D5.1 | Report on Governance Barriers for the Social Acceptability of Energy Transition Technologies and policies

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The project in brief

The Energy Union Framework Strategy laid out on 25 February 2015 aims at fostering a cost-efficient energy transition able to deliver secure, sustainable and affordable energy to all European consumers. It has embraced a citizen-oriented energy transition based on a low-carbon transformation of the energy system. At the end of the day, the successful implementation of the Energy Union will materialise in a change in energy production and energy consumption choices. Such choices are heavily shaped by particular economic prerequisites, value systems, gender-based preferences, efficiency of governance and the maturity of civil society.

The ENABLE.EU project attempts to understand the key drivers of individual and collective energy choices, including in the shift to prosumption (when energy consumers start to become also energy producers). The project will develop participatory-driven scenarios for the development of energy choices until 2050 by including the findings from the comparative sociological research. As differences between European countries remain salient, ENABLE.EU will have a strong comparative component.

The final aim of this project is to contribute to more enlightened, evidence-based policy decisions, to make it easier to find the right incentives to reach the twin goals of successful implementation of the Energy Union and Europe's transition towards a decarbonised energy system. To reach this final aim, ENABLE.EU will seek to provide an excellent understanding of the social and economic drivers of individual and collective energy choices with a focus on understanding changes in energy choice patterns. Results will be disseminated to relevant national and EU-level actors as well as to the research community and a wider public.

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1. Introduction

Building on a 2010 proposal by Jacques Delors, the European Union is now building its Energy Union that aims at fostering a cost-efficient energy transition able to deliver secure, sustainable and affordable energy to all European consumers.

The Energy Union Framework Strategy laid out on 25 February 2015 embraces a citizens-oriented energy transition. Resting on five pillars (Energy security, solidarity and trust; A fully integrated European energy market; Energy efficiency contributing to moderation of demand; Decarbonising the economy, and Research, Innovation and Competitiveness), it aims at easing the delivery of the EU energy-climate objectives: reduce EU territorial greenhouse gas emissions (by 20% by 2020, and by 40% by 2030), increase the share of energy coming from renewable sources (to 20% by 2020 and to 27% by 2030) and improve energy efficiency (by 20% by 2020, by 27% by 2030).

Those general EU objectives are largely supported by the EU public opinion. According to a special Eurobarometer survey[1] published in 2014, 80% of the Europeans agree with the statement that "fighting climate change and using energy more efficiently can boost the economy and jobs in the EU". This element is particularly crucial at a moment where many EU Member States face severe unemployment. In the meantime, 91% of the surveyed Europeans were supportive of national governments setting renewable energy targets and 92% in favour of governmental support for energy efficiency. Democratic legitimacy and public acceptance/support however need further efforts to understand and include all stakeholders in the governance of the energy transition; as well as ensuring that public policies are in line with citizens' preferences.

The development of energy transition policies will depend on the following prerequisites and assumptions:

- Energy cultures and energy systems differ across Europe. This means that there are different challenges and opportunities with respect to low carbon energy transition. Pathways to successful transitions will also differ. To understand this requires comparative research.
- A low carbon and more decentralised energy system will increasingly be based on public engagement and participation.
- Socio-economic incentives including regulatory and organisational structures should be employed for achieving social acceptance and public participation of citizens, including for those consumers wishing to become prosumers.
- Socialisation of new renewable and energy efficient technologies through innovative public discussion among stakeholders and the general public.
- Interactions between individual energy preferences and governance policies.
- Gender impacts both on individual and policy choices.

[1] Special Eurobarometer 409 on Climate Change, March 2014, online available at http://ec.europa.eu/public_opinion/archives/ebs/ebs_409_en.pdf, accessed on 15.02.2017.

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At the end of the day, the successful implementation of the Energy Union and the EU objectives depends on energy production and energy consumption behaviours from suppliers and consumers (i.e. households and business), and those behaviours will be heavily shaped by past, present and future policy choices formed by the interaction of different governance processes, economic prerequisites and the maturity of civil society.

1.1. Energy Union: closing the gaps between energy policies in the EU

Building a common European energy policy has always been challenging. The divergent interests of the EU Member States have pulled Europe's energy priorities in different directions stemming most incentives for policy coordination. It took more than 50 years for the European leaders to agree on a new European Common Energy Policy and still Member States continue to defend their rights to determine the national energy supply mix. Recent examples have been Germany's unilateral decision to abandon nuclear energy and Poland's insistence on preserving coal as the main source of power generation, to name just two. The EU Energy Union initiative announced in 2014 has provided a new impetus for streamlining Europe's energy policy under three interrelated objectives: security of supply, energy sustainability, and economic competitiveness.

To complete the Energy Union along the path of energy transition towards low-carbon, affordable and secure energy supply, the European Commission along other key stakeholders would need to actively engage consumers, both households and businesses. The different energy paths chosen by Member States have been largely the product of bottom-up pressures from consumers and/or citizens demanding cheaper and cleaner energy, nuclear phase-out, and reliable deliveries. Diverse demands stem from different socio-economic, sociocultural and socio-political environments in the Member States. Expanding policy-makers' understanding of these interrelated concepts is key to finding the right incentives for the successful implementation of the Energy Union initiatives.

Yet the energy transition envisioned in the Energy Union plan hinges upon the ability of markets to adapt to the new policy-driven framework. Despite the ongoing changes, consumers including households, businesses and industry still cannot fully benefit from the transformations as they face imperfect information, rising network fees and additional surcharges, limited retail and wholesale market competition (especially in CEE), insufficient support for demand-driven mechanisms and regulatory and investment gaps in decentralising supply on a large scale.[2] Consumer empowerment, in that respect, refers not only to the creation of more options for demand optimisation and improved pricing but to the transformation of consumers into active consumers or "prosumers".

The decentralised energy supply will be difficult to achieve before the ongoing process of market liberalisation and deregulation is complete. In fact, Member States, mostly in Central and Eastern Europe but also some Western countries, have been reluctant to open up their retail markets for fear of social tensions or citing limited conditions for competition. Protecting energy vulnerable households may however backfire as inefficient power consumption, for example, for heating drives

[2] European Commission, COM (2015) 339. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Delivering a New Deal for Energy Consumer, 2015, Brussels.

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up utilities' bills to excessive levels in the winter. The Bulgarian protests from 2013 that toppled the government are proof that maintaining artificially low energy prices does not guarantee social stability. This policy is also non-productive as it limits the incentives for improving energy efficiency, developing renewable energy technologies and making more economically rational energy choices.

The approach taken by the ENABLE.EU project towards the energy transition paradigm in the Energy Union is underpinned by the non-exclusive but recurring use of an adapted version of the neo-historical institutional theoretical framework as laid out by Streeck and Schmitter (1991) and Thelen (1999), to understand institutional change in industrialised democracies. According to the theory, studying institutions requires both a macro- and a micro-historical approach, in which one emphasises the sequencing and timing of the different patterns of interaction between grand economic and political processes (Ikenberry 1994, Moore 1966, Katznelson 1997). Instead of understanding institutions as functional bodies made up of regimes regulating collective action, political processes are the outcomes of a temporal ordering of international events and structural trends (Ikenberry 1994). Hence, policy formation is path dependent meaning that countries set in different economic environments may have different development pathways. Moreover, institutions continue to evolve in response to changing environmental conditions and ongoing political manoeuvring but in ways that are constrained by past trajectories.

From a neo-historical institutionalist standpoint, the development of the Energy Union is constrained by already chosen pathways of both the EU and Member States. Despite an ambitious plan to create an Energy Union, the attitudes and interests of Member States differ when it comes to supply, use and transformation of energy sources.[3] If left unchecked, discrepancies in the energy policies of EU members can hamper the adoption of a long-term approach to energy policy to ensure security, affordability and sustainability of the energy supply for Europe's citizens and businesses. Apt case studies of the divergent energy policy paths include Germany, Poland, the UK, France, Italy and Spain.

To ensure that national differences do not lead to national divergences, the EU would have to do more to drive forward a "big picture" approach to energy policy that goes beyond a simple balancing of different interests. There is a need for a paradigm shift to a focus on demand-side responses to energy issues since the supply remains the prerogative of each Member State. Two big trends need to be further strengthened and implemented under a clearly-specified long-term plan including the reduction of energy consumption by 27%[4] and the reduction of greenhouse-gases (GHG) by 40% (from the level of 1990), by 2030. It is important to point out that this coordinated target would not be important only for climate change mitigation but would also affect the security of energy supply and the affordability of energy. This governance trilemma in the decision-making of each Member States could be overcome through the provision of regulatory, political and financial incentives.

In addition, the realisation of this strategy to achieve transitions to sustainable, low carbon economies across Europe will require both radical and incremental innovations. As highlighted, many

[3] In itself, national diversity does not need to be negative for the Energy Union. For instance, cultural diversity leads to Spain's daily electricity consumption peak to be reached at 9-10 pm, while France's tend to be at 7-8 pm because Spaniards and French do not generally have dinner at the same moment. Yet, this diversity is actually positive for security of electricity supply.

