique en France, moteur en Allemagne"

¹²⁵ Le Monde (November, 2017): "Les sociétés d'économie mixte, leviers d'une dynamique locale de transition énergétique" - Laetitia Van Eeckhout

¹²⁶ Fachagentur Windenergie an Land (2016). Umfrage zur Akzeptanz der Windenergie an Land Frühjahr 2016.

CITIZENS AND SMALL COMPANIES PARTICIPATION IN WIND ENERGY PROJECT



Source : Survey of forsa, contracted by Fachagentur Windenergie an Land

Figure 19: Desire of wind small enterprise and citizens¹²⁷

Requiring companies to involve citizens financially is favored by more than half of the population, even if less than a third would also personally invest in a wind turbine (FA Wind 2015). This is reality in Denmark: a statutory regulation forces project sponsors to offer the local population a minimum ownership of 20% in any new installation.¹²⁸

¹²⁷ source: Fachagentur-windenergie.de

¹²⁸ Blog Energy transition - a global energiewende (2015): "Civic participation in the Energiewende: What Germany can learn from Denmark".

A public debate on energy in France in 2018

The multi annual energy plan (*Planification Pluriannuelle de l'Energie 2018/2028*) should be revised by the end of 2018 taking into account the objectives of the French Energy Policy (LTE law):

- decrease GHG emissions by 40% between 1990 and 2030 and divide them by a factor 4 between 2050 and 1990
- decrease the final energy consumption by 50% between 2050 and 2012 (20% between 2030 and 2012)
- decrease primary fossil energy consumption by 30% between 2030 and 2012
- increase renewable production share by 23% of the energy gross consumption in 2023 and 32% in 2030
- decrease nuclear in the energy mix to 50%

The objectives of the public debate are as follows:

- Inform the public on the project, its socio-economical stakes and environmental and territories impacts
- Allow the expression of different publics: elected representatives, institutions, societal and corporate representatives, associations, experts, citizens, people in general ...
- Allow everybody to get to know positions and arguments of the parties

« Consultation takes time and should be considered separately from communication. ...**If we want to move forward we need to study propositions coming from citizens or experts, which are often common sense.** They are not always taken into consideration... Nicolas Hulot, *Minister of the Ecological Transition* 22 January 2018 New year greetings to the press

Part C - Energy transition societal issues and Best practices

Understanding the citizen societal issues related to Energy transition technologies is the key to avoid the consequences of local oppositions and lasting legal procedures. The term “societal” relates here to the close relationship between Energy transition and the society as a whole, including its deeper structures.

Most of these issues are recurrent from technology to technology, from project to project, or from country to country and can therefore be anticipated. They address the political and legal context, the relationship between the project team and the local population, as well as some issues specific to particular technologies.

Based on bibliographic study, on one binational expert workshop organized in November 2017 in the framework of this project and 10 additional interviews of French and German Energy transition actors, 24 societal issues related to citizen acceptance of Energy transition could be identified and analyzed.

We classified these issues in 5 main consistent categories:

- (1) Citizen inclusivity,
- (2) Mutual trust,
- (3) Communication,
- (4) Motivation and incentives,
- (5) Specific technology issues.

This newly introduced typology of citizen acceptance issues related to Energy transition technologies may be visualized as an onion model, where each successive category forms an additional layer.

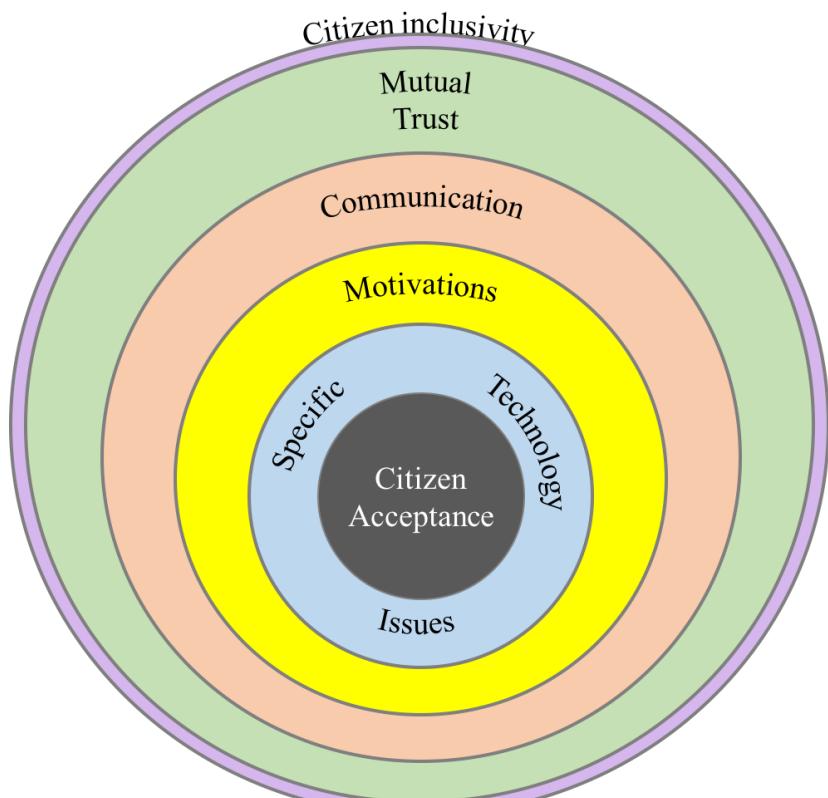


Figure 20: Onion model of citizen acceptance

Each layer represents issues to overcome and required answers, leading closer to the full citizen acceptance at the onion center. The outer onion layer forms the interface between included and excluded citizens (onion's outside) from the Energy transition process. **Citizen Inclusivity** is indeed the societal base of citizen acceptance for the Energy transition. **Mutual Trust** is the next pre-requirement of citizen acceptance, distrust being crippling before an Energy transition project even starts. **Communication and exchanged knowledge** may be built on this base of trust and enables the development of strategies to **motivate citizen** to adopt new technologies. Finally, every technology may present one or more **specific issues** for the society, representing the last barrier to achieve citizen acceptance.

Each of these categories is detailed in societal issue subcategories. These issue categories and subcategories were found significant in both France and Germany, although their frequency and importance may vary locally.

INC – Citizens Inclusivity

- INC.1 – Overcoming political and institutional barriers
- INC.2 – Overcoming legal and administrative difficulties
- INC.3 – Dialogue and listening
- INC.4 – Participative decision-making
- INC.5 – Enabling citizen initiatives

TRU – Mutual Trust

- TRU.1 – Project management and accountability
- TRU.2 – Finding local relays
- TRU.3 – Social justice
- TRU.4 – Analyzing the risks
- TRU.5 – Dealing with negative experiences

COM – Communication and Knowledge Exchange

- COM.1 – Quality and timeliness of Information
- COM.2 – Information transparency
- COM.3 – Audience-centered communication
- COM.4 – Reweaving the relation between science and society
- COM.5 – Dealing with external opponents

MOT – Motivation and Incentives

- MOT.1 – Citizens' resistance to change
- MOT.2 – Financial benefits for the citizens
- MOT.3 – Symbolic rewards
- MOT.4 – Reviving community feeling and local identity

TEC – Technology Specific Issues

- TEC.1 – Technology intrusiveness
- TEC.2 – Change in neighborhood morphology
- TEC.3 – Individual freedom restrictions
- TEC.4 – Finding beta users for immature technologies
- TEC.5 – Poor local technical skills

Table 7: Citizens in Transition typology of acceptance issues

Some of the listed acceptance issues are interlinked and interdependent. Consequently, the analysis of the issues as well as the listed best practices may overlap some points. Figure 21 shows the main dependencies between the individual issues. For the sake of clarity, these interrelations are not further addressed in the following sections.



Figure 21: Dependencies between the different societal issues

These societal issues are detailed in the following sections. Learnings and best practices for Energy transition project developers, from France and Germany, are presented.

INC – Citizens Inclusivity

Inclusivity encompasses behaviors and policies preventing the exclusion of people based on gender, origins, social class, sexuality, disability, wealth, level of knowledge, access to information, etc. We are obviously not all equal when it comes to Energy transition questions.

Thus, citizen inclusivity can be seen as a societal base of citizen acceptance for the Energy transition, following the deliberative concept of Jürgen Habermas¹²⁹. If citizens feel excluded from this process, or if the rules are not designed for them, they are likely to become indifferent, suspicious or even reluctant to any Energy transition project, spending their time and energy rather against than for it.

INC.1 – Overcoming political and institutional barriers

Energy transition reaches deep into the political dynamics characterizing a given social context (see the Geels & Schot model in part A). Indeed, it affects almost all public policy areas, from energy and environment, economic development policies, agricultural, planning, transport, science and technology, to health policies¹³⁰.

However, the long term required for Energy transition planning and citizen appropriation is often in contradiction with the short political schedules imposed by election intervals. National or local institutions may set laws or take local decisions contrary to citizen interest related to Energy transition. The experience shows that even the absence of political support to citizens willing to engage for Energy transition, may be fatal to their efforts: in the brownfield area of *Heppner* in Strasbourg for instance, a group of 150 families motivated to develop an eco-district project were facing the indifference of the municipality, whose planning requirements and project selection process were much more adapted to real estate developers. As a consequence, citizens are unable to engage for the Energy transition, feel to be left aside this global movement, and turn to be reluctant to both political power and the Energy transition implementation like it has been decided.

¹²⁹ J. Habermas (1981), as referred to by P.J. Schweizer (2017) in Partizipation bei der Energiewende und beim Ausbau der Stromnetze: Philosophische Fundierung, in Die Energiewende verstehen – orientieren – gestalten

¹³⁰ FP7 European project Milesecure-2050, multidimensional impact of the low carbon European Strategy on Energy Security on Socio-economic dimension up to 2050

Best practices:

A local political support is decisive to enable citizens to be part of the Energy transition. Laws and rules must become more citizen-friendly, integrating occasionally incentives for citizen-driven Energy transition projects.

A citizen inclusive Energy transition policy requires a certain consensus between the different political forces of a municipality, to reduce the impact of political changes on efforts brought to improve Energy transition appropriation by citizens. First steps to adapt the legal framework to the specificities of citizen-driven projects have been taken¹³¹ in France and Germany, but they keep relying on the local political will.

INC.2 – Overcoming legal and administrative difficulties

Even when national and local institutions set legal and financial incentives to encourage citizens to participate to the local Energy transition, these incentives may remain hardly accessible, at least for citizens not supported by professional advisers.

The absence of citizen-adapted commercial and legal frameworks leads to administrative complexity. A citizen cooperative in Beganne - France for instance required 10 years to plan their wind energy project, after having been asked an authorization from the Authority of Financial Market (AMF) which implied a complex cascade structure¹³². The legal framework for such a cooperative in Germany is more adapted to such initiatives¹³³.

Nevertheless, even with a high technical knowledge and a strong willingness to engage for Energy transition projects, many interested citizens give up: hiring the services of professional lawyers or advisers is most of the time a prerequisite, however the related fixed costs often offset these incentives and the whole project become non-profitable. Even in Germany, participative projects are facing difficulties requiring hard to find professional support¹³⁴

¹³¹ e.g. L. Calandri (2015), Les citoyens dans la gouvernance énergétique : « libre choix », « débat public », in Gouvernance et Innovations dans le système énergétique, De nouveaux défis pour les collectivités territoriales, Paris.

