CARISMA
Innovation for Climate Change Mitigation

Discussion Paper
No. 5
February 2018

How do contextual factors affect EU climate policies and their outcomes?

Mapping and categorisation, revisited

Authors

Noriko Fujiwara, Keith Williges and Andreas Tuerk

The CARISMA Project started in February 2015 and received funding from the European Horizon 2020 programme of the EU under the Grant Agreement No. 642242. CARISMA intends, through effective stakeholder consultation and communication, to ensure a continuous coordination and assessment of climate change mitigation options and to benefit research and innovation efficiency, as well as international cooperation on research and innovation and technology transfer.

Abstract

This paper is aimed at addressing how contextual factors beyond direct control of policymakers may actually influence the outcome of specific policy instruments. To answer this question, case studies were selected to cover six countries and two timely topics for climate change mitigation: measures to support renewable energy (RE) and smart technologies for energy efficiency (EE) improvement including smart grids. Despite the diversity of national circumstances and experts' backgrounds, the main results converged to identify a small number of contextual factors that were observed in multiple case studies and acknowledged as affecting adoption or/and implementation of policy instruments.

Table of contents

1 Introduction

One of the understandings widely shared among practitioners and researchers through their experience in the EU is that depending on the context, policies do not necessarily work as anticipated, based on the aims, structure or designs of specific policy instruments or mechanisms. However, it is possible that under certain conditions, policies can meet their stated aim and deliver expected results, and policy instruments can function to their best ability. In this paper, "contextual factors" imply such conditions shaping the environment in which policymakers make decisions beyond their direct control. More specifically, they refer to context-specific drivers or barriers to adoption or implementation of specific policy instruments.[1]

This new paper builds on the previous work in the CARISMA Discussion Paper *Contextual factors affecting EU climate policies and their outcomes* (Fujiwara, Tuerk, Spyridaki and Williges, 2017) by carrying out a set of case studies focused on support measures for renewable energy (RE) or smart technologies for energy efficiency (EE) in a range of countries, mainly EU member states. The previous Discussion Paper provides an introduction to the concept of *contextual factors,* the institutional, economic and social contexts which influence the formulation and implementation of climate policy instruments. It outlines a set of contextual factors which fit into three broad categories, (i) institutions and governance, (ii) innovation and investment, and (iii) attitudes and lifestyle, conveying a range of factors as shown in Table 1. These formed the basis for stakeholder discussion within the case studies.

Table 1. Overview of contextual factors as defined in Fujiwara, Tuerk, Spyridaki and Williges (2017).

Institutions and governance	Innovation and investment	Attitudes and lifestyle
• Institutional coordination • Regulatory alignment with non-climate policies • Administrative feasibility • Constellation of stakeholders	• Presence of a technological innovation system • Market and regulatory framework • Policy continuity • Macroeconomic environment • Corporate and investment culture	• Collective environmental beliefs and norms • Demographic attitudes and other parameters • Public perceptions • Behavioural disposition at the individual level • Knowledge and experience • Financial resources • Social capital

The cases, via stakeholder interviews, assess how the identified contextual factors supported or hindered specific policies, in order to provide examples for future policymaking and if possible identify any missing factors to augment the work of the previous Discussion Paper.

This paper consists of 5 sections. First, it sets out the aim, coverage, and focus of case studies (Section 2). Second, lessons learned from results of case studies are presented.

[1] The analysis places the emphasis on *measures to support such technologies* rather than technologies themselves.

The results are assessed in light of the aims of the case studies and some lessons are drawn from implementation of the methodology (Section 3). Third, based on these results, an overview of contextual factors presented in the CARISMA Discussion Paper, No.1 (Fujiwara, Tuerk, Spyridaki and Williges, 2017) is updated (Section 4). The last section concludes with a discussion on contextual factors (Section 5).

2 Aim, coverage, and focus of case studies

The aim of this paper is to re-examine how individual contextual factors identified in the CARISMA Discussion Paper (Fujiwara, Tuerk, Spyridaki and Williges, 2017) might influence the outcome of mitigation options by undertaking case studies across EU member states. Case studies were selected based on both partners' expertise and geographical coverage, as well as examining a variety of different policy foci and contexts. Table 2 below lists a short overview of the policy measures assessed for each country, and a rationale for their inclusion in this work. This selection was considered by CARISMA researchers to have a good distribution in EU-28 and beyond, including a developing country (Thailand), and a balance between support measures for renewable energy (RE) and smart technologies for energy efficiency (EE) including smart grids.