[4] This reduction is the reduction of EU energy consumption compared to a Business As Usual scenario.

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of the barriers to a successful transformation towards sustainability of the energy system are of a social character. Among other things, there is a need for the Energy Union to increase social acceptability of low-carbon technologies[5], and to make investments in new energy technology more profitable than they are today. This means that public support that may emerge from citizen engagement can be a fundamental driver of the low carbon energy transformations.

1.2. The Clean Energy Package for All Europeans: A Push Towards Better Energy Governance

Parting with habits is always difficult. People tend to delay changing their behaviour. Like people, so are governments rarely willing to shift their policies around to accommodate a long-term objective that does not seem necessary at the moment and that would require uncomfortable and sometimes even painful adjustment. Energy policy is an area where major changes can be difficult to undertake.

After three major energy packages (1996, 2003 and 2009) of legal changes mostly successfully adopted on national level, the EU has launched a more ambitious plan of designing a common Energy Union. The initiative is finally taking shape in the form of a comprehensive set of legislative proposals, including the November 2016 Energy Union Governance regulation proposal that is one component of the European Commission's 'Clean Energy for All Europeans' package.

The new Governance Framework proposed by the Package aims at:[6]

- ***Streamlining planning, reporting and monitoring obligations***: Integrated National Energy and Climate Plans, subsequent Integrated National Energy and Climate Plans Progress Reports, as well as integrated Commission monitoring at EU level;

[5] "Social acceptance" is one of the possible results, along with social unacceptance, from a complex process of "social acceptability". When emerging initially in the 1980s, the concept of social acceptance refers to "public perception" relative to market demands and in fact was used to identify and explain residual social resistance (Devine-Wright 2005). Nowadays, the concept of social acceptance is used by some researchers in a more analytical than conceptual way, referring to the "triangle of social acceptance" of renewable energies, which consists of the synthesis of three dimensions, as they are presented below in the current paper (Wüstenhagen, Wolsink and Burer 2007). The first dimension is "socio-political acceptance" and refers to the acceptance of technologies and policies by major social actors (public opinion, key stakeholders, politicians). The second one is "community acceptance" and refers to the "specific acceptance of siting decisions and renewable energy projects by local stakeholders, particularly residents and local authorities" and which centres on issues of procedural and distributive justice, as well as those of trust towards external actors. The third dimension is "market acceptance" and refers to the process of market adoption of an innovation, which integrates consumers (are they favourable towards renewable energy), investors and businesses (Wüstenhagen, Wolsink and Burer 2007). Recently, a more complementary approach is proposed and framed in terms of "sustainable development" framework (Fournis and Fortin 2016). In this approach, "social acceptability" is primarily linked to "an evolving social contract" related to renewable energy policy, which involves at least three levels of collective choice: (1) socioeconomic and technological choices; (2) the choice between two public policy paths - one centred on economic issues and mass production, the other on environmental issues and renewable energy; and (3) governance choices, which see either sustainable development as dominant over the economy, or economy (industry) as dominating the environment and social development. In this framework, social acceptability is a broader concept than acceptance and is understood as a collective choice of an energy-social contract that is also intrinsically political (Fournis and Fortin 2016).

[6] European Commission, COM (2016) 759 Commission Staff Working Document Impact Assessment: Proposal for a Regulation of the European Parliament and the Council on the Governance of the Energy Union, 2016, Brussels.

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- A ***governance process between the Commission and Member States*** on the establishment and implementation of National Plans in order to ensure the collective achievement of the objectives of the Energy Union.

National Plans and Progress Reports aim at achieving a streamlined planning, monitoring and reporting process that would make the implementation of the 2030 Climate and Energy Framework efficient.[7] The Energy Union initiative has formulated a new Governance system that would facilitate the reaching of the energy transition targets. As the energy transition objectives in the new proposed changes are non-binding, the Energy Union would necessitate the active involvement of Member States and the close engagement of all stakeholders.

The Commission would be also involved in the monitoring of the implementation of the National Plans via the institutionalised Energy Efficiency Progress Report and the Renewable Energy Progress Report. The latter is published by the Commission every two years and provides an overview of renewable energy policy developments in EU countries based on national reports about progress towards the EU's 2020 renewable energy goals. The Commission reports would be integrated in a comprehensive monitoring tool that would take stock of the existing developments on the five dimensions of the Energy Union. By designing a common instrument, the Energy Union would try to review the process of fostering the connection between Renewable Energy Sources' (RES) development, energy efficiency and CO2 emissions reductions.

[7] Ibid.

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2. Mapping governance bottlenecks to sustainable transition

While the Energy Union is developing a coherent plan for a sustainable energy transition, there are large differences between countries regarding their ability to sustain the costs of energy reforms and the investments needed. A low carbon energy transition requires disrupting the current energy system based on fossil-fuels, centralised generation, supply-side orientation, and all the practices, policies, technologies, business models, norms and attitudes linked to this system, while at the same time developing and introducing sustainable alternatives. This raises the challenge of good governance and of consistent policy-making that is predictable and based on a long-term strategy that cannot be easily overturned in the future.

The governance of the energy transition should be performed by a multitude of actors including the energy industry, local governments, civil society organisations, and consumer and prosumer associations. As an example, in Germany, the federal government has provided support for municipalities to develop plans for how to achieve 80-95% reductions in their greenhouse gas emissions by 2050. The planning processes involve both government planners and representatives of different local stakeholders. Other such state-initiated participatory structures include on-line response portals, town hall meetings, and public participation in the drafting of and commenting on renewable energy development plans.

The promotion of low-carbon energy in the European countries goes through a complicated innovation process. Its implementation follows a pattern, described in Roger's theory on diffusion of innovation (Roger 1983). He presents diffusion as the process by which an innovation is communicated through certain channels over time among the members of a social system. It is often the case that this process does not go through without any difficulties and barriers that may slow it down and make the adoption in the community more difficult, and it often involves different stakeholders, such as consumers, public and private officials. The case of the energy transition process in the European Union is not an exception and barriers can be found in the legal and regulatory system of the Member States, as well as in the socio-political and socio-cultural realm and among the general public and its level of accessibility of the policy and innovation implementation process.

As Laes et al. (2014) point out, due to the co-evolution of energy systems and other important societal subsystems (e.g., transportation, housing, industry), the transition to a low-carbon energy system presents first and foremost a "systemic" challenge. The authors employed an approach based on the transition theory in the studies of climate and environmental change to analyse how technologies, institutions, political and general culture, and social practices are reformed in a coordinated way in order to guarantee a more environmentally sound and equitable development trajectory in the energy transition governance of Germany, the Netherlands and the United Kingdom. Based on past studies within the selected approach, the authors emphasise the importance of some general characteristics that are directly applicable for the analysis of energy transition governance:

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- Transitions are co-evolutionary processes that require changes at the micro-level of "niches" (i.e., protected spaces where new technologies and/or practices are not exposed to the full selective pressures operating in the incumbent regime), at the meso-level of "regimes" (i.e., a dominant set of stable but continuously evolving artefacts, actors and institutions), and at the macro-level of the "landscape" (i.e., the set of processes which operate beyond the direct influence of actors in a given regime). Conducting a comprehensive literature review of papers on climate governance published between 2009 and 2015, Kivimaa et al. (2017) also argue that energy transition projects in the form of experiments, used as an approach in the policy development process, have four widespread implications - niche creation, market creation, societal problem solving and spatial planning. The first two implications coincide with the micro- and meso-level, identified by Laes et al. (2014) and refer to two different stages in the development of energy transition projects. The initial stage refers to pilot projects that create favourable, but limited in time and space, conditions for conducting an experiment for introducing new and innovative forms of energy production and use. The later stage refers to a situation, when the newly developed forms diffused in the society and economy to a degree, which allow a new market in terms of products and services, but also as institutional and regulatory framework, to be created and to become self-operational. The third and fourth implications of experiments in climate governance, i.e. societal problem solving and spatial planning, identified by Kivimaa et al. (2017), could be referred to the macro-level of "landscapes" (Laes et al. 2014) on condition that in the former case the agency behind the design and implementation of the experiments is much stronger and active, while in the latter case, the concept of "landscapes" presupposes the evolving set of processes which operate beyond the direct influence of actors. An important feature of the policy development through applying experiments, highlighted by the authors is the need for ex-ante and ex-post evaluation of the projects in order to set up proper and achievable goals and to account for their implementation and assessment of the impact. The lack of evaluation or improperly conducted one could hinder seriously the implementation of the experiments and could become an important bottleneck in the governance process.
- Transitions are multi-actor processes, involving a large variety of social groups and cutting across established functional specialisations and jurisdictional boundaries. In this respect, energy transition pathways require societal involvement and engagement. Laes et al. (2014) underline that low-carbon development cannot be achieved by (local or central) governments alone. To achieve such far-reaching changes, energy transition policies require strong and consistent public support and understanding, self-directed change in many domains of society, and collaboration among diverse social actors.
- Transitions involve moving away from established ways of doing things (in terms of behaviours, business models, end-user practices, etc.), and this inevitably provokes resistance from groups that fear that their interests will be harmed. In this respect, low-carbon development requires the simultaneous pursuit of multiple goals and the management of issues that cut across established administrative responsibilities. Researchers stress that transition governance should not just balance and trade off economic, social, and environmental concerns, but should create win-win situations for all involved stakeholders. Particularly, the shift in the goal setting of the respective state authorities is of a great importance, as existing administrative structures and procedures tend to encourage a partial vision of problems (sometimes referred to as 'silo mentality'). As the

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evidences from the German case study show, even the reluctant support by the central government to the energy transition agenda at its early formative stages (roughly 1975–1990), which supports a gradual reorientation of research and development (R&D) funds, was enough to open up small space for experimentation and learning in wind and solar power for a range of companies and academic departments (Laes et al. 2014, p. 1136).