¹³² Newspaper Capital, (July, 2014): "L'éolien citoyen anecdotique en France, moteur en Allemagne"

¹³³ D. Ohlhorst (2017), Akteursvielfalt und Beteiligungsformen im Kontext der Energiewende in Deutschland: das EEG und seine Reform, in Die Energiewende verstehen – orientieren – gestalten

¹³⁴ Quoting from Leuphana Universität Lüneburg in the frame of the Transnik project (2017).

Best practices:

The German juridical framework is currently more flexible and straightforward than in France for individual citizens and/or citizen initiatives acting in the Energy transition, according to Andreas Rüdiger from the *IDDRI*. Ideally, legal and administrative frameworks should adapt to the different possible situations, registrations and forms should be low time-consuming, possibly digitized, simplifying for any citizens the access to funds or financial supporting mechanisms related to Energy transition without the systematic support of a professional lawyer to juggle between the different laws and status.

Legal stability is also an essential aspect, which here also differs greatly between France and Germany. It enables citizens to have a long-term vision on rules and laws and commit for the future with complete confidence.

For more complex projects such as citizen-owned windmills or solar photovoltaic installations on public buildings, some private energy companies offer local citizens some adapted “turnkey packages” including commercial and legal support. In Baden-Württemberg, EnBW supported in such a way many citizen initiatives over the last 15 years. Many German cooperative banks¹³⁵ play also a significant role, funding citizens Energy transition projects, and bringing them their juridical and financial competencies.

INC.3 – Dialogue and listening

The frequency and quality of dialogues are good hints for the level of inclusivity of an Energy transition project.

In France, public concertation (so-called “*enquête publique*”) is mandatory since 1983 (*Loi Bouchardau*) for projects “likely to affect the environment”, as well as to land use planning and urban renewal since 2000 (*Loi SRU*¹³⁶). It consists in informing the population about the features of the new project and gather their observations and feedbacks during a period of at least 30 days. Ideally, public concertation must take place at the earliest phases of the project, reach an audience as wide as possible, and be 100% transparent. The national independent administrative authority *Commission Nationale du Débat Public*

¹³⁵ e.g. GLS Bank, Volksbank, Sparkasse.

¹³⁶ French Law n° 2000-1208 of December 13th 2000 related to solidarity and urban renewal
<https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=LEGITEXT000005630252>

(CNDP) has been created in 1995 to advise project developers and local authorities on public information and dialogue participation and make sure that citizens are well informed and their points of view considered. Thus, it contributes to develop a public concertation culture in France.

In Germany, participation has been strengthened in 2013 by the law for the improvement of public participation and unifying of planning processes (*Gesetz zur Verbesserung der Öffentlichkeitsbeteiligung und Vereinheitlichung von Planfeststellungsverfahren*)¹³⁷.

Unfortunately, some project coordinators dread this mandatory process, which often gather fears, worries and contestations, and tend to skimp it.

Best practices:

The mutual exchange of information and knowledge sharing between the project development side and the citizens is essential to improve and legitimate Energy transition projects. Listening and addressing in particular the population fears and worries, even before the mandatory public concertation, shows positive effects on the project opposition reduction. Rational AND irrational worries need to be both answered, no questions or worries should be neglected.

INC.4 – Participative decision-making

Most Energy transition project are planned first and third-party acceptance are requested later, following the “decide-announce-defend” planning process. This “top-down” policy style excludes de facto local citizens and other parties, whose expected role is to provide criticism, not to support the project. As a consequence, non-participatory decision-making processes turn out to be destructive for local acceptance¹³⁸. At the same time, participation is not necessarily sufficient to overcome existing skepticism or opposition¹³⁹.

The World Bank also recognized that engaging various actors in participatory decision-making is an important way of reaching a balance between different

¹³⁷ Gesetz zur Verbesserung der Öffentlichkeitsbeteiligung und Vereinheitlichung von Planfeststellungsverfahren (PIVereinhG) vom 31. (May, 2013): https://www.bgblerichterstattung.de/xaver/bgblerichterstattung?start=%2F%2F*%5B%40attr_id%3D%27bgblerichterstattung%27%5D#_bgblerichterstattung%2F*%5B%40attr_id%3D%27bgblerichterstattung.pdf%27%5D_1518112739270

¹³⁸ Wolsink, M. (2000): Wind power and the NIMBY-myth: institutional capacity and the limited significance of public support. In: Renewable Energy 21-1, 2000/09, p. 49-64.

¹³⁹ G. Hage, L. Schuster (2018): Daher weht der Wind! in Bausteine der Energiewende

levels of power, creating a platform for actors to communicate on an equitable basis and address problems and set priorities.

Best practices:

The underlying character of planning process must change from confrontation to collaboration. The project developer must first connect with local authorities and create a network of local actors around a project. Stakeholders and local residents must be involved from the very early stage in an "open planning" process (also called participative democracy) with given goals and constraints, but enough flexibility and adaptation possibilities, too.

Consensus must be built, passive supporters must be encouraged to get involved in decision making about Energy transition projects. Getting the adhesion of local residents is much easier based on this consensus, leading to substantial time and budget savings. In the case of wind energy projects, local actors should be able to define certain zones where wind turbines may or may not be sited by letting them propose sites or select from offers. In a successful project conducted in Germany 2002, the local actors additionally chose the planner and the concept itself¹⁴⁰.

INC.5 – Enabling citizen initiatives and cooperatives

The most effective way to include citizens in the Energy transition process is to allow and foster their bottom-up initiatives¹⁴¹. As individuals, citizens may invest in Energy transition technologies in their own house, participate to crowdfunding campaigns financing renewable energy projects, or even contribute to sponsoring.

Citizens may also join together under the form of citizen cooperatives (generally a "*Gesellschaft bürgerlichen Rechts*" (GbR) in Germany or a "*Société d'Économie Mixte*" in France) for a stronger impact. Concretely, a dozen to hundreds of citizens can for example invest together in a photovoltaic roof, a wind energy installation or a micro hydro-power installation, and manage these installations and their productions in a participative way. Although the motivations of these

¹⁴⁰ Jobert, A.; Laborgne, P.; Mimler, S. (2007): Local acceptance of wind energy: Factors of success identified in French and German case studies. Energy Policy 35, 2751-2760. doi:10.1016/j.enpol.2006.12.005

¹⁴¹ The Energy transition to energy democracy (2015), Intelligent Energy Europe Project REScoop 20-20-20 Final report

citizens may be firstly financial, most of them see the opportunity to reappropriate the Energy transition as community. Beyond the symbolic notion of autonomy, it is a militant gesture to make Energy transition become again a citizen matter, and not only a sector whose management has been delegated to a minority of industrial companies.¹⁴²

Best practices:

In Germany, some governments and local companies strongly support citizens' initiatives for the Energy transitions. Municipalities make roofs of public buildings and infrastructures freely available for solar roof initiatives, companies accompany citizens in the creation of citizens' cooperatives etc.

As a consequence, nearly 50% of renewables are in the hands of citizens and cooperative groups.¹⁴³ EnBW, the main energy supplier of Baden-Württemberg at the hand of regional and municipal authorities (see part A), started in 2004 offering municipalities and their inhabitants a "Solar-Bürger-Aktiv" model for citizen participation in photovoltaic and wind energy installations.

This model was a facilitating package which includes prepared administrative forms and contracts, guidelines on project management, how to found a GbR¹⁴⁴, a feasibility study based on local irradiations / wind data and the proposition of an accountant and experienced maintenance operator. The model pattern may be easily adapted to different places.

The GbR "Rutesheim-Solar-Aktiv" in the city Rutesheim, Baden-Württemberg, was created in 2004 thanks to this package. It counts 75 members, all inhabitants of Rutesheim, who have originally invested each a minimum of 1 000 € in two photovoltaic installations of 42 kW mounted on the town hall and public high school¹⁴⁵. The municipality rents its roofs for free during 20 years; then the ownership of the solar installation will be shifted from the cooperative to the municipality.

¹⁴² Guillaume Christen (2016): "Transitions énergétiques et liens avec la nature. Les coopératives citoyennes d'Alsace sont-elles une alternative au marché de l'énergie ?"
Pensée plurielle 2016/3 (n° 43), p. 139-154. DOI 10.3917/pp.043.0139

¹⁴³ Wuppertal Institute for climate, environment and energy (ed.) (2017): Realising long-term transition towards low carbon societies. Impulses from the 8th Annual Meeting of the International Research Network for Low Carbon Societies. Wuppertal Spezial 53. Wuppertal. ISBN: 978-3-946356-03-5
<https://epub.wupperinst.org/frontdoor/index/index/docId/6636>

¹⁴⁴ The GbR is the simplest company form foreseen in the German law, covering the economic cooperation between individuals even without a written contract. Sources: Industrie und Handelskammer Karlsruhe, Bundesministerium für Wirtschaft und Industrie. (2018)

¹⁴⁵ Blog of the GbR Rutesheim-solar <https://rutesheim-solar.jimdo.com/rutesheim-solar-aktiv-i/>

Thanks to this gesture of the municipality and the interesting feed-in tariff at that time, the payback-period reached merely 8 years. Additionally to the management of this solar installation, the citizens' cooperative members organize frequently visits and presentations to other citizens, leading to a multiplication of the citizens' participation and acceptance in the regions.

France is not that far yet, but the legislation is changing in order to facilitate the development of local initiatives¹⁴⁶. The local units of the national environment agency *ADEME* also support innovative experiments on this field¹⁴⁷

¹⁴⁶ e.g. R. Mainnevret (2015) : Les partenariats en forme de sociétés (SEML, SEMOP, SCIC, SAS). "Quelle pertinence pour les collectivités ? in Gouvernance et Innovations dans le système énergétique, De nouveaux défis pour les collectivités territoriales" Paris.

¹⁴⁷ Source: www.ademe.fr

TRU – Mutual Trust

Mutual trust is the necessary social capital of any Energy transition project and a critical recurring issue, particularly when projects reach an industrial dimension. Without trust, citizens won't be receptive to any argument nor message of the project team, whatever the quality of their communication plan, since their credibility is not provided.

Mutual trust is a prerequisite at the beginning of many Energy transition projects. It must be further maintained and cultivated during the project development and exploitation phases.

TRU.1 – Project management and accountability

Project developers are the ambassadors of the Energy transition in new projects. Positive or negative experiences of citizens with these projects will rub off the credibility and acceptance of later similar projects. A high-quality management system with a clear accountability and a reachable person in charge is therefore essential to build up trust-based interpersonal relationships between the project development team, public authorities and the citizens.

This accountability should remain over the whole project life-cycle, from the project planning to the implementation, commissioning, exploitation and maintenance and end-of life phases.

Best practices:

Although Energy transition projects involved many different stakeholders (economic, political, environmental protection, etc.), a project coordinator or another responsible person of the development team should be designated as contact point for the citizens and local public authorities. He/She represents the project team accountability externally, from the project development to the implementation. Finally, the project commissioning and audit may be realized by an external independent expert, possibly involving citizens.