Table 2. Selection of case study locations and policy measures for assessment.

Country case	Policy measures assessed	Rationale for selecting the case
Netherlands	Evolution of smart grid policies	Early adopter of smart-grid policies
Croatia	Renewable energy support scheme from 2008 to the present	RE policies spurred by EU accession, little initial capacity, significant obstacles
UK	Wind support scheme	Long-running RE policies with substantial changes, with a focus on wind power
Spain	Feed-in-tariffs and the evolution of policies that altered support measures for renewables	Long-running RE policies in a region with high solar potential
Greece	Policies encouraging energy efficiency in buildings	Assessing factors for EE policies in early stages of development
Thailand[2]	Renewable energy support instruments	Extension of the assessment of contextual factors beyond an EU focus

While the range of cases differs widely in terms of location and topic, broad convergence of the cases over two main sets of policy instruments, support measures for RE and smart technologies for EE including smart grids, make some comparison possible between the targeted countries.

The framework for assessing individual policy instruments was broadly agreed upon by all case study leaders. Each case study was tasked with producing a factsheet (Fujiwara,

[2] The Thai case is included as presenting a discussion on the first results of initial observations emerging from research efforts, and serve as illustrative example and not a definitive list of issues.

Williges and Tuerk 2017)[3] presenting a short overview of the technology and policy decisions in question, with a focus on the policy evolution relevant to the technology option being discussed.

Based on a review of academic literature and/or policy documents, the main focus of cases was a series of semi-structured interviews (a flexible interview approach combining a pre-determined set of questions with the option of discussing any interesting emerging themes or details at greater length) with researchers, policymakers, and other relevant stakeholders. While cases developed their final interview questions independently, all partners based their interviews around the common framework, assessing how contextual factors can affect the outcome of policy instruments.

The coverage and designs of stakeholder interviews are summarised below (Table 4 in Appendix).

3 Lessons learned

The main aim of the case studies – to validate the contextual factors identified in literature review (Fujiwara, Tuerk, Spyridaki and Williges, 2017) – was largely fulfilled. About 40 stakeholders, with expertise in one or both policy instruments at a country level, participated in the consultation process from January to June 2017 (see Table 4 in Appendix). Presentation of the case study design in a factsheet format allowed case study leaders, who were not involved in the process of contextual factor identification, to both prepare case studies and further conduct more focused research to serve as background information. Interviews not only provided knowledge and information but also enabled stakeholders to express their concerns or opinions about when and where policies do not work and ideally come up with proposals, suggestions, or solutions. While the methodology itself is not particularly innovative or comprehensive, confronting stakeholders with a short list of contextual factors for climate change mitigation policy is not a common practice. If at all, a focus on contextual factors might be more implicit and embedded in a larger research project focusing on particular policy areas such as renewable energy and energy efficiency respectively.

Another advantage of the CARISMA approach was designing case studies as a tool of coordinating and supporting action to (i) make the best use of existing knowledge, (ii) communicate with stakeholders, and (iii) receive feedback to update the presentation and organisation of that knowledge. This approach was useful in not only summarising stakeholders' inputs but also reaching out a wider audience or readership beyond Europe, however it did limit the level of detail able to be conveyed in project outputs, and further publications can be foreseen which may allow for better discussion of the breadth of knowledge acquired.

Beyond the lessons learned in regard to filling knowledge gaps pertaining to contextual factors and the methodology implemented here, the cases exhibited a number of broad,

[3] The factsheets can be found in the Appendices of a full report, Fujiwara, Williges and Tuerk (2017).

common conclusions relevant for future policymaking. Several factors were identified in multiple cases as being linked to success or failure of policy implementation, and they merit discussion, in order to encourage policymakers to consider them more fully when designing or implementing future policy. These factors are (i) the presence of technological innovation system (TIS) with an emphasis on decrease of technology costs, (ii) the market and regulatory framework, especially the structure of the electricity market and the presence of the EU regulatory framework, (iii) policy continuity, (iv) the macro-economic environment with a reference to economic crisis, and (v) public perception.

One of the most salient messages to emerge from stakeholders was that more weight needs to be given to the *presence of a technological innovation system* and its adaptability to a changing environment. The rapid drop in prices of solar PV was highlighted in a number of cases as an example of this, where the possibility of such a change was unexpected, and policy was ill-equipped to cope, leading to inefficiencies and drastic changes to the Feed in Tariff (FIT) designs, particularly in Spain and the UK. Presence of a TIS might have mitigated such changes, due to higher adaptability.