- Due to the inherent complexity of contemporary industrial societies and the rigidity of the systems in place, transitions are long-term processes, as witnessed also by historical evidence on past energy transitions not driven by sustainability concerns. Laes et al. (2014) do not differentiate the nature of the energy transitions in the past and in recent times, however, the transition to low-carbon energy nowadays aims at replacing the existing fuel sources rather than just adding new sources to the existing ones.

The comparison of the three case studies by Laes et al. (2014) shows the major differences in the energy transition governance frameworks and the existence of key factors that determine the development in each of the countries. In Germany, these were the initially reluctant support by the government, which shifted the R&D funding and those, opened new market, in combination with the gradual increase in the societal engagement by the general public. In The Netherlands, the energy transition agenda was developed under a rather small research programme, which benefited from the Dutch research tradition in studying relations between technology and society, supported since the 1970s by several environment-technology research programmes. The long-lasting research provided ample opportunities for dialogue between researchers and policy makers, thus ensuring legitimacy of the transition policy in both the world of science and world of politics. As a result, the coalition-building between researchers eager to see their ideas having a policy impact and policy advisors in need of new ideas to invigorate the national environmental planning (NMP) process led to the adoption of the transition management approach in the fourth NMP. As the authors underline, "it is important to realise that in the Netherlands transition thinking has been introduced as part of innovation policy, and, more specifically, as a socio-technical alignment mechanism situated in a complex network of technology push and market pull policies" (Laes et al. 2014, p. 1140).

In the UK, the initial push for setting up national targets for mitigating the climate change aimed at developing a legally binding framework and was initiated and led by an environmental non-governmental organisation "Friends of the Earth", interested local people initially not institutionally organised and local members of parliament (MPs). As a result, the concept of a climate law made up of targets and budgets became the focus of a major public and political campaign effort. Later on, the Committee on Climate Change was established as an independent expert advisory body that can make recommendations to government concerning the pathway to the 2050 UK target. The Committee reports annually to Parliament, and the government was required to formally reply to its reports. The merit of having an independent watchdog lies in forcing government to publically justify its own actions on a regular basis. This in turn contributes to a credible government commitment to long-term policies, which was a necessary precondition for creating a stable investment climate (Laes et al. 2014, p. 1141-1143).

The analysis of the three case studies demonstrates that due to the long-term nature of the transition processes, the most important challenge for energy transition governance is the credible commitment of future governments to overall transition visions and goals. However, as authors point

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out, such commitment is always a matter of degree, since governments can hardly "bind" future governments to carry out specific plans or programmes. The study reveals the composition of what the authors called "commitment devices", which make it harder for future governments to overturn previous commitments. "Commitment device" refers to a composition of actors, procedures and practices, and institutional frameworks that are established in order to prevent future governments from decreasing their commitment to the transition visions and goals. However, as the authors highlight, there is a disagreement in the existing literature, on whether short- to mid-term incentives should take the form of target-setting or a commitment to particular types of regulation or institution building (Laes et al. 2014, p. 1144). In all cases, the increased "political cost" (in terms of losing public support) has been the major factor for preserving the future governments' commitment to the energy transition agenda. In this respect, the degree of public engagement is crucial for the sustainability of the transition processes.

The studies of governance of transition to low-carbon energy show a variety of approaches and disciplines. In many of the cases, researchers have applied multi- or inter-disciplinary approaches[8], combining concepts and methods borrowed from different disciplines and sciences. The literature review has identified four broad groups of theoretical frameworks: Innovation systems, incl. science technology studies, multi-level perspective, evolutionary approach and social practice theory. These frameworks use specific key concepts and apply respective methods to the study of governance of energy transition. However, irrespective of the vast variety of literature on the topic especially in the last two decades, the boundaries between approaches are not very sharp and research concepts often overlap.

The innovation systems approach implies analysing governance of energy transition, identifying successful constellation of actors and activities in implementing technological and social innovations or their failures and studying institutional patterns and human-non-human networks (Hargreaves et al. 2013, Hielsher 2011).

The multi-level perspective is developed mainly by Geels (Geels 2002, Geels 2011) and serves as a basis for the development of the approach on strategic niche management, applying multi-level perspective for studying policy development (Van der Schoor and Scholtens 2016). It analysed local communities, implementing energy transition projects as "protected niches" which have the possibility to influence the existing "regime". Often researchers combine the study of local energy initiatives, seen as "niches" with the innovation system approach, focusing not only on the technological innovations but also on the social innovations in community energy production (Verbong and Geels 2007).

The evolutionary systems approach looks at the path dependence and possible lock-in situations, referring to the interplay between social, cultural, political, economic and technological past

[8] Usually multidisciplinarity refers to the use of knowledge (concepts) from different disciplines from a particular area of science – e.g. social sciences, and stays within their boundaries, while interdisciplinarity refers to an analysis, synthesis and harmonisation of links between disciplines into a coordinated and coherent whole to create new instruments, models, approaches that couldn't occur if they were separately handled, thus integrating natural, social science and humanities, engineering sciences, etc.

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developments that could determine recent and future development paths.

The social practice theoretical framework analyses how everyday social practices of using energy evolve over time, including also how innovations change the existing practices (Van der Schoor and Scholtens 2016, Hargreaves et al. 2013).

The review below will present how these approaches are applied in the study of transitions to low-carbon energy system, focusing on the governance aspect of transition. The next sub-chapters will look consecutively at (1) the regulatory, legislative and financial obstacles in the promotion of low-carbon energy technologies; at (2) social and political barriers that emerge and need to be overcome in the energy transition processes; at (3) public acceptability of newly introduced technologies and transition policies and at (4) governance challenges faced by the emergence of electricity prosumers.

2.1. Regulatory, legislative and financial obstacles hindering the promotion of low-carbon energy technologies

When it comes to regulatory schemes for promotion of low-carbon energy, the European Union provides a guidance for the Member States in terms of policy design and regulations in order to overcome the low investments. However, such legislative and regulatory changes may or may not lead to a successful outcome in terms of social acceptability. Negro et al. (2012) divide the regulatory and legislative barriers into two groups – barriers caused by soft institutional interaction and by hard institutional interaction.

The first group includes policy and legislative actions, that due to less control and planning on a central level lead to an ineffective promotion of low-carbon energy. When it comes to hard institutional interference, the main challenge for the success of policy implementation could be the level of involvement and pro-active support of the government. As Negro et al. (2012) present it, a "stop-and-go" approach could be one of the biggest obstacles to energy transition policies, whereas the government announces a subsidy regime but delays its implementation. A good example is the Netherlands, where between 1998 and 2001 renewable energy technology subsidies were abruptly stopped and then reintroduced in another form without a clear indication of the rationale behind. Similarly, Haas et al. (2011), who have focused on the implementation strategies for RES and their promotion in terms of effectiveness and efficiency, argue that the system's credibility is crucial for the diffusion of the innovation and the investment flow. A promotional strategy needs to be consistent and to avoid uncertainty it should generate a list of concrete planned activities. When it comes to the financial side, the level of government involvement does not refer only to the amount of investment but also to the priority setting of the public funding. As the researchers point out, technology-specific financial support measures are much more effective and efficient, compared to the general subsidy instruments, which could turn into an important obstacle for the sustainable transition to low carbon and decentralised energy system. An example of the latter case could be the development of RES in Bulgaria in the period 2009-2013, when the general subsidisation of RES led to a boom in the installed capacity. For the same period the renewable energy capacities installed in the country amounted to 1 568 MW and the total installed capacity reached 1 651 MW, i.e. 95% of

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the total capacity was installed between 2009 and 2013.[9] It resulted into a sharp increase of the electricity price for final customers and a subsequent significant decrease in the public support to the transition to a low carbon energy system (CSD 2014, p. 69-70).

The establishment of multi-level governance regimes can also produce obstacles for the successful RES technology diffusion process. Smith (2007) follows the difficulties in establishing a multi-level governance system in the UK energy market. His focus is on the ineffectiveness of regional governance processes as a result of their dependence on the national level. By pointing the main areas in the implementation of energy policies and strategies, Smith argues that a horizontal relationship between the representative institutions on national and regional level has to be established in order to optimise policy development and implementation.