After the implementation, a trustable technical assistance and maintenance should be insured, with close contact with the project developers if possible. In some cases, local energy agencies have been created¹⁴⁸ to support the development and the monitoring of projects.

¹⁴⁸ e.g. the Agence Locale de la Maîtrise de l'Énergie de l'agglomération mulhousienne created in 1999.

TRU.2 – Finding local relays

Opposition to Energy transition projects may be grounded by the lack of trust in public administrations, external energy suppliers or private developers. Even companies which support the municipalities in the implementation of Energy transition technologies are generally rather seen as advocate or lobbies than neutral experts. The current debates about “fake news” show how all the given information, even when neutral and scientific-based, is put in doubts¹⁴⁹.

In such a case, local personalities, inspiring sympathy and trust like council members, local ecological associations or other local opinion leaders, might serve as relays¹⁵⁰ to the Energy transition Project planning. Municipal actors are given greater confidence than actors from outside the region, as the confidence in *Stadtwerke* comparing to the “Big four” (see part A) shows. Energy transition projects, even when driven externally, must be sufficiently anchored in the territories.

Best practices:

In the early phases of its projects, *Endura Kommunal*, which supports municipalities in the implementation of wind parks in Baden Württemberg, meets the local council. They ask which essential local partners should be first contacted (ecological associations, clubs, citizen representative) in order to create acceptance and to use them as multiplicator. Possibly, these “opinion leaders” are brought to other similar projects already implemented, with the possibility to exchange spontaneously with the local population on-site.

TRU.3 - Social justice

The interaction between Energy transition and social justice and its consequences, such as energy price evolutions, energy poverty or geographical equity are important topics of discussion¹⁵¹. Whether it is at country scale (Northern/Southern hemisphere), at regional scale or between social categories, there are imbalances towards climate change: some have

¹⁴⁹ A.Brunnengräber (2018), Klimaskeptiker im Aufwind, Wie aus einem Rand- ein breiteres Gesellschaftsphänomen wird, in Bausteine der Energiewende

¹⁵⁰ e.g. Freiburg Green City, Wege zur Nachhaltigkeit (2007), or the municipal climate Plans (Plan Climat Energie de Territoire) in France

¹⁵¹ K. Tews (2017), Energiearmut – vom politischen Schlagwort zur handlungsleitenden Definition, in Die Energiewende verstehen – orientieren – gestalten, p. 295

contributed more than others to the phenomenon; some suffer more heavily from the consequences; some citizens hold mainly the drawbacks of the Energy transition, while other market players harvest the benefits.

This sense of injustice is felt by many citizens, for instance in areas where energy suppliers install intrusive renewable energy installation like wind parks, or for citizens who can't afford to insulate their building or change their heating system while energy taxes are rising up. It leads to a dissatisfaction about Energy transition policies and a mistrust of the public authorities and economic system as a whole.

Best practices:

Drawbacks and risks related with Energy transition technologies must be balanced with benefits for the affected municipalities and citizens. In order to increase acceptance for the Energy transition, larger parts of the society need to see themselves as beneficiaries. The expectation towards public authorities to act as keepers of such a social justice is stronger in France, where the welfare-state model is culturally more important (see part A). The question of fair legislations, appropriate tax systems, investment refunding, incentives, however plays a role in Germany too.

In its wind energy project development, *Endura Kommunal* uses rental-pooling for making sure that not only the landowner benefits from the wind energy income but also its direct neighbors also impacted by the new installation. Communes, which benefits from taxes and fees from this new installation may also have this fair redistribution role. Ideally, municipalities choose their project developer according to a catalogue of locally relevant criteria, in particular aiming to realize a maximum of benefits. A good way to achieve local social justice is to give citizen the opportunity to financially participate in and benefit from the new windmills. Therefore, financial participation can be one of the criteria when choosing a project developer.

TRU.4 – Analysis of risks

In order to avoid scaring population and rising local opposition, project developers sometimes hide some inherent risks to new Energy transition technologies, presenting only the shiny side of the medal. However, this

strategy reveals to be counterproductive in a digitalized society of wide internet and (dis-)information access.

Energy transition like all technological and societal disruptions is not a "Zero risk" endeavor: health risks, economical risks, environmental risks, technical risks, data security are part of the equation. An exhaustive and transparent analysis of risks, including a detailed plan to supervise, minimize them and possibly deal with them in case of crisis management is a pre-requirement to a mutual trust between the project development team and the local population. Citizens are more likely to accept risks, if they know and trust (see TRU 1) that they are under control.

Best practices:

Realize an exhaustive analysis of risks for the environment, the citizens and the projects, based on independent scientific studies and a detailed plan to supervise risks, minimize them and possibly deal with them in case of crisis management. For instance, in the case of biogas plant where the spread of putrid odors in the neighborhood is a sizeable risk, innovative real-time odor monitoring enables biogas plant operators to react instantaneously to a leakage, by identifying and repairing it.

Such risk analysis and real-time monitoring can be made publicly available to citizens for the sake of transparency (see COM.2 - Information transparency)

TRU.5 – Dealing with negative experiences

Projects implementing Energy transition technologies may have critical impacts ex post on the local population, due to problems of the technologies themselves, errors in project design, in project operation, or problems in assessing the weight of citizen's expectations with regards to privacy, practicability or comfort. Geothermal power plants experiments led to seismic incidents in South-Western Germany¹⁵² and Switzerland¹⁵³, increasing the pre-existing opposition to such projects in the Region. Some wind farms built too close to villages in Northern

¹⁵² Ingo Sass, Ulrich Burbaum (2010): Damage To The Historic Town Of Staufen (Germany) Caused By Geothermal Drillings Through Anhydrite-Bearing Formations

¹⁵³ Das Deep-Heat-Mining-Projekt in Basel (2018): "Technischer und erdwissenschaftlicher Hintergrund": <http://www.seismo.ethz.ch/static/Basel/www.seismo2009.ethz.ch/basel/indexb941.html?m1=project&m2=b>

Germany (project-developers having used municipal competitions to their advantage) setting off growing controversies.

If a successful crisis management is not promptly set up, citizens may feel cheated by the installer or project development team. As a consequence, such negative experiences may spread out very quickly in the rest of the population, locally and on a wider scale through social networks, affecting the credibility of the project responsible as well as the whole Energy transition technology.

Best practices:

To further maintain the trust between the different actors of the running project, and keep a solid credibility basis for the next projects, project responsible must take on responsibility before citizens for possible negative project outcomes. If the error is not repairable, compensation measures for the victims and/or environmental prejudices must be taken (such financial compensation may be worth more compared to the effect of long-term credibility losses). The lessons learnt must then be shared and used by other projects.

COM – Communication and Knowledge Exchange

Even when a societal base and social capital is locally existing, an Energy transition project seeking for local citizen acceptance, cannot afford a communication disaster. The challenge of communication is not as trivial as it may seem, particularly for the historic industry which has worked for decades with limited contact to citizen, developing *au contraire* a culture of secrecy on nuclear and grid safety issues.

The change of context following the digitalization of information, new market competitors and bottom-up projects is changing the rules of project management on the field of energy. While adapted timing, formats and transparency are prerequisite for a good communication process, it is also essential that the citizens get the global stake of new Energy transition technologies, before adhering to it.

COM.1 – Quality and timeliness of information

Information quality has been conceptualized with different “dimensions” or “metrics” by academics¹⁵⁴ as well as federal administrations¹⁵⁵ : relevance (also called usefulness or utility), accuracy, timeliness, completeness (or exhaustiveness), coherence, accessibility, security (or integrity), format, compatibility, validity (or unbiased).

Citizen acceptance of Energy transition projects implies to reach an ambitious level for most of these information quality dimensions.

Several of these dimensions depends on the information recipient (the citizen) and could therefore be adapted to different audiences and projects: the relevance relates directly to the usefulness from the public perspective. Complete information for one person may be incomplete for another and too much information for a third one, similarly some information may be too accurate when its degree of precision exceeds the public understanding capability or background knowledge. However, while addressing a group of citizens, information accuracy and completeness should be levelled upwards.

¹⁵⁴ Miller H. E., The Multiple dimensions of information quality - Information Systems Management · March 1996.

¹⁵⁵ Information Quality Act - Public Law 106-554, 2001 - US Federal register

Accessibility and timeliness are two complementary keys of information quality. Without it, citizens might feel passed over and become resistant to the further steps in the process due to their fear of the unknown.

Best practices:

The first information must be brought at the very early stage of the project, even (and particularly) if everything is not fixed and acted yet. Project developers must then provide continuously accessible public information on technologies and project development, if possibly in different formats (informational events, open consultation hours, daily press, websites etc.), fostering exchange between locals, relevant actors and developers. Public dialogues must be of course objective (i.e. accurate, unbiased and reliable) and include experts and responsible persons from politics and administration.

The given information should be adequate to the target audiences, without underestimating its technical understanding (further information in COM.3 - Audience-centered communication). Information from neutral actors and organizations considered trustworthy by the population is most effective (see TRU.2)¹⁵⁶.

COM.2 – Information transparency

Transparency is directly related to the completeness and accuracy of information. The citizens' feeling that a part of the information is hidden by the project development team together with public authorities is very recurrent in the Energy transition. This lack of transparency leads almost systematically to a citizen distrust toward the project developers and public authorities.

Among the information whose citizens complain the most to not be given: project costs, benefits and risks, and their distribution to the different involved parties (users, investors, owners).

¹⁵⁶ Bürgerdialog Stromnetz GbR (ed.) (2017): Netzausbau vor Ort. Dialog in den Regionen. Berlin.
<https://www.buergerdialog-stromnetz.de/assets/Downloads/BDS-Netzausbau-vor-Ort-Dialog-in-den-Regionen.pdf>

Best practices:

Not only technological aspects should be communicated to the citizens but also socio-economic impacts in term of employment, municipal economy, etc. Not only the positive facts are to be given but they have to be informed about risks and negative aspects as well. Even if some risks mentioned by the population look irrational or improbable, they must at least be addressed.

Citizens have to know and weight the different project risks, costs and benefits based on transparent data. The contrary would systematically lead to suspicion and distrust.

COM.3 – Audience-centered communication

“There are not only engineers on this Earth.”

Conversely, there are also not only retired people ready to participate at 3 pm to a public information meeting. There is often a misunderstanding between the project development team and the local population, because the message and information of the former does not reach the expectations of the latter.

The perception of this message may also differ based on personal, situational and cultural factors. In his Book “Beyond Culture” (1976), Edward T. Hall distinguished between high-context and low-context communication (also called indirect, respectively direct communication), which refers to the degree to which speakers rely on factors other than explicitly speech to convey their message.

Germany has for instance a low-context communication culture, where words hold the full meaning without room for other interpretation, where conflicts are acceptable (and easily solvable), and therefore with a shorter duration of communication. On the other side of the communication scale, France, as most of Latin and Arabic countries, present a high-context communication culture, with a more internalized understanding of what is communicated living more room for interpretations, where situations and relations count as well as words.

Based on these observations, “Audience-centered communication”, also called “Target group specific communication”, consists in differentiating the

Information message, form, levels and media depending on the different target audiences, while conserving a high overall information quality.