Another crucial factor was proven to be the *market and regulatory framework* with the structure of the electricity market and the presence of the EU regulatory framework as sub-sets. Several interviewees in the UK case highlighted the insufficiency of the electricity market design in dealing with increasing shares of RES, indicating that the market was set up to benefit large utilities with business models which do not fit RES production patterns, therefore limiting their interest. This is in contrast to countries like Germany, which have placed greater importance on citizens being the driver of renewables deployment. The case of Spain also emphasised that the electricity market has presented a significant barrier in the form of low prices of RES, limiting expansion, but that adaptation by producers should lend itself to the return of favourable conditions for RES expansion. As to the EU regulatory framework, the Dutch case highlighted the mismatch between Smart Grid solutions requiring cooperation with separated energy companies, and the EU's limits on cooperation of commercial entities such as large and small energy suppliers, leading to viewing the framework as a blocking factor. In Greece, the EU framework was seen as a driving factor, with updates in EU regulation spurring the development of domestic policies and subsequently, the energy efficiency market, especially pertaining to the energy performance of buildings and building innovation technologies.

The third contextual factor which emerged as important to policy success was *policy continuity*. The Croatian, UK, Dutch, and Spanish cases all identified this as either an enabling or blocking factor for policies, depending on whether or not continuity existed or if policies experienced abrupt or radical shifts. In Croatia for example, policy continuity as exhibited by the "non-stochastic" or linear approach to policies and growth was seen as an enabling factor, as the government planned for annual quota changes and an adaptive management system without introducing radical changes. The Netherlands as well found continuity to be a driving factor, while the UK and Spanish cases exhibited a lack of policy continuity resulting from broad and frequent reforms acting as a blocking factor. The upshot for continuity is that there is a balance to be struck. Changes can have beneficial effects, and policies designed with future corrections as a possibility have been seen as

successful, while tipping the balance too far towards radical or retroactive changes may hinder overall success.

Stakeholders also pointed to the profound effects of the *macro-economic environment* on energy policy. Almost all respondents mentioned the recent financial and economic crises as having a major influence on energy policy planning. Policymakers should place more emphasis on assessing a range of scenarios, both best and worst-case, when designing and implementing policy.

Case studies found that compared with economic factors, social and political factors[4] tend to go unnoticed or receive insufficient attention in RES or smart technology support measures. Perhaps unsurprisingly, *public perception* was frequently mentioned as an important enabling or limiting factor. Croatia has a higher rate of energy poverty than the EU average, and while initial (low) RES targets were not met with much public reaction, recent policy changes have seen the opposite, with public disapproval for an increase in levies for renewables. Other cases (e.g. the Greek case) show the need for policymakers to consider the knowledge and skills of its citizens while designing policy, as there is currently a lack of knowledge and expertise in building efficiency measures, and thus a lack of ability to implement such measures. The UK case highlights the need for direct involvement of citizens in success of previous energy policies, with a comparison to Germany, where almost 50% of RES installations are owned by cooperatives and private individuals, which is often touted as an explanation for the energy transition's success in the country. A more focused consideration of the *behaviour of households*, and moving beyond provision of information and training schemes, and better understanding of behaviour is also highlighted as a factor in policy success in one our case studies.

4 Feedback from the case studies to categorisation of contextual factors

In addition to drawing lessons learned and extracting key messages to policymakers about how to deal with contextual factors in practice, case studies could also contribute to elaboration of the categorisation of contextual factors and clarification about their effects on policy adoption or implementation. The new set of contextual factors resulting from case studies still maintains the three categories in Table 1 with a different emphasis on individual factors. This section provides a closer look at the difference and where it comes from, and explains possible reasons from an analytical viewpoint as an explanatory text for Table 3 at the end of this section. The table provides categorisation of contextual factors and their effects on policy adoption or implementation, based on case study results.

[4] The three types of contextual factors in Table 1, namely (i) institutions and governance, (ii) innovation and investment, and (iii) attitudes and lifestyle are considered 'political', 'economic' and 'social' respectively.