The horizontal integration of regional and national institutions for the implementation of energy policies and strategies should be supported also by proper vertical integration of EU and national policy options and institutional frameworks. As detailed below, the existing research shows that often the country specifics could lead to mismanagement and ineffectiveness of the governance process regarding the implementation of support schemes for RES[10] even if the same support schemes are highly successful and effective in other countries. In other words, every strategy on European level should be adjusted to the geographical particularities of the Member States (Reiche at al. 2004). Examples of such specificities are numerous: The analysis on Bulgaria shows that to a large extent the introduction of feed-in-tariffs for RES and CHP (combined heat and power) energy production in the country was mismanaged and has led to the creation of a speculative investment environment because it was not part of a strategic framework planning with clear and well leveraged financial and capacity demand projections (CSD 2014).

Meyer (2003) argues that the green certification can be a suitable tool only in those cases where the energy installations are flexible enough to compete on the same market, while they could be much less effective in highly regulated markets. An investment for German production of wind power through green certificates could thus be sub-optimal (Reiche et al. 2004). Furthermore, as the stage of liberalisation of the energy market varies between EU countries, it is difficult to implement a unified policy that would cover each country specifics. Germany and Spain have been given as the good examples in the adoption of feed-in tariffs and the way the instrument is leading to an increase in the share of wind energy and photovoltaics in the beginning of 2000s. However, even then some

[9] The exponential growth of RES installed capacity in Bulgaria has come as a result of the introduction of feed-in tariffs for RES development and CHP energy production. The price for solar and wind energy as of 2013 was respectively EUR 118.13 per MW/h and EUR 66.35 per MW/h. For reference, the price for electricity produced by Kozloduy NPP was then EUR 13.5 per MW/h.

[10] Among the most common support schemes are: 1) feed-in tariffs/premiums which involve a contractual relationship between consumers and producers based on a fixed price of the electricity generated by a given RES technology; 2) the green certificates, that serve both as an accounting mechanism in the case obligations set by the government have to be met or as facilitators of the creation of a green certificate market that functions independently from the market of electricity; and 3) green or renewable energy quotas, defined by national, regional or local governments, refer to the definition of minimum shares of RES in the energy mix of power utilities, electricity suppliers or sometimes also large electricity consumers. The fulfilment of their quota obligations could be achieved not only by own production but also by means of a dedicated market for renewable energy certificates, often also referred to as tradable green certificates.

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researchers argued that although the situation in these countries is promising, this instrument will not be sufficient in the long run (Reiche et al. 2004). More recently, the feed-in tariffs have appeared to be less efficient as they fail to ensure that electricity is sold on minimum cost, fail to foster innovations and in general – fail to meet the market needs and particularities for promotion of low-carbon energy. Furthermore, feed-in-tariffs do not have the same effect once used for other renewable energy sources such as water and biomass (Frondel et al. 2010).

The green quotas, on the other hand, have their struggles in terms of ecological effectiveness. By analysing the impact which they have in the Netherlands, where quotas are the main instrument, they fail to produce sufficient results in terms of wind power diffusion compared to the cases of Germany and Spain for the period 1990- 2002 (Reiche et al. 2004).

The institutional and legislative obstacles for promoting low-carbon energy are not the only factor for weakening the energy transition process, as a strong internal opposition can also be seen as a major barrier. As Geels (2014) suggests by studying the case in the United Kingdom, it is often the case that promoting energy transition is restricted by coal, gas and nuclear producers. He argues that incumbent regime actors use instrumental, discursive, material and institutional forms of power to resist climate change-related pressures, pointing that scholars should focus not only on niche-innovation, but rather on the regime dynamics, to observe the resisting actors as actively involved in the process and to add power relations on regime level as part of the variables influencing energy transition.

When it comes to the discussion on promotion of low-carbon energy, the financial aspect is often put as one of the main challenges. Low-carbon energy is often presented as expensive and the arguments for this statement have been analysed by Geels (2014). As the financial crisis in 2008 weakened the public, business and political attention towards environmental issues, it has made the process of low-carbon energy production more difficult. One of the barriers observed is the difficulty to mobilise a large amount of investments in a period of economic crisis, which should support the research and development phase, as well as the period of innovation implementation. As the investment in niche-technology is going to be promoted with greater difficulties in times of crisis, there is a wider need for more concrete policy and institutional support towards market uncertainties such as fiscal reforms and promotion of price-based policy instruments. The findings from the research show that the financial crisis has mainly negative impact on energy transition, by distracting attention of both investors and citizens from climate change and sustainability.

Another study focused on the market stability is testing its relation to the innovation levels in a country. Blind et al. (2016) argue that as the market uncertainty increases regulations tend to increase their effect on promotion and innovation, while as the market uncertainty decreases the formal standardisation has positive effect on promotion of innovation. They test their statements based on the data from the German Community Innovation Survey, and the results from the Heckmann model show that when an organisation is operating on a European level, it is also more likely that it would be innovation active, compared to the cases where the organisation is operating on a local level. Another finding leads to the conclusion that even though the relation between the level of education in the organisation and the level of innovation is significant, the effect of the former is rather low. The work of De Santis et al. (2016) to a large extend confirms these findings, however their main focus is the general relation between policy stringency and innovation level, arguing that as the

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former grows, so does the latter.

The external financial factors are not the only one influencing the energy transition process, the determination of low-carbon energy prices is also considered a factor, which may have negative effects on the diffusion process. What Kalkuhl et al. (2014) are stating is that despite the subsidies for green energy production, these sources still tend to fail in their competition with gas and oil.

Based on these findings, it can be concluded that there are some general trends in the problems which governments have in the energy transition process. What appears as important in this case is the establishment of open institutions, involving both the public and the private sector in the implementation process. Furthermore, the development of straightforward policies, following a constant and responsive plan also seem to decrease the probabilities of having obstacles in the diffusion phase of the low-energy promotion. Finally yet importantly, a better communication on European level and vertical integrated governance processes between EU and national level, which take into consideration national specificities seem to have an important role for the further regulation adoption on national level.

2.2. Socio-political barriers: traditions and diverse political cultures

The next governance barrier that is going to be observed is related to the socio-political relations in the implementation of the energy transition process. In the previous sub-chapter where the focus was put on national actions, regulation and legislative processes, most research was based on the case study methodological approach. In this sub-chapter, governance barriers are analysed through the lenses of the interplay between social and political realms in the society and most of the researchers have yielded precedence to survey and in-depth interviews as methods for data collection to test their hypotheses.

Marques et al. (2010) combine and analyse many studies in the field of renewable energy and draw several conclusions on the country specific variables that influence the transition process. Their observation on the geographical particularities to a large extend repeats the findings of Meyer (2003), concluding that the size and the resources of a country are crucial for determining its renewable potential. Using data from the OECD Factbook, Eurostat, the UN, DG Energy and BP, Marques et al. (2010) find a statistically significant negative correlation between the use of coal and oil and the success of renewable energy support programmes. Meanwhile, a bigger energy dependency ratio of a country was correlated with more positive outlook for the renewable energy sources. This could be interpreted as a result of the higher oil and gas prices countries pay when energy dependency pushing them to be more active in seeking to diversify energy sources through domestic production. Household income levels and energy prices also show positive correlation with the attractiveness of renewable energy technologies. In this respect, the attitudes of mid- and high-income level households and the presence of affordable energy prices in terms of purchasing power, correlate with higher attractiveness of RES and vice versa. The negative correlation between the predominant use of coal and oil and the success of renewable energy support programmes on local and national level reveals that the traditions in the use of energy by customers (either personal or collective) are difficult to be changed. These traditions could pose important obstacles for the implementation of the policies towards the transition to low-carbon energy system. Again, as already

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mentioned, the active engagement and participation of citizens in the design and implementation of energy transition policies is highlighted as vital for the success of RES programmes through gradually increased public support to these programmes.

The division of power on different governance levels is another factor, which as many scholars argue, usually complicates the energy transition process. Rio et al. (2008) focused on the obstacles for promoting renewable energy sources caused by the lack of interest of local authorities to spend time and resources to engage in renewable energy promotion programmes. Insufficient local community engagement and participation has been one of the biggest roadblocks for the implementation of local transition programmes. Local communities are not empowered to actively join the energy transition, while their efforts are being replaced by central-planned support programmes that benefit large investors instead of community-owned generation (CSD 2011, CSD 2011a). Rio et al. (2008) also argue that there is lack of empirical research of the factors driving energy investments on the local level and of the benefits the energy transition could bring in terms of employment, demography, education and generally, wealth.

When it comes to analysing the success of the energy transition on the local level, one of the most important factors to be considered is the public engagement of the community. The level of interaction between individual and collective behaviour in the energy sector is determined by the level of public engagement. The role of the public in low-carbon transitions tends to be framed as an issue of social acceptance of the technologies and deployment measures involved. However, this suggests that consumers' passive agreement could be enough for a certain policy initiative to take hold. In the case of the Energy Union, which involves a large-scale transformation of energy choices both on collective and individual levels, the active participation of whole social groups including local communities is required.