The different target audiences are generally categorized based on their average age, study and profession, and cultural background. In Germany for instance, people tend to have a stronger affinity for technology than in France. Technological or scientific-based arguments will not reach an average French audience as effectively as “Experience knowledge” (how things went in a similar project). Another example: discussing about money is much more common and well-accepted in Germany, than in France, reflecting the differences between direct vs. indirect communication.

It has to be taken also into consideration that long-time residents might be a more interested and involved target audience, because they stronger connect with a place or area. Twenty years are generally required to create new neighborhood feeling. This must be compared with the average local population staying period which reaches four to five years in France.

Best practices:

At the beginning of the project, the target groups need to be identified in order to tailor the message, language usage and citizen expectations in term of communication. In the case of high contextual communication cultures, relationships and backgrounds between the different project actors and the population should be analyzed. Since citizens' expectations and questions are mostly the same for a same target audience from project to project, the communication plan may be prepared and improved in advanced, whether it be a website, arguments for dialogue with opponents etc.

COM.4 – Reweaving the relation between science and society

Although citizens are globally in favors of Energy transition policies (93% in Germany and 91% in France¹⁵⁷), they have very different levels of interest, awareness and technical knowledge.

¹⁵⁷ Harris Interactive survey conducted for Heinrich Böll Stiftung on 1004 French adult citizens in November 2017 through the quota methodology (age, living area, gender, profession)
http://fr.boell.org/sites/default/files/uploads/2017/12/rapport_harris_-_le_rapport_des_francais_a_lenergie_fondation_heinrich_boll_1.pdf

Furthermore, the relation between Science and Society has undoubtedly changed over the last decade: although science and technologies have become increasingly significant and pervasive in all spheres of social life, science have faced a loss of authority¹⁵⁸ in particular in the political spheres, and young people lose interest in scientific studies.

Many citizens don't understand the usefulness of new Energy transition technologies, like smart grid or smart meter. Why should I postpone my electricity consumptions because of my neighbors? Why is Energy transition a global stake? Why is it useful and urgent? As a consequence, a majority of people become indifferent to Energy transition technologies.¹⁵⁹ The current low-tech trend is a kind of answer to technology complexity.

In this context, reweave the relation between Science and Society is essential to raise acceptance and enthusiasm for the Energy transition technologies.

Best practices:

If the background knowledge and interest of the audience on Energy transition technologies is observed as very low, trying absolutely to educate people (in France, the often to be heard "*Faire preuve de pédagogie*") or to change their values is often counterproductive. Instead, actual population values and levels of knowledge can be evaluated and used to design the most effective communication plan, with an emphasis on the meaning of Energy transition as a society project.¹⁶⁰

COM.5 – Dealing with external opponents

Some organized groups of opponents, often claiming to be ecological associations, come from outside to destabilize new Energy transition projects, in particular wind park projects, high voltage grid expansion, biogas or hydraulic plants. In the name of their perception of the environment, they act at regional level (for instance in the *Black Forest* in Germany) or even at a national level

¹⁵⁸ "Wissenschaftsbarometer 2" from Wissenschaft im Dialog (WiD). Also from the press: Sueddeutsche Zeitung (July, 2016), Die Zeit (April, 2017)

¹⁵⁹ France Energie Eolienne (September, 2016): "Etude IFOP 2016 Sur L'acceptabilité De L'éolien"
<http://fee.asso.fr/actu/etude-ifop-2016-lacceptabilite-de-leolien/>

¹⁶⁰ Bell, D. Gray, T & Haggett, C. (2005): 'Policy, Participation and the 'Social Gap' in Wind farm Siting Decisions' Environmental Politics Vol 14, no.4 p460-477

(in France), even in quasi-inhabited zones like the former East/West German border where a high voltage grid is planned to be installed.

Their strategy consists in systematically suing authorizations of new Energy transition projects, setting a confrontation atmosphere in public concertation meetings, and trying to convince the local population against the project. They use for this purpose argumentations based on the emotional register, which answer directly the worries of citizens.

Municipalities generally do not have an expert to answer objectively the opponents, while companies supporting the municipalities in their new Energy transition project are not seen as neutral but advocate. As a consequence, the local citizens do not know anymore where is the truth and who to trust. The perception ("Wahrnehmung" in German, literally the consideration of the truth) by the citizens is key in the communication against external opponents. Rational arguments brought by the project developer isn't generally enough, since perception of technologies depends on emotions, culture and the credibility of the messenger (see TRU.2).

Best practices:

First of all, better act as react! Speak and act first. Being the second to speak is a disadvantageous position, because most of the communication time is used to answer the first speaker's arguments, instead of leading the discussion. Since their arguments are systematically the same, the project developers may analyze them in advance and prepare factual counterarguments.

Furthermore, in order to oppose their emotional and unverified arguments, rational arguments are often useless. The most effective communication in this case is to bring positive experience feedbacks, and to offer the population to visit similar projects. Local relays (see TRU.2) or independent third parties, seen as trustworthy and neutral, may play a mediator role, participating to the debate with the population, bringing an objective view to the different arguments, and eventually giving a neutral verdict.

MOT – Motivation and Incentives

There are many reasons for active and passive resistance against the Energy transition and its technologies. Creating incentives and spreading motivation helps to mobilize the population. On-site studies and surveys show that citizens are much more accepting new Energy transition projects if benefits and risks are shared fairly between them and the project developers. Enabling and emphasizing financial as well as social advantages may form positive attitudes toward the Energy transition. It encourages to reflect the own practices and to consider individual possibilities to contribute.

MOT.1 – Citizens' resistance to change

The reasons for resistance toward Energy transition technologies and change in general are diverse. Besides the fears regarding issues as health risks or data security, the citizens' resistance is also associated with the desire for individual and family autonomy, or the satisfaction with the present state and effort to change.

There are people enjoying change because they like to deal with new things and circumstances and the opportunity to grow personally and professionally. But there are also the ones who dislike change because they rather prefer their set routines. The latter are more likely to be suspicious of change and thus to oppose new projects. For the effective handling of resistant citizens their motives have to be known. Is it a particular technology they oppose or the general change and associated/feared effort?

Best practices:

To analyze citizens' reasons for resistance in detail it is important to communicate with the citizens. The opportunity to express themselves in person as well as anonymously should be given to them. Therefore, possible methods for investigation are, for instance, open discussions, online surveys, meetings with local city offices or citizens' representatives. Results should be gathered without any fix expectations or judging and individual for each region/city/district.

Further it is important to investigate the user's social practices, needs, knowledge level and routines in order to understand their acting and to be able to develop innovative technologies that are accepted by the user and thus, fulfill

their expected environmental effect. A method to generate such insights on consumers are so called “living labs”. A user centered approach to develop usable and acceptable products and services is applied. Product and enhancements are collaboratively created and validated in empirical real-life experiments by users and stakeholders.¹⁶¹

MOT.2 – Providing financial benefits for the citizens

Sometimes citizens have the feeling to hold mainly the drawbacks of the Energy transition, while few market players harvest the benefits. The citizens’ properties may lose value through projects or their own well-being is impaired. Financial compensation for drawbacks as well as a fair distribution of financial benefits of Energy transition projects among the local affected population counteracts this feeling of social injustice (see TRU.3), and simultaneously increases the acceptance.

Best practices:

Different forms of financial benefits or participations are regularly discussed and tested: a lower electricity price, investment possibilities in Energy transition projects, higher saving interest rates or some compensation payments.

According to a survey of the *Fachagentur Windenergie*¹⁶², 90% of the German population find at least one of these incentives well adapted to raise their acceptance towards wind turbines and even 77% among people who have a negative image of wind energy. The most popular incentive would be a lower electricity price for the local population (64%), followed by the investment possibility for citizens and municipalities. Consequently, first, it should be analyzed if the citizens’ acceptance/resistance is linked to personal benefits or drawbacks and what kind of self-interests they have. In a next step, a strategy with respective financial incentives should be developed. It is important to make

¹⁶¹ Baedeker, C. et al. (2014): Transition through sustainable Product and Service Innovations in Sustainable Living Labs: application of user-centred research methodology within four Living Labs in Northern Europe. Paper for presentation at the 5th International Sustainability Transitions (IST) Conference, August 27-29, 2014 Utrecht, The Netherlands

¹⁶² Fachagentur Windenergie an Land e.V. (FA Wind) (ed.) (2016): Umfrage zur Akzeptanz der Windenergie an Land – Herbst 2015. Ergebnisse einer repräsentativen Umfrage zur Akzeptanz der Nutzung und des Ausbaus der Windenergie an Land in Deutschland. Berlin.
https://www.fachagentur-windenergie.de/fileadmin/files/Veroeffentlichungen/FA_Wind_Umfrageergebnisse_Fruehjahr_2016.pdf

sure, that the strategy is feasible and affordable before making promises to the population¹⁶³.

In the case of wind parks, for instance, project developers in the Black Forest distribute incomes not only to the parcel owner, but also to its neighbors who might be directly impacted, in function of the distance.

Another example is a small town called Mastershausen, Germany. Here the municipality invested in renewable energy technologies. The revenue is used to fund the construction of a fast internet connection, playgrounds and a library. In addition, the local Energy transition is further promoted by subsidies for house insulation and public transport¹⁶⁴.

MOT.3 – Creating symbolic rewards

In the case that people are not (only) interested in financial benefits, compensations and incentives through symbolic rewards may be an effective way to strengthen their acceptance¹⁶⁵ of Energy transition projects and their willingness to invest in such. A symbolic reward emphasizes the appreciation and acknowledgement for the citizens' contribution. Furthermore, symbolic rewards are good publicity and are likely to attract attention. As a result, for instance, the recognition and reputation of a municipality increases and attracts tourists. The attraction itself can also be seen as a symbolic reward.

Because of its success in renewable energy, Wildpoldsried, a village in southern Germany, receives about 100 visiting groups each year from countries all over the world. The mayor of Fukushima, Japan, has visited twice¹⁶⁶.

Best practices:

Symbolic rewards might be given for various accomplishments in diverse ways: For example, prizes could be passed to municipalities for the development of effective and fair marketing strategies, a certain amount of installed capacity

¹⁶³ Bell, D. Gray, T & Haggett, C. (2005): 'Policy, Participation and the 'Social Gap' in Wind farm Siting Decisions' Environmental Politics Vol 14, no.4 p460-477

¹⁶⁴ Energy transition, The Global Energiewende (January, 2018): " We are the Energiewende: German villages go 100% renewable"

<https://energytransition.org/2018/01/we-are-the-energiewende-german-villages-go-100-renewable/>

¹⁶⁵ K. Tews (2017), Energiearmut – vom politischen Schlagwort zur handlungsleitenden Definition, in Die Energiewende verstehen – orientieren – gestalten, p. 295

¹⁶⁶ Energy transition, The Global Energiewende (August, 2013):"With Citizen Buy-in, German Village Generates 5X Renewable Energy It Needs"

<https://energytransition.org/2013/08/german-village-generates-5x-renewable-energy-it-needs/>

from renewables or even the energetic independency, or for participating in pilot projects.

Another possibility to give a symbolic reward is to publicize the achievements on a large scale or to name the municipality in a travel guide. Thereby, they gain recognition as a good role model and tourists are attracted. The organization of thematic events and the installation of symbolic sights or landmarks are further ideas to show appreciation. For example, the exterior of the Splittelau district heating plant in Vienna was once designed by Hundertwasser. But symbolic rewards cannot only be passed to municipalities. Other actors, such as individual citizens, businesses or city districts can also be awarded for their contribution and achievements.