A study conducted by Van der Schoor and Scholtens (2014) focuses on the opinion and the attitude of the local community towards the factors that accompany the transition process. In their research, the authors ask the key question of how initiatives by the local communities contribute to the decentralisation of the energy system. By analysing the cases of 13 local initiatives in the Netherlands, they point to the challenges associated with building a sustainable relationship between the public and private sector to overcome institutional and legislative bottlenecks. On a practical level, the main obstacles that are observed by the study is the ability of the community leaders to maintain the interest and participation of community members in day-to-day tasks associated with licensing, financing and management procedures. The lack of consistency and predictability of procedures undermine the commitment of community members to complete an energy transition project from the start to the end. Broader challenges such as the establishment of leadership and coordination on local level are also mentioned. What is lacking in this case is a narrower vision on concrete energy goals which will lead to the achievement of the common vision of the community.

Locally-based support schemes have been seen as positively correlated with the success of the implementation of new energy technologies. A study, conducted by Corsatea et al. (2016) focuses on the case of Italy, arguing that subsidies and support schemes on the local level increase local innovation. Their findings confirm the results of Van der Schoor et al. (2014) in terms of the positive relationship between the level of governance independence on local level and the promotion and deployment of renewable energy technologies in the local communities. The penetration of

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decentralised energy system on local levels seems strongly correlated to the independence of regional governments based on information gathered between 1998 and 2007 in 20 different Italian regions. The findings also show that the party affiliation of the region has only a limited correlation with the promotion of renewable energy technologies, irrespective whether a particular party has supported or opposed the RES policies.

However, the study of energy transition processes on the community level face several methodological problems. Community case studies, even when spanning across a multitude of different geographic and socio-economic contexts, are limited in their scope for deriving universal conclusions. Since no unified methodology and theory is being used in these studies, their replicability is almost impossible if the results are to be consistent. The information gathered is usually too detailed and country-specific making it dependent on the concrete circumstances not fitting a standardised pattern of social behaviour. In order to better understand common deficits in enabling energy transition policies on a local level, further data aggregation is necessary, according to Sarrica et al. (2016).

As energy transition is closely related to both technological and social innovation, the literature had tried to understand what are the prerequisites for the success of an innovator, whether it is an individual or a company. Verbong and Geels (2007) observes that the main driver behind innovation in energy transition technology in the Netherlands has not been the concern for environmental issues or the national policy agenda, but rather the "Europeanisation" of energy policy. The same is confirmed in the case of the Bulgarian RES policies that have been developed mainly under the pressure of aligning national regulatory framework with the European one and particularly of fulfilling the EU targets. Fabra et al. (2015) point out the different path dependencies in the energy policies of Germany, the UK and France showing how despite the fact that the three countries had developed large conventional power generation capacities making the energy transition process harder to accept, the countries have gradually adopted a long-term low-carbon energy policy. The latter has been most evident in Germany.

Germany's commitment to an energy transition has fostered a pan-European agreement on decarbonisation plans. Germany has achieved a great progress in fostering an energy transition towards decarbonisation of the energy supply and improving energy efficiency. Furthermore, Germany is opposed to nuclear power and has decided to phase it out while insisting on higher renewable energy targets for 2030. In fact, Germany urged the Commission to reinforce the governance standards for renewable energy policy including in terms of the legal implementation of the plans for renewable energy and energy savings. In Germany, the government has also developed a comprehensive and ambitious energy-saving plan, based on a three-pronged approach including strict national regulation on renovations and use of renewable energy resources, financial incentives such as loans and grants provided by a government-sponsored public investment bank (Kreditanstalt für Wiederaufbau) and dissemination of information and awareness raising through pilot projects aimed at behavioural change (Fabra et al. 2015). In France, whose electricity mix was composed by 92% of low-carbon sources in 2014, i.e. nuclear (74%) and renewables (18%, mostly hydro), the adoption of an energy transition strategy had been more difficult. Despite the prevalence of low-carbon energy sources in the country, the new strategy required justification of subsidy schemes that were seen potentially to drive up the electricity prices (Fabra et al. 2015).

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2.3. Public acceptability of technologies and policies

The concept of governance as distinct from the concept of government, addresses both formal aspects of government as well as the informal social and political expectations that accompany the application of authority. The concept of governance evokes a more pluralistic pattern of rule than does government: governance is less focused on state institutions, and more focused on the processes and interactions that tie the state to citizens and civil society institutions (Bevir 2010). To implement a new technology shift successfully, one needs to not only develop the physical ('hardware') and institutional ('software') infrastructure, but also make sure the consumers/citizens accept the shift. For the diffusion process to be completed, not only the energy transition interest groups need to accept the policy and technological change, but also these parts of societies not directly involved with the energy transition. Despite the essential role of public acceptance for the success of the energy transition, there is still little research on the topic. Fast (2013) positions this question in the geographical realm and opens a discussion on the main types of public acceptance studies that are being conducted. He uses the typology presented by Wüstenhagen et al. (2007), dividing the public acceptance in three aspects: socio-political, market and community.

- His findings show that generally the **socio-political aspect** of the public acceptance is the most widely studied one, focusing either on instrument efficiency or on opinion surveys. Major topic here is the mismatch between community and political support towards promotion of technologies, known as "Not in my backyard" (NIMBY) phenomenon. The basic problem in this case comes from the assumption that people tend to support the low-carbon energy policies and at the same time are against their development in their adjacent territories. Wolsink (2007) claims that such statements are "falsified" and argues that the real reason behind negative public attitude towards green energy production are the problems in the communication during the policy implementation process. According to him, selfishness is not the motivation behind NIMBY attitude rather than top-down policy implementation. By studying the cases of wind energy promotion in Denmark, the Netherlands, the UK and Germany he claims that the essential part of all good practices correlate with the public involvement in the process, incl. discussions on local level and active participation in all stages of the policy implementation cycle. Therefore, he argues, where NIMBY phenomenon has been detected, it is caused by the hierarchical governance structures rather than by individual selfishness.

  The argument that NIMBY factor should be treated consciously has also been made by Devine-Wright (2005). He addresses the empirical studies on public acceptance of wind energy production and points out their main weakness in terms of case selection such as presenting predominantly industrialised countries and failing to operationalise the public attitude in valid and reliable manner. When adding the lack of sufficient theoretical background, he concludes that even though the empirical interest in the topic is growing, it remains rather fragmented and misleading. An argument in favour of these findings are the lack of NIMBY studies in low-carbon energy different from wind-energy.

- The market aspect of public acceptance (Wüstenhagen et al. 2007) refers to the process of market adaptation to the innovations in the energy production. Wüstenhagen et al. present this situation

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as the case in which the consumer has the possibility to choose its energy source, without being involved in the production. In this hypothetical situation, the NIMBY factor is no longer valid, as the production of green energy can take place far from the household. Bird et al. (2002) point to education and marketing as the most important variables for green energy consumption. Even though customers tend to be influenced by low prices, what seems to matter more is the straightforward government position that remains stable in time. Wüstenhagen et al. (2007) emphasise also the lack of strong relation between green energy consumption and the promotion of innovations and technologies in the sector.

Another important factor for the market acceptance is the price evaluation given by the consumers, or in other words, how much should the renewable energy cost. The findings made by Zografakis et al. (2010), based on the survey of the attitudes in Crete, Greece, show that people with higher energy awareness, coming from a higher income families and bigger size of the household are the one which are more likely to pay more for such services.

- The third aspect of public acceptance comes from the community. One of its major characteristics according to Wolsink (2007) is that it follows a U curve shape, so in the beginning and at the end of the implementation process it has a high public support and rather low public acceptance in the site phase. Bailey et al. (2011) tackle on the first phase in the innovation distribution and the community attitude towards it by studying the perception of local communities in UK towards the potential development of wave energy. The results show that the acceptance relays on the efficiency of the technology towards climate change, its economic efficiency and the lack of potential for future negative effects. However, following the critiques made by Wright (2005) it is important that these results should be treated consciously, having in mind that UK is already an industrially highly-developed country and the case study fails to compare the effect between different countries.

  A major argument in favour of the positive community attitude towards the renewable energy implementation refers to the ownership. What Warren et al. (2010) find by conducting a survey among the inhabitants of Isle of Gigha and its adjacent Kintyre peninsula in Scotland is that people tend to have positive attitude towards energy production in their region if they have some share in the company ownership. In general, people share this positive attitude as a contradiction to the NIMBY approach.

  What can be seen as common for the majority of researches on the topic is that the engagement of the local community has an essential effect on the positive attitude towards energy transition projects. However, any conclusions based on the conducted studies should be taken consciously, as when it comes to studying of the community attitudes towards the energy transition process the majority of studies have taken place mainly in the United Kingdom, Denmark, the Netherlands and Germany, which excludes a big part of the European Union.