MOT.4 – Reviving community feeling and local identity

Working for a common goal strengthens communities and neighborhood networks. In this perspective, Energy transition projects initiated and developed by communities are great opportunities to develop such community feelings.

At the end of the days, inhabitants may be proud to have achieved at their scale a more environment-friendly world. Such experiences link them together as long as the photovoltaic installation produces solar energy for them, as long as a biomass-based heating district network connect their houses together with a low-carbon heat. Sharing economy applied to Energy transition (e.g. electric cars, biogas plant) may also strengthen these community feelings.

Best practices:

In the Bavarian village of Larrieden, a small group founded a community renewables initiative, originally to struggle against the village desertification. They decided to develop a biogas unit, two district heating networks, and a giant modern wind turbine along with several solar roofs. Suddenly, everyone had a reason to get together regularly, share ideas, talk about costs, and figure out laws and permitting procedures. Thereby, not only the community's economy was saved but also the people got to know each other and the community feeling was strengthened.¹⁶⁷

¹⁶⁷ Energy transition, The Global Energiewende (November, 2017): " We overlook how renewables can bring people together"
<https://energytransition.org/2017/11/we-overlook-how-renewables-can-bring-people-together/>

TEC – Technology Specific Issues

The implementation of new Energy transition technologies brings societal issues specific to the different technologies. Some tend to shrink the citizen private spheres with their material and immaterial intrusiveness. Innovative and promising, some may still not be mature, with unknown long-term system performance for instance. As a consequence, citizen societal acceptance of Energy transition may vary depending on the technology features and specific impacts.

TEC.1 – Technology intrusiveness

Several innovative Energy transition technologies deeply interfere with the citizen private sphere. They may be intrusive in different ways: physical obstructiveness, invasion of privacy, and security risk. A survey conducted among a group of senior citizens showed that technology intrusiveness represented 19% of the total technology judgments, but accounted for almost half of the negative judgements in general¹⁶⁸.

Smart home technologies, including smart meters, collect through a bunch of sensors daily energy loads and room environmental parameters. These private household-related data may reveal many things about citizens' private life habits. Home automation systems and smart grid technologies control additional devices (e.g. shading, lighting) and energy consumptions, based on algorithms implemented in processors inside their private homes, or in network operator systems.

The psychoanalyst Jacques Lacan has created the neologism "extimate technologies" to designate such new technologies which are both intimate and external¹⁶⁹. Even if these technologies give valuable services like real-time feedback about energy consumptions, citizens may feel more like targets, rather than agents of their energy use. Rather than being in control, they may become increasingly dependent on these new technologies¹⁷⁰.

¹⁶⁸ Melenhorst, A.-S., Fisk, A., Mynatt, E., Rogers, W. (2004) - Potential Intrusiveness of Aware Home Technology: Perceptions of Older Adults. September 2004, Human Factors and Ergonomics Society Annual Meeting Proceedings 48(2)

¹⁶⁹ Lacan, J. (2006) Le Séminaire de Jacques Lacan XVI : D'un Autre à l'autre. Paris: Editions du Seuil

¹⁷⁰ H. Zwart (2015) 'Extimate' Technologies: Empowerment, Intrusiveness, Surveillance. The fate of the human subject in the age of intimate technologies and Big Data. In: Emerging Technologies and Human Rights (proceedings). Strasbourg: Council of Europe, p. 40-45.

Best practices:

“Extimate technologies” are not limited to the Energy transition. Smartphones for instance are a very invasive technology, able to track us and collect very sensible data on our private life. However, most of smartphone users do not complain about this intrusiveness, assessing that the technology benefits are bigger than the mentioned disadvantages.

To strengthen the acceptance of intrusive technologies as smart meters, benefits for users must be put forward, balancing the disadvantages (intrusion in private sphere). Moreover, trust has to be built up by transparency, asking for instance which private data users want to share with their operators, and rewarding them for this data disclosure.

TEC.2 - Change of neighborhood morphology

Some Energy transition technologies may have an important visual impact on the landscape and the neighborhood landscape: Wind turbines impose their moving silhouettes in the skyline. Photovoltaic panels alter the perception of built exposed surfaces such as roofs and façades, with different materials, surface textures, and colors. Certain persons even perceive “biogas plants as an UFO family having landed in the countryside landscape”¹⁷¹.

Of course, not all these technologies are installed in “sensitive places”. Very few complains about solar panels installed on flat roofs in industrial area, or on roofs which are non-visible for pedestrians and wind parks in the Northern German countryside provoked relatively few objections. However, they undoubtedly changed the neighborhood morphology for the local population. Since aesthetics and perception are subjective, even if 75% of French inhabitants living at proximity of wind turbines have still a good image of them¹⁷², some other citizens may find them too intrusive in their landscape.

Best practices:

Some approaches and tools exist to help authorities preserving the quality of pre-existing urban areas while promoting renewable energies. This is the case

¹⁷¹ Extracted from discussion held during Citizens in Transition round table

¹⁷² France Energie Eoliennes (September, 2016): "Etude IFOP 2016 Sur L'acceptabilité De L'éolien"
<http://fee.asso.fr/actu/etude-ifop-2016-lacceptabilite-de-leolien/>

of Leso-QSV¹⁷³, developed by Swiss researchers from *Ecole Polytechnique Fédérale de Lausanne*, which is based on a combined assessment of the architectural integration of solar panels, site sensibility and panel visibility, in order to evaluate the visual impact of solar energy use technologies in urban morphologies.

Many citizens are also proud to have visible Energy transition technologies in their neighborhood, like the former president of the local Rhein-Hunsrück District, Bertram Fleck, who answered a question on wind turbine aesthetics:

"An ugly view? That is a question of value. Some people like looking at wind turbines, because they represent the Energiewende."

Some Energy transition technologies may even become landmarks of the landscape, like some wind parks which have become a promenade for the local population¹⁷⁴, or semi-buried seasonal thermal storage which have been arranged in sightseeing platform.

TEC.3 - Individual freedom restriction

The implementation of some Energy transition technologies may be related to obligations and freedom restriction¹⁷⁵, due to the technology itself, or the way it is deployed.

Because of the current battery capacities, electric car owners are currently forced to stop every 300 km to reload in a sparse network of charging stations, depending on the regions. Smart grid peak shaving technology is based on a delegation of the user energy load control to the network operator. Although this service leads to energy savings, it is not possible anymore to consume what we want when we want. Technology choices become life-style choices.

Some public policies related to Energy transition technology deployments also force citizens to change their old car against a new efficient one in German "Umweltzone", connect their new building to the renewable district heating

¹⁷³ Munari-Probst, M. C., Roecker, C. (2015) - Solar Energy promotion and urban context protection : Leso - QSV (Quality Site Visibility) method. Conference PLEA 2015.

¹⁷⁴ France Energie Eolienne (September, 2016): "Etude IFOP 2016 Sur L'acceptabilité De L'éolien"
<http://fee.asso.fr/actu/etude-ifop-2016-lacceptabilite-de-leolien/>

¹⁷⁵ A. Kibbe, O. Arnold, F.G. Kaiser (2017), Energiewende, nicht ohne selbstgewählten Wohlstandverzicht, Definition, in Die Energiewende verstehen – orientieren – gestalten, p. 331

network in some new urban development (to make it profitable for the operators), install the *Linky* smart meter in their home for all French residents etc.

Even if most citizens understand that it is for the common good, few of them feel that the Energy transition rhyme actually with a series of freedom restrictions.

Best practices:

Mandatory deployment of energy transition technologies at local/national scale has the benefit to accelerate tremendously the energy transition, but on the other hand meet a lower local citizen acceptance. In this optic, comparing both French and German smart meter deployment strategies is very telling (see Part B.2). However, *Linky* smart meter contracts leave the freedom to the user to select which of their home appliances may be remotely controlled during peak shaving, and get advantageous tariff contacts for that. Citizens are more inclined to abandon their plentiful life-style if they see direct benefits for them and their community.

TEC.4 – Finding beta users for immature technologies

Energy transition has become an urgency to face climate change and resources scarcity. Public policies set financial incentives for new promising technologies in order to accelerate the emergence of these technologies on the market. However, beta users and early adopters are not easy to find, although they receive generally benefits from testing these not-yet-mature technologies.

Users are generally more reticent in using smart meter or smart home appliances than other fancier technologies (smartphones, vocal assistants etc.), although they are as much intrusive. They are also very marked by the few negative experiences during demonstration phase of these new Energy transition technologies.

Best practices:

In the project *SusLabNWE*, the involvement of households was key to analyze experiences with sustainable product-service-innovations as smart feedback devices (e.g. smart meters). The approach included a combination of financial incentives for participation and a communication strategy (press release, direct

contact person in project team, flexible event timing rather after working hours etc.). Thus, the project succeeded not only in finding a reasonable number of users but also on keeping them, with a dropout rate of 0 %.

TEC.5 – Poor local technical skills.

The Energy transition involves a process of technology transfer, which may be unevenly distributed geographically. There is in some places an inadequate availability of trained installers for the new technological equipment, and a poor quality of locally available technology supplies. Even once the Energy transition technologies are implemented, an absence, discontinuity or poor accessibility of technical assistance and maintenance services represent important issues for local populations.

In such a case, the new transition technologies create dependencies for users with respect to “foreign” experts, manufacturers and technicians, as well as materials and tools which must be imported from outside the locality¹⁷⁶. As a consequence, citizens may feel abandoned from the Energy transition process, left with an alien technology they can’t properly use.

Best practices:

Energy transition is a slow global process. It requires a technology and competence transfer over all territories which requires time and professionals. In France, 330,000 new workers would be required between 2013 and 2030 and 825,000 until 2050¹⁷⁷. Huge training programs, coordinated at national and local level (e.g. *Pôle Fibre Energivie* in the region *Grand Est*), are needed to prepare these workers to new required competences.

Network of professionals must be built over the whole territory to share experiences and provide a local solution. Several French local authorities have started to organize training clusters (*Pôle de compétences*), but often face a certain reluctance from established professionals, who need to be supported in their efforts to reduce fears and risks when their investment is not immediately clear and certain. An entire new generation needs to be prepared to these new Energy transition jobs.

¹⁷⁶ Project “Pathways for carbon transitions (PACT)” (November, 2014): Report D4.1 “Driving socio-economic forces and actors, acceptability, heritage, policies”

¹⁷⁷ Ademe (2013) - Évaluation macroéconomique des évolutions énergétiques 2030-2050

There are great hopes for French education, but there is still a long way to go in order to turn the corner. For example, one of the only ministries not represented at CNEFOP (*Conseil National de l'Enseignement, de la Formation et de l'Orientation Professionnelle*) is the Ministry for Ecological and Solidary Transition. Germany drives the change through its education: in 2014, there were already 385 renewable energy-related programs at German universities and colleges, and 824 “solar (secondary) schools”.

Part D - Innovative solutions to improve citizens' acceptance

In light of the findings of Part C and based on previous projects, we conceptualize two global solutions to improve citizens' acceptance for Energy transition technologies and projects. One is rather technology-based (Citizen information and participation 2.0) whereas the other is based on user integration in innovation processes (Livings Labs).