In his systematic review of the literature related to questions of social acceptance of renewable energy (RE), Fast (2013) echoes Wüstenhagen et al. (2007) in identifying three principal dimensions of social acceptance:

- Socio-Political acceptance: acceptance of technology by policy makers or the general public measured via opinion polls. As an amendment to the work of Wüstenhagen et al. (2007), Fast

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(2013) refers to the findings of Bailey et al. (2011) that while the majority of public opinion surveys conducted in the United Kingdom signalled considerable support for RE, "public concern about the visual and environmental impacts of RE projects [is nonetheless] a major factor behind the stalling or rejection of many planning applications for on-shore renewables developments" (p. 139). However, the authors pointed out that the degree to which public consultations dictate the success of new RE infrastructures is very much unique to the UK because it is part of the institutional framework and culture. However, as the authors highlighted, the design and implementation of the UK government policies on renewable-energy developments have revealed some interesting tensions between the government's desire to promote consultation and the need to set up strategic energy goals. "Planning Policy Statement 22 introduced in 2004, for instance, requires planning authorities to foster community engagement but stresses that renewable-energy proposals should be assessed using 'objective' material and analysis 'wherever possible'" (Bailey et al. 2011, p. 140).

- Market acceptance: willingness-to-pay (WTP) models and the diffusion of new technology in households and corporate organizations.

  RE technologies are in general characterised by a higher initial per unit cost than energy generated from non-renewables. Even when energy from renewables is subsidised by a centralised body, some metric of WTP is crucial in assessing the viability of green energy technologies. Unsurprisingly, the vast majority of the literature reviewed found a positive correlation between WTP and household income. A notable exception was found in Akcura's (2015) reference to Hansla et al.'s (2008) study, which found the effect of income on average WTP to be statistically insignificant. Additionally, the size of the residence was also found to be positively correlated with a household's WTP (Zografakis et al. 2010).

  WTP was also found to be contingent upon a number of demographic variables. Chiefly, the literature reviewed found statistically significant interactions between the gender and age of survey respondents, and the household's WTP. Bollino's study of households in Italy, for example, found that where respondents were willing to pay more for RE, females possessed a lower mean WTP (Bollino 2009). With respect to the age of respondents, Akcura's study of households in the UK found that "age is a significant factor only in the decision on how much to contribute" (Akcura 2015, p. 25); the paper revealed that older respondents on average had a lower WTP. Doubt is cast upon this finding by Bollino's observation that older respondents simply possessed a more "widespread WTP distribution" (Bollino 2009, p. 92).

  In all studies considered, households were found to be willing to pay more for renewable sources when the positive environmental externalities associated with RES are emphasised. Longo et al. (2008), for example, found that respondents were on average willing to pay an additional "£29.65 to decrease the greenhouse gas emissions by 1% a year" (Longo et al. 2008, p. 141). Figure 1 summarises the findings of a number of similar studies as presented by Longo et al. (2008, p. 142).

  Figure 1: WTP for improving renewable energy

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Study	Goett et al. (2000)	Champ and Bishop (2001)	Roe et al. (2001)	Wiser (2003)	Batley et al. (2001)	Bergmann (2006)
Data year	1999	1997	1997	2001	1997	2003
Stated preference method[a]	CE	CV, SBDC	CE	CV, SBDC	CV, OE	CE
Questionnaire type	Phone–mail–phone	Mail	Intercept	Mail–phone	Mail	Mail
Completed questionnaires	1205	193	835	1574	742	219
Surveyed area	US	Madison, Wisconsin (US)	8 US cities	US	Leicester, England	8 Council D in Scotland
Hypothetical scenario	Increase in renewable share (25% of energy supplied by hydro)	WTP for wind energy	Increase in renewable energy of 1% and a decrease of emissions of 1%	Increase renewable energy from 2% to 8%	Increase in renewable sources	Renewable projects tha no increase pollution
Households WTP/year	98.44[b]	71.79	16.32[c]	39.72[d]	95.20	25.26

Source: Longo et al. 2008, p. 142

The information possessed by households regarding the environmental impact of RE was also found to impact upon WTP. In Crete, Zografakis et al. found that "people knowing that it is possible to produce energy from the sun are willing to pay on average more for RES than those who do not" (Zografakis 2010, p. 1092). Since broadly WTP was found to be statistically different from zero, successful projects for energy transition would do well to promote public awareness of the spillover effects of RE, if they wish to foster greater market acceptance.

A number of studies also considered the impact of energy security on WTP. The majority found that WTP increased if RE was presented concomitantly with increased energy security (see Figure 2) (Longo et al. 2008, p. 142).

Figure 2: WTP for avoiding energy shortages

Study	Hartman et al. (1991)	Beenstock et al. (1998)	Layton and Moeltner (2005)	Baarsma et al. (2005)	Carlsson and Mar (2004a)
Data year	1988	1990–1991	1998	2003–2004	2004
Stated preference method[a]	CV, OE	CR	CE	CR	CV, OE
Questionnaire type	Mail	In person	Mail	Mail	Mail
Completed questionnaires	1501	2950	1421	12,409	1678
Surveyed area	California, US	Israel	US	The Netherlands	Sweden
Hypothetical scenario	1 h shortage	1 kWh unsupplied electricity	1 h shortage	1 h shortage	1 h shortage
Households WTP/year	65.77	10.46	16.12	78.16	1.29[e]

Source: Longo et al. 2008, p. 142

The effect of energy security on WTP was found to be highly dependent upon the country in which the study was conducted, however. While Longo et al.'s study conducted in the city of Bath (UK) failed to reject the hypothesis that "it is more important to internalize external costs affecting human health and the environment than guaranteeing energy security" (Longo et al. 2008, p. 146), in Crete Zografakis et al. found that over 70% of respondents considered the impact of renewables on the energy security of the island to be either 'very important' or 'very much

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important'. With this in mind, it is therefore important to tailor energy transition projects within the EU to the specific energy security needs of the country in question.

- Community acceptance: responses to the siting of wind farms and other RE infrastructures. It refers to the acceptance of siting decisions and more generally – to decisions for implementing renewable energy projects by local stakeholders, particularly residents and local authorities. Community acceptance focuses on issues of procedural and distributive justice[11], as well as those of trust towards external actors (those who initially suggest and then implement the project).

  As Fast (2013) underlines, the bulk of research on community acceptance of RE was found to be conducted in the UK (see Figure 3) (Fast 2013, p. 856). Among these studies, respondents were found to emphasis on the visual impact of RE technologies on the surrounding landscape.

Figure 3: top five countries for analysis of renewable energy social acceptance issues

Country	Wind-power social acceptance studies in country as % of total global wind power social acceptance studies (%)	Wind-power social acceptance studies as % of total renewable energy social acceptance studies reported from that country (%)	% of total global installed wind capacity (and rank)
UK	41	80	3 (8th)
USA	21	52	20 (2nd)
Greece	7	25	1 (18th)
Germany	5	100	12 (3rd)
Denmark	4	100	2 (11th)

*(World Wind Energy Association 2012). Note that China is the leading country for wind power with 26% of global installed capacity.

Source: Fast 2013, p. 856

Indeed, Fast's comprehensive review notes that some authors "compared the UK with other European countries suggesting that a uniquely British mythology of the countryside leads to high levels of protest" (Fast 2013, p. 856). To that end, throughout his review Fast was only able to find one UK case study reporting unambiguous support for wind turbines.

2.4. Governance challenges to the rise of electricity prosumers

Since the 1990s, and particularly in the last decade, the traditional paradigm of passive distribution and one way communication and flow between electricity suppliers and consumers is being replaced by a new paradigm of active distribution that is bound to dramatically altered role of the consumer (Flavia et al. 2013). Indeed, the new electricity system, i.e. 'smart grid', enables bidirectional flow of communication and electric power between suppliers and consumers, thanks to a pervasive

[11] Procedural justice refers to the fairness in the administrative/regulatory processes that resolve disputes and allocate resources, while distributive justice refers to the perceived fairness in the distribution of rights or resources. The perceived fairness could differ significantly from the procedural fairness, as the former depends on what one considers as moral irrespective whether it is aligned with the administrative or regulatory prescriptions and procedures.

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incorporation of information and communication technologies - ultimately transforming the traditionally passive end-users into active players. However, consumers face significant impediments to this broad transformation of roles. This means that the majority of consumers remain very passive. The reasons vary. A recent study showed that over 50% of the consumers believe that if they leave their historical, usually state-owned supplier, and replace it with another one, this could endanger their security of supply (ACER/CEER 2015). This is additionally reinforced by the fact that the European retail energy markets are often characterised by high concentration and the lack of effective competition at both the production and the distribution levels. The lack of retail market efficiency is reflected in the low switching rates of consumers in the EU. According to the 2014 study by ACER, only 6.3% of all power and gas consumers have switched their supplier. However, the share varies significantly across the countries in Europe (ACER/CEER 2015). In general, a large chunk of consumers continue to look at the energy sector as exclusively driven by the state.

The more informed consumers are, the more likely that they would become active market participants and would accept the Energy Union initiatives in strengthening the efficiency of retail markets. Although the supply of energy is open to competition, while the transmission service is a natural monopoly, the consumers believe that the quality of the transmission is a function of the supply. This shows a general lack of understanding of the energy sector, which the policy-makers would need to address, if they want to foster the shift to decentralised energy system and prosumer-led behaviour. Paradoxically, however, namely these institutions (mostly the national energy regulators), which are responsible for expanding the information about the energy market functioning, are those that prevent the active liberalisation of markets, mostly because of:

- **The prevalence of regulated prices on retail markets.** The removal of regulated tariffs is crucial for the enhancement of the competition of energy markets, the improvement of energy efficiency and the decentralisation of energy supply. The social protection of regulated consumers from the market opening deteriorate their ability to operate on the market and removes the incentives for investing in own production via renewable energy sources. By remaining captured by the regulated market, these consumers do not receive adequate market signals to optimise their consumption.
- **Lack of information about market alternatives.** In order to make consumers more active, it is crucial to design a transparent and trustworthy online price comparison tools, as well as to introduce online platforms, which would allow a collective switching of the supplier. The lack of information about potential market offers prevents public engagement and diminishes the consumer trust in the process of liberalisation and decentralisation.
- **Switching suppliers might not lead to large consumer gains.** Even if the switching procedure is easy, the consumer may still prefer to remain passive, as his savings would not be big enough to make him act. One of the major reasons for the limited savings might be the relatively high share of taxes, subsidies and other fixed components in the final energy price at the expense of reduced share of the generated power. According to ACER, in only five Member States the share of the generated power in the final price has been over 50% (ACER/CEER 2015). Hence, the price-based market competition among suppliers is severely limited pushing them to compete on the contract terms, rather than pricing. The suppliers have expanded the role of non-price terms to capture more clients. These makes the more active participation of consumers beneficial to their

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interests. In the case of spot pricing, for instance, the electricity price is indexed to the market clearing price at power exchanges, which guarantees that the consumer would receive a direct benefit from falling wholesale prices. This scheme requires trust by consumers in the ability of traders to judge the development of wholesale market, which is why, apart from the Scandinavian countries, such pricing terms remain still limited in scope.

However, one interesting approach of suppliers in changing energy preferences of consumers is the existence of dual-fuel offers, which allows consumers to purchase both electricity and natural gas as a packaged product, and thus, achieve savings on their bills. Moreover, many consumers are influenced in their energy choices by the guarantee from suppliers that the power supplied to them is at 100% generated from renewable energy sources.[12] Additional methods for raising the consumer interest in the retail market include smart billing and packaged services for internet, TV and others. According to a study by Ofcom, consumers tend to prefer switching power providers much more when they are convinced that packaged deals lead to lower prices (Ofcom 2011). By expanding the number of services, utility companies provide, they can significantly expand their business and make the energy markets much more integrated in the overall development of retail markets. Smart billing, on the other hand, can optimise their energy consumption. According to a recent study of the UK market, close to 25% of all consumers have begun receiving advises from their utility suppliers on how to decrease their energy bills. This could happen through the design of "pro-active alerts" pointing to consumers that they have been consuming too much or to show how one's energy consumption compares to that of his/her peer group (Opower 2015). Smart billing has to work, though, hand in hand with innovative smart metering techniques and flexible regulations allowing for individual analysis of consumption patterns.

With these types of scenarios as a backdrop, much research has recently focused on how policy makers, energy regulatory institutions and power utility companies envision the role of people or electricity consumers in the years ahead. Increasingly, policymakers expect, and need people to become much more active participants in energy systems, in order to reach ambitious climate and energy efficiency goals (Irwin et al. 2012). This entails that people should engage practically with e.g. energy efficiency measures such as in-house energy displays, as well as be supportive of local production of energy. Volatility does not only mean that people will have energy produced in new ways and closer to their daily lives. To work in a practical way, it will also require more active participation. Ideally, energy users should begin buying and selling electricity, offer "flexibility", change their consumption patterns, use electric vehicles, and switch to sustainable modes of supply. Such ambitious shifts in practice certainly cannot be achieved under a conceptual regime where humans simply choose between accepting or rejecting new technologies. Instead, energy – its production and consumption as well as the making of new technologies and their implications – should become much more integrated into the fabric of the everyday life.

Some authors view customer engagement as a psychological process comprising cognitive and emotional aspects (Brodie et al. 2013), where customer engagement includes calculative as well as

[12] Some traders even issue certificates to consumers concerning the amount of CO2 emissions, which are saved due to the renewable energy choice of a certain consumer. ACER contends that more than 50% of the offers to households and businesses in Vienna, Brussels, Luxembourg, Berlin, Amsterdam and Stockholm consist of electricity, entirely generated by renewable sources (ACER/CEER 2014).

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affective commitment and trust. Consumer engagement in sustainable technology is influenced by attitude, social norms, perceived behavioural control and personal norm. In particular, attitudes can be influenced by such important factors as confidence, trust and distributive fairness (Huijts et al. 2012). A purely individualistic approach would be insufficient if we are to understand the drive behind the transition towards "prosumption".[13] So far, however, research on prosumers has largely focused upon technical aspects (Brand et al. 2014), management schemes (Rathnayaka et al. 2011) and possible economic benefits and costs resulting from prosumer participation in the energy system (Kaufmann et al. 2013). There is also some literature that addresses the driving forces behind prosumer developments, such as Leijten et al. (2014) who focus on acceptance of future energy systems and Pamula (2014) who analyses attitudes towards the prosumer role.

In addition, there is an overarching question as to who will have the opportunity to become prosumers, and who will involve themselves as prosumers. According to some studies, the early adopters of prosumer technology come from the higher income groups (Darby 2012, Westskog and Winther 2014, and Westskog and Winther in progress), while some highlighted the ambiguous effects, which this technology has on fuel-poor households. Darby (2012), for instance, finds that the restricted access to new technology, know-how and resources might affect the fuel-poor negatively by creating hindrances that prevent them from becoming involved in the smart metering technology. On the other hand, the use of smart meters might increase awareness through the potential to develop clear, accurate information by, for instance, the deployment of energy displays. Finally, several studies discuss how policies, regulations and practices of businesses might influence prosumers (Westskog and Winther 2014, Schleicher-Tappeser 2012). Westskog and Winther (2014), for example, have found that many Norwegian end-users consider electricity to be a common good. This perception is not congruent with the principle underlying the liberal market pricing system, and the authors show how this mismatch in "logics" reduces people's willingness to engage in energy savings. Similarly, Schleicher-Tappeser (2012) argues that the transition of the energy system that might be envisioned by an extensive prosumer development will signify a change from a top-down energy system towards bottom-up dynamics. He points out that the speed and ease at which this change will take place depend to a great extent on the evolution of regulatory frameworks, and business strategies and practices.

Furthermore, a key element for the expansion of the share of "prosumers" in the energy market is to decide the regulatory regime for trading between "prosumers" and the grid operator. Also, it is important that the EU and national government create the conditions for "prosumers" to be treated as energy producers, which have rights (for example to sell their excess power at real market prices) and obligations (the offering of network services such as regulating the load, voltage, etc.). Thus one could create different categories of prosumers such as household and micro-prosumers, which do not have responsibilities like real power plants and large-scale prosumers (such as CHPs and factory plants), which can provide network services to the market.

[13] European consumer policy is mainly based on the assumption that the consumer is a rationally acting individual and has its roots in the information paradigm that suggests that the consumer is able, willing and competent to deal with the information provided and to take informed rational decisions. The consumer is regarded as an individual where the collective dimension of consumer behaviour is still largely set aside (Micklitz et al. 2011).

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4. Conclusions

The literature review on governance of transition to low-carbon energy system in Europe reveals that although the Energy Union is developing a coherent plan for a sustainable energy transition, there are large differences between countries regarding their ability to design and implement such a transition. Respectively, the existing studies apply variety of theoretical frameworks aiming at understanding the practical planned and unplanned implications of the transition processes. A low-carbon energy transition requires disrupting the current energy system based on fossil-fuels, centralised generation, supply-side orientation, and all the practices, policies, technological development, business models, norms and attitudes linked to this system, while at the same time developing and introducing sustainable alternatives. This raises the challenge of good governance and of consistent policy-making that is predictable and based on a long-term strategy that cannot be easily overturned in the future.

As many of the reviewed studies point out, due to the co-evolution of energy systems and other important societal subsystems (e.g., transportation, housing, industry), the transition to a low-carbon energy system presents first and foremost a "systemic" challenge. Respectively, the transition governance should be performed by a multitude of actors including energy industry, local and central governments, civil society and public sector organisations, local communities and individual persons but also non-human actors such as technologies, regulations, ideas, processes, and any other relevant factors that could be seen as so important for creating social situations, as the human actors are.