D.1 Citizen Information and Participation 2.0

D.1.1 Targeted Issues and challenges to answer

Part B and C showed that communication before and during Energy transition projects is key to increase citizen acceptance.

Through concertation (INC.3) and participation to the decision making (INC.4), citizens feel better included in the Energy transition process. They wish information of good quality and timeliness (COM.1), transparent (COM.2) and adapted to their personal needs and knowledges (COM.3). Indeed, the proportion of confident and enthusiastic people is higher among populations which have been well informed early in the project (rising from 42% to 63% for wind energy projects in France).¹⁷⁸ For the project developers, providing instantaneously citizens with the right information at the right time enables to tackle effectively the identified reasons of citizen worries and reluctance.

Most people who experienced for the first-time Energy transition projects are not fully reassured about the real impact of these technologies. However, their fears and doubts are most of the time positively answered as soon as the first wind turbines for instance is installed¹⁷⁸. In like manner, citizens having already experiences with renewable energy technologies show a higher acceptance than those confronted for the first time. For the latter, having a realistic impression of the degree of intrusiveness (TEC.1) and visual impacts on the neighborhood (TEC.2) of the finished project state before it starts would diminish their fears. Discussing with relatives, friends, or trustful persons of their surrounding who have already experiences such projects appeases also these doubts (TRU.2).

¹⁷⁸ French Public Opinion Institute IFOP realized in 2016 a qualitative (25 interviews) and quantitative survey (1500 answers) on wind turbine acceptability in France among the entire population, wind park neighbors and elected representatives <http://fee.asso.fr/actu/etude-ifop-2016-lacceptabilite-de-leolien/>

Beside a good information on the Energy transition projects, many persons wish to be better informed about participation opportunities¹⁷⁹. The more the developer connects with local authorities and creates a network of local actors around the project, the higher is the acceptance.

D.1.2 Existing solutions

To obtain information on wind energy project, most people surf on internet (see Figure 22). It has the advantages to be instantaneous, durable, interactive and continuously updatable. Most municipalities or local energy agencies provide a free internet service to people without internet access at home.

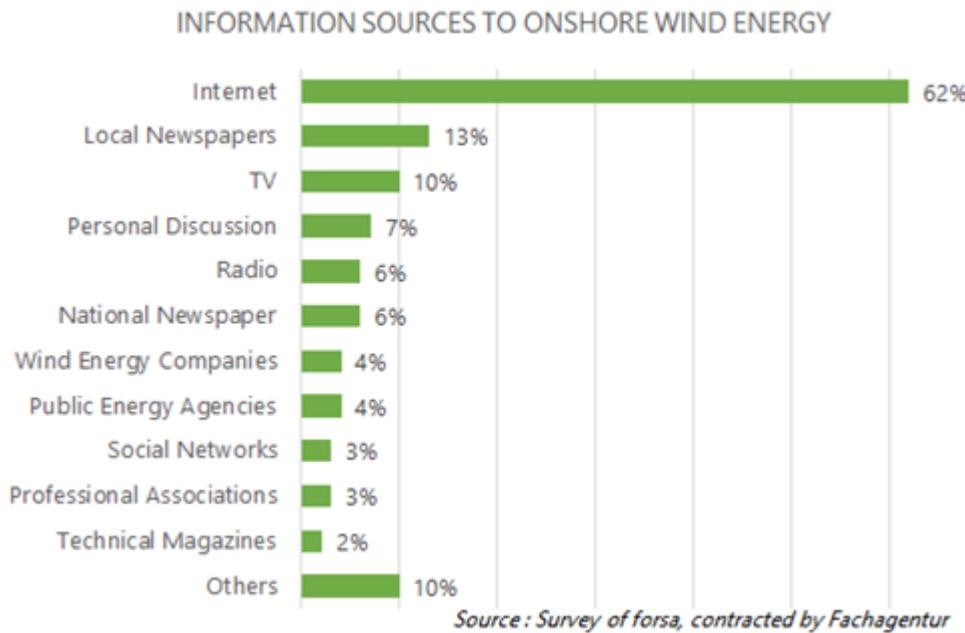


Figure 22: sources of information for wind energy - source: Fachagentur-windenergie.de

Users may easily search and locate useful information, possibly from different sources and point of views. On the other hand, because of the profusion of different sources and opinions, finding out objective information on internet is far to be an easy task for common users. Proposing neutral official information

¹⁷⁹ Fachagentur Windenergie an Land e.V. (FA Wind) (ed.) (2016): Umfrage zur Akzeptanz der Windenergie an Land – Herbst 2015. Ergebnisse einer repräsentativen Umfrage zur Akzeptanz der Nutzung und des Ausbaus der Windenergie an Land in Deutschland. Berlin.
https://www.fachagentur-windenergie.de/fileadmin/files/Veroeffentlichungen/FA_Wind_Umfrageergebnisse_Fruehjahr_2016.pdf

website, which balances objectively the benefits and drawbacks or risks of the projects is therefore particularly important within a trustful communication strategy.

Several wind energy project developers propose such official information website to municipalities, like *Endura Kommunal* from Freiburg - Germany for the new wind park project of Elztal in *Black Forest*¹⁸⁰ : it gathers documented information on wind energy environmental and economic impacts, opinions from citizens and local politicians of different parties, maps, photomontages (or video shows) representing landscape views with the new wind turbines, a monitoring of the project development etc. Such websites are very helpful to provide detailed information to citizens. On the other hand, most of them are pretty static and don't enable an exchange between the citizens and the different actors.

The Web 2.0 generation, at the origin of the social network revolution, enables users to interact and communicate virtually together as a global community. Based on it, several citizen participative platforms (so-called Democracy 2.0 or civic tech¹⁸¹) were developed these last years, in order to reinvent the relationships between citizens and their representatives as well as catalyze bottom-up initiatives.

For instance, *Fluicity* (www.flui.city) builds web platforms and applications to fluidify the information exchange between citizens and public authorities. Through online surveys and forums, representatives may evaluate the acceptance of new projects and measures among the populations, and get new ideas from them. Citizens may group together around local participative projects. Municipality Information are widely and instantaneously spread to citizens through a news-feed accessible on each smartphone.

Cityility is another web application (www.cityility.com) aiming at maximizing exchange and mutual aids between citizens of a same collective buildings or a same neighborhood. It allows citizens also to inform instantaneously its landlord, property developer, facility manager or municipality about incidents

¹⁸⁰ Website of the new windpark of "Oberes Elztal" (January, 2017) <https://www.windenergie-oberes-elztal.de/>

¹⁸¹ Forbes (June, 2015): "Why Civic Tech is the Next Big Thing" Mike Montgomery <https://www.forbes.com/sites/mikemontgomery/2015/06/24/why-civic-tech-is-the-next-big-thing/#1e9edf2d369a>

and needed repairs, by adding geotags on an interactive map of their buildings or neighborhood.

Other promising information technologies enable citizens to have a realistic and immersive insight of a completed Energy transition project before it is started. This is the case of 3D Geographical Information System (also called virtual 3D city model) and augmented reality.

In the research project 3D-VIS¹⁸², *Fraunhofer Institute* and its consortium partners developed a software to plan wind energy parks and high-tension lines collaboratively around a multitouch table. Based on virtual 3d city models, it allows to visualize in 3D different project variants and their impacts over their neighborhood. For instance, citizens can virtually experience the visual effect of the rotating wind turbine blades from the windows of their house.



Figure 23: Collaborative planning of wind turbines, source: Project 3D-VIS

Other similar 3D collaborative applications, such as the *UrbanAPI*¹⁸³, are accessible through 3D web client and on mobile applications, thanks to the latest *HTML5*, *webGL* and *OpenGL* web technologies.

Augmented reality is another powerful immersive technology, which can bring variants of the future in front of our eyes, integrated into the reality through

¹⁸² Website of 3d-vis Project (Dec 2017): <http://www.3d-vis-projekt.de/>

¹⁸³ Website of the UrbanAPI project (January 2018) <http://www.urbanapi.eu/>

the camera of our smartphone or digital tablet. It is now commonly used in architecture and (participative) urban planning¹⁸⁴, enabling different users to observe the changes of their neighborhood and landscape morphology following the implementation of a photovoltaic installation or a wind park¹⁸⁵.

Immersion in the future may even be multi-sensory, combining visual and acoustical dimensions for instance. French research institute *CSTB* developed the simulation software *MitraSON*¹⁸⁶, capable of exterior soundscapes restitution in a realistic manner. Their immersive room Le Corbusier in Sophia-Antipolis allows an even more realistic experience, deeply involving the audience in a future with more wind turbines and electric cars.

D.1.3 A new concept development

Allying collaborative Web 2.0 and 3D geographical information technologies would provide together citizens, project developers and public authorities with a powerful communication platform for Energy transition technologies and projects.

Such a platform, or rather multi-platform: accessible on computers, smartphones, digital tablet or immersive rooms, would be a virtual meeting place for the different stakeholders of the project, enabling them to exchange together and with the citizens about project development scenarios and alternatives.

Fully exhaustive and transparent information on the project and technologies would be provided in real-time to citizens, possibly with different optional “user filters” to provide them with data adapted to their individual technical knowledge and needs. It could include a project monitoring, costs and benefits dashboard, as well as a graph representing the roles and interactions of the project stakeholders.

¹⁸⁴ Reinwald, F., Berger, M., Stiuk, C., Platzer, M., Damyanovic, D., 2014. Augmented Reality at the Service of Participatory Urban Planning and Community Informatics - a case study from Vienna. *The Journal of Community Informatics*, Vol.10, No3 (2014)

¹⁸⁵ Dekker, G., Zhang, Q., Moreland, J., Zhou, C. (2013). MARWind : Mobile Augmented Reality Wind Farm Visualization - Proceedings of World Congress in Computer Sciences 2013 (<http://worldcomp-proceedings.com/proc/p2013/MSV3593.pdf>)

¹⁸⁶ Website of CSTB (January, 2018) : <http://software.cstb.fr/Products/MithraSON-EN.html>

Thanks to immersive technologies such as augmented / virtual reality, citizens would get a realistic impression of the technology intrusiveness degree and the visual (and/or acoustical) impacts on their neighborhood, in order to reduce their apprehensions and doubts. In return, citizens would provide project coordinators with their opinions and acceptance rate on different proposed project alternatives, possibly identifying spatially-related issues with geotags on interactive maps.

Such a platform would also integrate discussion forums, common to different Energy transition projects to exchange experiences and questions, and social network functionalities, to make full use of the community roles (family, friends, local and regional authorities) and interact with trustful local relays.

Moreover, this virtual meeting place would integrate a citizen participation portal as catalyst of local citizen initiatives. It could propose crowdfunding campaigns, connect persons wishing to create local citizen energy cooperatives together and support them in the juridical and administrative process.

Beside all these citizen-oriented functionalities, this platform would also provide planning teams and public authorities with a collaborative planning tool. This tool would support the project decision making process based on realistic visualizations and simulations of project model variants, and on the citizens feedbacks and alternative propositions. The overall Energy transition project and its acceptance would be greatly improved by this experience of collective intelligence.