The studies on energy transition governance show variety of approaches and disciplines. In many of the cases, researchers have applied multi- or inter-disciplinary approaches, combining concepts and methods, borrowed from different disciplines and sciences. The literature review has identified four broad groups of theoretical frameworks: Innovation systems, incl. science technology studies, multi-level perspective, evolutionary approach and social practice theory. These frameworks use specific key concepts and apply respective methods to the study of governance of energy transition. However, irrespective of the vast variety of literature on the topic especially in the last two decades, the boundaries between approaches are not very sharp and research concepts often overlap.

Within the evolutionary approach, the major trend in the reviewed studies applies transition theory concepts for analysing the co-evolution of technologies, institutions, business strategies and user practices, within a multi-level perspective on micro, meso, and macro level. Thus the research findings emphasise the importance of some general characteristics that are directly applicable for the analysis of energy transition governance:

- Transitions are co-evolutionary processes that require changes at the micro-level of "niches" (i.e., protected spaces, e.g. particular local communities, where new technologies and/or practices are not exposed to the full selective pressures operating in the incumbent regime of fossil-fuel energy), at the meso-level of "regimes" (i.e., a dominant set of stable but continuously evolving artefacts, actors and institutions), and at the macro-level of the "landscape" (i.e., the set of processes which operate beyond the direct influence of actors in a given regime).

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- Transitions are multi-actor processes, involving a large variety of social groups and cutting across established functional specialisations and jurisdictional boundaries. In this respect, energy transition pathways require societal involvement and engagement. Laes et al. (2014) underline that low-carbon development cannot be achieved by (local or central) governments alone. To achieve such far-reaching changes, energy transition policies require strong and consistent public support and understanding, self-directed change in many domains of society, and collaboration among diverse social actors.
- Transitions involve important shifts in the existing behaviours, business models, end-user practices, etc., which provokes resistance from groups that fear that their interests could be harmed. In this respect, researchers emphasise that transition governance should not just balance and trade off economic, social, and environmental concerns, but should create win-win situations for all involved stakeholders. Particularly, the shift in the goal setting of the respective state authorities is of a great importance, as existing administrative structures and procedures tend to encourage a partial vision of problems. As the evidences from the German case study show, even the reluctant support by the central government to the energy transition agenda at its early formative stages (roughly 1975–1990), which supports a gradual reorientation of research and development (R&D) funding, was enough to open up small space for experimentation and learning in wind and solar power for a range of companies and academic departments. Later on, the activities within this "niche" created substantial outcomes in terms of new products and services, which led to the opening of new markets and gradual increase of public support towards low-carbon energy production (Laes et al. 2014).
- Due to the inherent complexity of contemporary industrial societies and the rigidity of the systems in place, transitions are long-term processes, as witnessed also by historical evidence on past energy transitions not driven by sustainability concerns. However, by contrast with past energy transitions, the recent one aims at replacing the existing fuel sources rather than just adding new sources to existing ones, as the formers did. The long-term nature of the transition processes presupposes also the importance of the credible commitment of future governments to overall transition visions and goals. However, as some of the researchers point out, such commitment is always a matter of degree, since governments can hardly "bind" future governments to carry out specific plans or programmes. The concept of "commitment devices" is used, to describe and analyse the composition of actors, procedures, practices, and institutional frameworks that are established in order to prevent future governments from decreasing their commitment to the transition visions and goals. However, one of the challenges, met by the application of this approach is its human-centred nature, which is criticised by some researchers who employed the concepts from the science technology studies' and innovation systems' frameworks to highlight the importance of non-human actors.

The governance of transition to low-carbon energy face a complex set of regulatory, legislative and financial obstacles that hinder the promotion and implementation of respective policies on local, national and international levels. As most of the reviewed studies underline, the two major challenges for the success of policy implementation are the level of involvement and pro-active support of the local and/or central government, and the level of public engagement and participation (Negro et al. 2012, Haas et al. 2011, Smith 2007, Van der Schoor and Scholtens 2014, Bevir 2010, Wüstenhagen et al. 2007, Hielscher 2011, etc.). When it comes to the financial side, the level of government

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involvement does not refer only to the amount of investment but also to the priority setting of the public funding. As the researchers point out, technology-specific financial support measures are much more effective and efficient, compared to the general subsidy instruments, which could turn into an important obstacle for the sustainable transition to low carbon and decentralised energy system.

The establishment of multi-level governance regimes can also produce obstacles for the successful RES technology diffusion process. Following, for instance, the difficulties in establishing a multi-level governance system in the UK energy market, Smith (2007) focuses on the ineffectiveness of regional governance processes as a result of their dependence on the national level, while other researchers highlight the need for adjustment of general visions and goals setting of the energy transition strategies on EU level to the countries' specificities and the geographical particularities of the Member States (Reiche at al. 2004, Hielscher 2011). The institutional and legislative obstacles for promoting low-carbon energy are not the only factor for weakening the energy transition process, as a strong internal opposition can also be seen as a major barrier. As Geels (2014) argues by studying the promotion of energy transition in the United Kingdom, the incumbent regime actors use instrumental, discursive, material and institutional forms of power to resist climate change-related pressures. His finding implies that future research should focus not only on niche-innovation, but rather on the regime dynamics, to observe the resisting actors as actively involved in the process and to add power relations on regime level as part of the variables influencing energy transition.

Based on these findings, it can be concluded that there are common obstacles faced by diverse stakeholders, participating in and creating the governance of energy transition. The establishment of open institutions, involving both the public and the private sector and the public in the design and implementation process, could mitigate the barriers and risk of failure. Finally yet importantly, a better communication on European level and vertical integrated governance processes between EU and national level, which take into consideration the countries' specificities, seem to have an important role for further regulation adoption on national level.

When it comes to analysing the success of the energy transition on the local level, one of the most important factors to be considered is the public engagement of the community. The reviewed studies show that public participation and engagement in low-carbon transitions tend to be framed as a two-dimensional issue: the rise of prosumers and the issue of social acceptance of RE technologies and practices.

Regarding the first aspect, several researchers view customer engagement as a psychological process comprising cognitive and emotional aspects, where customer engagement includes calculative as well as affective commitment and trust (Brodie et al. 2013, Huijts et al. 2012). However, a purely individualistic approach would be insufficient if we are to understand the drive behind the transition towards "prosumption". So far, however, research on prosumers has largely focused upon technical aspects (Brand et al. 2014), management schemes (Rathnayaka et al. 2011), possible economic benefits and costs resulting from prosumer participation in the energy system (Kaufmann et al. 2013), the driving forces behind prosumer developments (Leijten et al. 2014) and public attitudes towards the prosumer role (Pamula 2014). The emergence of prosumers is also an important issue, often related to the affordability of renewable energy. According to some studies, the early adopters of prosumer technology come from the higher income groups (Darby 2012, Westskog and Winther

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2014, Westskog and Winther in progress), while others highlight the negative effects that the implementation of the prosumer-concept might have on fuel-poor households (Darby 2012).

Regarding the second aspect, despite the essential role of public acceptance for the success of the energy transition, there is still little research on the topic, focused mainly on specific case studies. Based on the research done by Fast (2013) and Wüstenhagen et al. (2007), public acceptance is presented in three aspects: socio-political, market and community.

- The socio-political aspect is the most widely studied one, focusing mainly on the mismatch between community and political support towards promotion of technologies, known as "Not in my backyard" (NIMBY) phenomenon. The basic problem in this case comes from the assumption that people tend to support low-carbon energy policies and at the same time are against their development in their adjacent territories. Some researchers claim that such statements are "falsified" and argue that the real reasons behind negative public attitude towards green energy production are problems in communication during the policy implementation process or mismanagement during the policy design (Wolsink 2007, Devine-Wright 2005).
- The market aspect of public acceptance (Wüstenhagen et al. 2007) refers to the process of market adaptation to the innovations in the energy production. An important factor for the market acceptance is the price evaluation given by the consumers, or in other words, how much should the renewable energy cost. The findings made by Zografakis et al. (2010), based on the survey of the attitudes in Crete, Greece, show that people with higher energy awareness, coming from higher income families and bigger households are the ones which are more likely to pay more for such services. Other studies confirm these findings. In all studies considered, households were found to be willing to pay more for renewable sources when the positive environmental externalities associated with RES are emphasised.
- The third aspect of public acceptance refers to the attitudes and opinions within the local communities. As some researchers underline, the bulk of research on community acceptance of RE was found to be conducted in the UK, Denmark, the Netherlands and Germany, which decrease the validity of the research findings (Fast 2013, Bailey et al. 2011, Wright 2005). However, a major argument, found to be valid also outside the UK, which is in favour of the positive community attitudes towards the renewable energy implementation, refers to the participation of local community in the RES ownership (Warren et al. 2010). What can be seen as common for the majority of research on the topic is that the engagement of the local community has an essential effect on the positive attitude towards energy transition projects.

Reviewing the literature on energy transition governance clearly reveals how diverse both the research field and its analyses are. There are (still) no widely recognised key concepts and definitions nor a clearly delineated respective set of theoretical frameworks. However, the diversity and complexity of the research object suggest that a comprehensive theory could be hardly elaborated.

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