In terms of development and business model, a programming company could develop a unique modular IT architecture whose content could be easily adapted to the different projects, so that most of developing costs would be mutualized, and costs for customers could be significantly reduced. Such a platform would be delivered plug-and-play to project management teams or municipalities, so that these ones do not need any programming skills to use and maintain it. For persons without internet access or not used with internet, municipalities and project development team could even provide free internet service and demonstration meetings, so that nobody would be excluded from the Energy transition process.

D.2 Living Labs and experimental space

D.2.1 Targeted Issues and challenges to answer

Part B and C showed that citizens inclusivity as well as communication and knowledge exchange during energy transition projects is key to increase citizen acceptance. The LivingLab approach is also tackling the information and participation gap (already addressed in solution D.1), enhancing the energy technology innovation process.

There is a need to address already in early stages of energy transition projects the effectiveness of energy technology innovations that is limited by two problematic complexes: (1) many innovations with high sustainability potential fail due to inadequate market acceptance and secondly (2) due to unexpected real usage patterns, they often do not meet the original expectations of their sustainability effects (rebound effect¹⁸⁷). Important factor causing rebound effects are unexpected user behavior or wrong application of potentially sustainable innovations. So, it is essential to take behavioral aspects into account¹⁸⁸.

In this way, the LivingLab approach especially targets the aspects of citizens inclusivity through dialogue and listening (INC.3) and participative decision-making (INC.4), the communication and knowledge exchange through audience-centered communication (COM.3) and the enabling of science and society interlinkages (COM.4), and addresses the issue of increasing motivation and using of incentives (esp. analysing the citizens resistance to change MOT.1, creating symbolic rewards MOT.3), to finally increase the energy transition acceptance.

Traditional methods for generating insights on consumers rarely make it possible to experience the full benefits of sustainable products, and often fail to predict accurately whether consumers will understand the technologies that underpin truly innovative products. As a result, sustainable products and innovations often fail in the market¹⁸⁹.

¹⁸⁷ Herring H. (2009) Sufficiency and the Rebound Effect. In: Herring H., Sorrell S. (eds) Energy Efficiency and Sustainable Consumption. Energy, Climate and the Environment Series. Palgrave Macmillan, London

¹⁸⁸ Liedtke, C., Welfens, M.J., Rohn, H., Nordmann, J. 2012a. Living Lab: User-Driven Innovation for Sustainability. International Journal of Sustainability in Higher Education. 13(2), 106-118.

¹⁸⁹ Report of Mac Kinsey - 2006

Thomke & Hippel¹⁹⁰ highlight that one of the basic problems in product development is that the needs of the user / customer have to be understood by the developer, which in turn understands the possibilities given by enabling technology. The process of conveying the need to the developer is a complex, often trial and error like, process where the developer responds with concept models or prototypes to solve the needs until the user is sufficiently satisfied.

For the project and technology developers, providing experimental spaces for users and developers in LivingLabs enables to tackle effectively missing market acceptance of new energy technologies and taking rebound effects into account in innovation processes. Living Labs differ from "pure real laboratories" in that innovations are not implemented directly in the real world on a larger scale, but are tested and developed in a real-world laboratory. By doing so, they reduce liability risks and problems of service maintenance during implementation and contribute to confidence in energy innovation processes.

D.2.2 An innovative citizen-centered solution

Living Labs are research and innovation platforms that address real-world usage processes at an early stage of an innovation process. A Living Lab consists of four main activities: (1) conducting contextual and user studies and determining the cultural, legal, technical and market-specific boundary conditions; (2) co-creating innovations involving users and developers; (3) conducting experiments in use scenarios; and (4) evaluating products and services in real-world environments.¹⁹¹

The involvement of users in the design and evaluation process of sustainable products is fundamental to develop usable and acceptable products and services. Central to involving users are living labs based on a research and development (R&D) methodology where innovations such as product-system-services or application enhancements are created and validated in collaborative and empirical real-life experiments¹⁹².

¹⁹⁰ Thomke, S.; Hippel, E. von (2002): Customers as Innovators: A New Way to Create Value. In: Harvard Business Review, 80(4)

¹⁹¹ See InnoLab website <http://www.innolab-livinglabs.de/> and OpenLivingLabs website www.openlivinglabs.eu

¹⁹² Sleeswijk Visser, F., Visser, V.. (2006): Re-using users: co-create and co-evaluate. In: Personal and Ubiquitous Computing, 10(2-3), 148–152

Involved users can give a more effective feedback, as they already have a relatively deep understanding of the application's concepts. Thus, the LivingLab concept can be generally understood as the ability to **bring user, technology and business into an open innovative development process** that establishes real life environments.¹⁹³.

The Sustainable LivingLab (SLL) methodology is rooted in projects conducted by the Wuppertal Institute and several cooperating partners, and was further developed in a continuous action research approach¹⁹⁴ together with both scientific and business partners as well as users in households. Results showed that, "products with significant environmental effects in the use phase should be developed in LivingLabs with a clear focus on the user context to prevent unwanted side effects".¹⁹⁵

The described methodology was applied in the German focus region InnovationCity Ruhr, Model Town Bottrop¹⁹⁶. During Insight Research, first a pre-analysis of building characteristics was conducted comparing heating energy consumption of different types of buildings in InnovationCity Ruhr (sample based on quantitative data on cost structure for heating energy by Housing Society VivaWest and InnovationCity Management). Then the experiment on the effect of smart home systems and traffic light feedback on heating energy consumption was conducted in 80 private households.

¹⁹³ Eriksson, M. et al. (2006): Living Labs as a Multi-Contextual R&D Methodology Proceeding of the International Conference on Concurrent Enterprising (Milan, Jun. 26-28)

¹⁹⁴ Lewin, K. (1951): Field theory in social science. Harper & Row, New York.

¹⁹⁵ Liedtke, C., Welfens, M.J., Rohn, H., Nordmann, J. (2012). Living Lab: User-Driven Innovation for Sustainability. International Journal of Sustainability in Higher Education. 13(2), 106-118.

¹⁹⁶ The idea of InnovationCity Ruhr, Model Town Bottrop, is to transform a complete city district with a population of about 70,000 into an exemplary district for energy efficiency by 2020. More than 100 projects addressing different fields of action have already been proposed – some are already implemented. InnovationCity Ruhr is managed by the InnovationCity Management GmbH which is an official partner of SusLabNRW (for more information see <http://www.bottrop.de/microsite/ic/>)

Key Findings

Part A

#1 Different understandings of the Energy transition exist in France and Germany

These different understanding are firstly reflected in the semantics: the German term *Energiewende* introduced in the 90s invokes a rupture, whereas the French term *Transition Energétique* describes a softer path.

The considered end goal of energy transition is also different in both countries: In France, the Energy transition main goal is energy decarbonization, making CO₂ emissions the most considered key performance index. In Germany, CO₂ emissions is one index among others: politicians often mention the climate neutral society ("Klimaneutrale Gesellschaft") as global goal to achieve, related to a combination of solutions such as development of renewable energies, reduction of energy consumption and (nuclear) wastes and citizen participation.

#2 Comparing the German *Energiewende* with the French *Transition Energétique* is a delicate exercise in terms of complexity and comparability

Such a comparison requires a careful preparation and to pay attention to many aspects of the respective contexts. Municipal organization, industry and energy market structures, research funding, history and heritages, landscapes, population density, natural resources, the role played by communities, the value of symbols, the relationship to money or technology are just some of the main aspects differentiating France and Germany. They deeply influence and connect with the dynamics and choices of the Energy transition. This one cannot be easily isolated of the socio-cultural context.

Arguments pro or contra the different types of energy sources and Energy transition approaches are connected to point of views and personal or group values, leading to a range of clichés: the difference between *Energiewende* and *Transition Energétique* cannot be resumed to a mere dichotomy between the French nuclear plants versus the German brown coal plants for instance.

#3 Two different approaches of Energy transition technology deployment, based on “Grand Projet” in France, and social market economy in Germany (example of the smart meter deployment)

Historically in France, the welfare-state through its owned companies (EDF, GDF etc.) has played a central and leader role in the development of the energy system and the main Energy transitions since WW2: modernizing the electricity industry, securing the national energy supply, transition to hydropower during the reconstruction period, transition to nuclear after the oil crisis, and now transition to smart grids and smart meters. Guiding principles are the territorial equality for the energy access and the social equity with a unique fixed and low regulated energy tariff.

In Germany, most Energy transitions and new technologies have been deployed by the social market economy (“*soziale Marktwirtschaft*”), guided by laws (e.g. *Erneuerbare-Energien-Gesetz*) and incentives (e.g. Feed-in-tariff) implemented by the federal state.

Comparing the smart meter deployment strategies in both countries is a very telling example of both approaches: the state-owned company *Enedis*, which is in charge of the power distribution over 95% of the French territory, invested five billion euros to develop and install the smart meters *Linky* project in 35 million households by 2021. In Germany, the Law on the digitalization of the energy transition (July 2016) expects all net operators to replace the current meters with “advanced” meters from 2020 until 2032.

#4 Decision-making stakeholders in the energy sector are more numerous in Germany than in France

The German energy sector is characterized by a higher number of decision-making stakeholders, from regional energy supply companies to citizen energy cooperatives, via municipal utilities (“*Stadtwerke*”). This has the consequence to reduce coordination and system control possibilities for specific players and increase the plurality of technologies and the diversity of the energy mix.

At the contrary, the French system shows a high concentration on a few decisive stakeholders, strengthening the control on interactions between the system components, thus increasing the system structuration and its resistance to exogenous change. Since the end of the energy supply monopoly in 2007, the French stakeholder number is however increasing.

#5 Cities are the local drivers of the Energy transition

Closer to citizens and their everyday life than governments and industries, and responsible for solving critical environment issues (air pollution, resilience, urban heat islands etc.), cities are trend-setters and coordinators of the energy transition at the local level.

Many German cities still own their municipal workshops which are multi-service companies in charge of energy, transportation, communications, water-management, waste management (the list variates from a company to another). They give municipalities the local steering opportunities and needed cash to drive their local energy transition. Without such levers on the industrial side, French municipalities however managed to invite themselves into the national climate discussions. They can be considered as innovative actors influencing and challenging the existing regime.

Part B

#6 Despite all these contextual differences, Energy transition acceptance of both French and German Citizens reach a similar high level

According to last surveys and on-site studies, German and French populations are aware of the energy transition and widely agree the expansion of renewable energies (93% in Germany, 89% in France). In details, solar installations are the most popular technologies, followed by wind mills (81% in Germany, 77% in France). The more experiences and touch points citizens already have with renewable energy technologies, the higher is generally their acceptance. Having such technologies installed in its neighborhood influence from neutrally to positively the acceptance rate for instance.

Proponents in both countries are part of all political affiliations, educational levels, age groups and income classes. French citizens show however more doubts about the capabilities of these technologies to replace the existing system at the horizon 2050.

#7 Several kinds of citizen oppose energy transition projects in both lands, representing though a minority of the population

In both countries, persons having a bad opinion on the current energy transition represent a minority of the population (between 5% to 11%). Active resistance is even more rare, but the nuisance impact of these opponents, regrouped in structured organizations and federations, can be much stronger than the support of other acceptance groups.

However, most opponents to energy transition projects are either passive or local who are in favor of a certain technology but do not want them to be realized close to where they live ("Not-In-My-BackYard" syndrome). Empirical surveys reveal that reasons for local opposition are diverse: financial, health, environment, aesthetic impacts. As for conventional energy plants, this syndrome is often revealing a fear of the unknown and citizens already surrounded by renewable technologies show a significant higher level of acceptance.

#8 Citizens generally want to be more involved into the Energy transition, even if this involvement expresses in different ways in France and Germany.

A lot of French and German citizens say to be poorly informed about participation opportunities and wish for a better public involvement in the planning process. There are also four out of five citizens (same ratio in France and Germany) to find Citizen cooperatives important for the energy transition. However, in practice such structures are six times more common in Germany than in France (respectively 1 000 and 165 in 2015). This is partly due to a more adequate and simple legal framework in Germany, but also due to different expectations regarding the role of the State and the population: Most French people assess this is the role of the welfare-state and public authorities to lead the energy transition, whereas German citizens are used since many years to take a personal part in energy transition projects (50% of renewables are in the hands of citizens and cooperative groups in Germany).

#9 Bottom-up initiatives can be the combined catalysts of Energy transition, citizen acceptance and community feelings

Active participation (e.g. financial involvement, commitment to the local Agenda 21 or energy cooperatives) strengthened the acceptance of citizens. Financial participations of citizens in energy transition projects are already possible in France as in Germany through crowdfunding or crowdlending online platforms. Some citizens may also regroup locally in citizen cooperatives (or *RESCoop*) to plan, fund, manage and collect the dividends from energy transition installations.

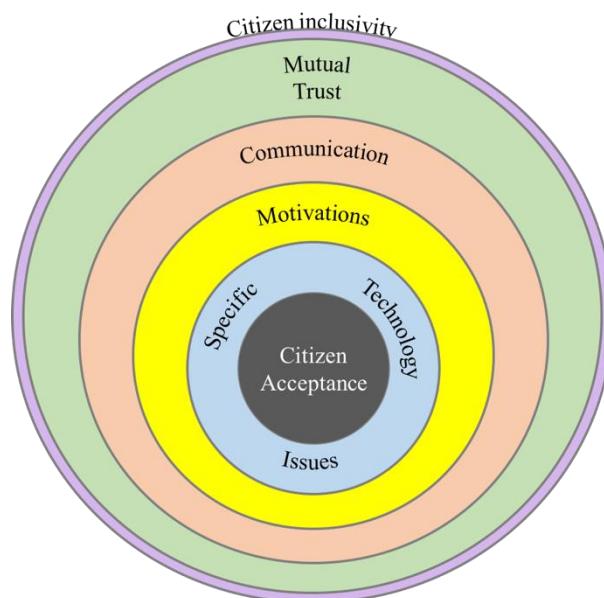
These cooperatives generate a high local energy transition acceptance, democratize energy supply, strength the community feelings and face in practice no opposition on-site. French and German citizens both show a higher confidence in local cooperatives, associations and small projects than in big companies and public authorities to manage the deployment of renewable technologies. Energy transition is not only a matter of energy production system for citizens but also an opportunity to claim ownership of the energy management through citizen cooperatives.

Part C

#10 This study proposes a new typology of citizen societal issues related to the energy transition

This typology is a co-creation between the project partners and some energy sector professionals, based on experiences of both French and German energy transition projects. It aims at providing a guideline to energy transition actors in order to avoid possible friction points and maximize the chance of citizen acceptance before, during and after implementing new energy transition technologies.

Twenty-four societal issues related to citizen acceptance of energy transition could be identified, analyzed and classified into five main consistent categories: Citizen inclusivity, Mutual trust, Communication, Motivation and incentives, Specific technology issues. These issue categories may be visualized as onion layers: each layer represents issues to overcome on the way to full citizen acceptance.



#11 Citizen inclusivity is the societal base of citizen acceptance

We are obviously not equal when it comes to energy transition questions. If citizens feel excluded from this process, or if the rules are not designed for them, they are likely to become indifferent, suspicious or even reluctant to any energy transition project, even before it starts, spending their time and energy rather against than for it.

To include a maximum of citizens into this global process, political and institutional decisions must consider their interests (INC.1), legal and administrative frameworks must be adequate to them (INC.2), citizens needs also to be included in the project dialogue since the early project design phase (INC.3) while their remarks and propositions should be seriously considered in an open planning process (INC.4). Finally, citizens willing to participate actively into the energy transition process should find on their ways support and incentives rather than barriers (INC.5).

#12 Mutual trust is the necessary social capital to start any Energy transition project

Mistrust is a critical recurring issue, particularly when projects reach an industrial dimension. Without trust, citizens won't be receptive to any argument nor messages from the project team, whatever the quality of their communication plan, since their credibility is not provided for. Trust and credibility are a prerequisite at the beginning of any energy transition projects. This social capital should be further maintained and cultivated during the project development and operation phases.

The energy transition project management team must be exemplary, accountable for positive as well as negative evolutions of the project (TRU.1). Project developers must find local relays among local representative persons and associations to set a trustful connection with the local population (TRU.2). Sense of justice is also a pre-requirement of any trustful relation (TRU.3). Risks must be clearly analyzed and transparently presented to the local population, as well as the measures to supervise and minimize them (TRU.4). Finally, if negative experiences related to energy transition technologies occur, they must be recognized, and answered promptly, to maintain the trustful connection between the project responsible team and the local population (TRU.5).

#13 Communication makes the difference in an energy transition project

The communication has globally been revolutionized in the past decades. Limited contact to citizen, culture of secrecy on projects such as nuclear or grid safety issues are not even possible in a digitalized world or with bottom-up projects. Thus, citizens should not feel passed by or they might develop forms of resistance.

Complete information shall be given from the very early stage of the project and continuously then (COM.1), this information must be transparent (COM.2) and its format adapted to the profile of the local population (COM.3). It must also reweave the relation between science and society, in order that citizen understand global stakes of the energy transition (COM.4). Finally, the communication plan must anticipate the interferences with opponent organizations, act rather than react, bring positive experience feedbacks rather than only scientific proofs, and eventually offer the population to visit similar projects and discuss with the local population (COM.5).

#14 Benefits and motivation sources must fairly balance drawbacks and risks

On-site studies and surveys show that citizens are much more accepting new energy transition projects if benefits and risks are shared fairly between them and the project developers. Enabling and emphasizing financial as well as social advantages may form positive attitudes toward the energy transition.

Understanding and analyzing the local citizen resistance to change (MOT.1) allows to set the appropriate financial compensations (MOT.2) and imagine the right symbolic rewards (MOT.3) able to trigger citizen willingness to positively participate into the energy transition process. Local identity and community feeling expression through energy transition projects is also a lever to strengthen the citizen acceptance (MOT.4).

#15 Technology specific issues and risks must be openly assessed, answered and supervised

The implementation of new energy transition technologies brings societal issues specific to the different technologies. Some tend to shrink the citizen private spheres with their material and immaterial intrusiveness (TEC.1), some others modify the neighborhood morphology (TEC.2), they can also restrict the individual freedom to which citizens were used to (TEC.3). Some, innovative and promising, are still not mature and need to be tested by beta users (TEC.4). Finally, the Energy transition" involves a process of technology transfer, which may be unevenly distributed geographically. An entire new generation needs to be prepared to these new energy transition jobs (TEC.5).

As a consequence, citizen societal acceptance of energy transition may vary depending on the technology features and specific impacts. To be widely accepted and used, these specific issues and risks must be openly assessed, anticipated, and minimized, possibly with citizen experiences and information technologies.

Part D

#16 A Citizen Information and Participation 2.0 platform to maximize citizen acceptance

The more experiences and information citizens already have with renewable energy technologies, the higher generally is their acceptance. On the opposite, those confronted for the first time have often many doubts and a fear of the unknown.

A communication platform based on web technologies, democracy 2.0 and virtual reality has been conceptualized during this study, based on existing technological solutions. It aims at transforming the relationships between citizens, their representatives, and project's owners as well as catalyze bottom-up initiatives.

Such a web-platform could integrate different features able to answer the different issues listed in the part C: a virtual meeting place to dialogue with the project developers, a news-feed to get the right information at the right time, a social network to make full use of the community role (family, friends, local

authorities) and exchange their experiences, a crowdfunding portal to get financially involved.

Furthermore, immersive technologies such as augmented / virtual reality would give citizens a realistic impression of the technology intrusiveness degree, in order to reduce their apprehensions and doubts, and visualize the local path to Energy transition.

#17 A citizen experience lab to maximize citizen acceptance

It is not breathtaking to say that sustainable products and innovations often fail in the market and have a poor return on investment. In order to reach citizen expectations and needs, another solution is to develop a user centered approach. Involvement of users in the design and evaluation process of sustainable products is fundamental to develop usable and acceptable products and services. Users should be considered as a source for innovation and bring together technology and business into an open innovative development process that establishes real life environments. The solution is organized around three phases Insight Research, Prototyping and Field Testing.

Overall

#18 Interactions, inspirations and solution transferability between both Energy transitions are possible... within certain limits

Sharing energy transition project experiences, both best practices and faced problems, represent a rich source of knowledge for further projects and initiatives. Bi-directional inspiration from France and Germany multiplies this knowledge and enables to understand the influences of different contextual factors. This mutual inspiration makes us also glimpse the success of innovative foreign economic models and legal frameworks which would have seemed unthinkable or unfeasible at home.

However, every solution cannot be transferred one-to-one between different countries. A filtering process to isolate the solutions from the political, socio-economic and cultural contexts should be done. For instance, a "Grand Projet" approach cannot be undertaken in Germany, since the State has little participations in the energy players.

At the opposite, French municipalities do not have the same means to realize a local energy transition, as German municipalities do with their Stadtwerke. But a multitude of alternative solutions exist. On the other hand, frameworks and motivations to foster citizen cooperatives, project management methods to maximize citizen acceptance as well as all other solutions listed in part C are easily transferable and adaptable to the different energy transition projects.

Though these exchanges and lessons learned process, past errors can be avoided, risks can be anticipated, and citizens can fully appropriate their Energy transition.

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Annex 1: Stakeholder Interviews

In the framework of this study, 14 interviews with Energy transition stakeholders of diverse backgrounds and profiles have been conducted:

Interviewed persons	Organizations	Date interview
Karl Schumacher, Citizen	Citizen cooperation Rutesheim-Solar-Aktiv-I GbR	17/10/2017
Emilie Fourgeaud, Wind project manager	Volkswind - France	02/10/2017
Etienne Becker	France Stratégie	23/10/2017
Sabine Barden, Wind project manager	Endura Kommunal	12/12/2017
Markus Jenne, Energy transition Lawyer	Sterr-Kölln & Partner	15/12/2017
Bernard Gsell, CEO	EDF Deutschland	8/11/2017
Matthieu Terenti	Enedis	20/11/2017
Etienne Beeker, Energy senior manager	France Strategy	23/10/2017
Michel Bénard	Independent consultant	24/10/2017
Melanie Peschel	Smart grid project C/sells - Germany	23/01/2018
Philipp Meidl	Stadtwerke Düsseldorf	23/01/2018
Director	City of Freiburg	20/12/2017
Engineer	Transnet BW	30/01/2018
Project manager	ex-Stadtwerke Karlsruhe	18/12/2018