4.1 Institutions and governance

For institutions and governance, the literature survey led to a list of four – mainly political – factors:

- institutional coordination (between ministries, between national and sub-national levels),
- regulatory alignment with non-climate policies (e.g. regulations for cycle lanes v.s. automobile lanes, regulations for spatial planning),
- administrative feasibility, and
- constellation of stakeholders (e.g. tax reform).[5]

Two case studies provide evidence for two of the above four factors, *institutional coordination* and *constellation of stakeholders*. Observation of institutional coordination is based on three sub-factors: absence of a single governing body to govern energy or an energy agency with a mandate to design policy (RE support measures in Croatia); difficulties with coordination between national and EU institutions (also RE support measures in Croatia); and those with coordination between national ministries (support for smart technologies to improve EE in Greece). All the three sub-factors are regarded as barriers to adoption and implementation of policy instruments. The roles that EU institutions could play in inspiring policies of certain member states warrant special consideration, together with the influence of EU regulations (see the presence of the EU regulatory framework under the *market and regulatory framework*, in the category "innovation and investment"). In contrast to the aforementioned barriers, the factor *constellation of stakeholders* is viewed positively, with a focus on political will and a ministry's commitment as an enabler (support for smart technologies to improve EE in Greece).

None of the case studies explicitly mentioned regulatory alignment with non-climate policies or administrative feasibility, however the UK case alluded to this with mention of the country's overarching focus on pursuing cost-efficiency more generally. It is possible that regulatory alignment is less relevant to the narrower scope of the case studies in supporting measures for RE and smart technologies than the scope of examples to describe climate change mitigation policies. Administrative feasibility was highlighted in wind-power development permitting and planning procedures of UK local authorities. Sub-national administration was not the main focus of these case studies.

4.2 Innovation and investment

According to the literature survey, the category of innovation and investment consists of five – largely economic – factors:

- the presence of a technological innovation system (e.g. clusters and regional collaborative networks, market formation processes),

[5] Stakeholders may emerge as supporters or sceptics of a mitigation option. A constellation of stakeholders may limit or streamline the uptake of mitigation options (Fujiwara, Tuerk, Spyridaki and Williges, 2017).

- market and regulatory framework,
- policy continuity (e.g. retroactive changes to RE support measures),
- macro-economic environment (e.g. financial crisis), and
- corporate and investment culture.

Five case studies together support all the factors, except corporate and investment culture. Although the literature review included an example of difference in RE investment across companies in Sweden, no case studies focused on this factor.

Presence of a technological innovation system was recognised to affect policy adoption or implementation with four possible sub-factors: absence of the technological innovation system (RE support measures in Croatia); the level of ICT development (support for smart grids in the Netherlands); limited capacity of new market actors for the promotion and installation of smart technologies (support for smart technologies to improve EE in Greece); and in relation to market formation processes, decrease of technology costs (RE support measures in Croatia, the UK and Spain). The absence of a TIS and limited capacity of new market actors were viewed as barriers while a high level of ICT development as an enabler. Stakeholders found both aspects in the decrease of technology costs: decreasing costs are in theory beneficial for RE deployment but, depending on incentive designs, they may make continuation of the originally planned measures unsustainable. This point is further discussed with respect to *policy continuity*.

The factor, *market and regulatory framework,* with five market sub-factors and four regulatory sub-factors, attracted wide attention from stakeholders across case studies. On the market side are (i) the national framework for decentralised RE production (support for smart grids in the Netherlands), (ii) the structure of the electricity market (RE support measures in the UK and Spain), (iii) a lack of maturity and innovativeness in the energy services market and construction sector, (iv) the need to integrate public support for investments in households, and (v) the lack of a private investment framework and sustainable financing schemes (the last three sub-factors derived from the case of support for smart technologies to improve EE in Greece). The emergence of a national framework for decentralised RE production was viewed as an enabler. The three sub-factors mentioned by the Greek study were considered to be barriers. The structure of the electricity market can be either a barrier or an enabler. On the regulatory side are (i) the presence of the EU regulatory framework (smart grids in the Netherlands; smart technologies in Greece), (ii) unclear regulatory frameworks (RE support measures in Croatia), and (iii) a lack of energy planning (RE support measures in Spain). The last two sub-factors were considered to be barriers. The presence of the EU regulatory framework can be an enabler or a barrier e.g. if it interferes with the national framework.

Policy continuity was considered important in terms of "non-stochastic" or linear approaches to policies and growth (RE support measures in Croatia) and some consistency to avoid frequent changes (RE support measures in the UK and Spain). The linear approach was seen as too inflexible and therefore a barrier. Although RE support measures were initially welcomed in Spain, frequent changes afterwards were regarded as barriers, which was similar to the UK experience.

The effects of the *macro-economic environment* were also well acknowledged, highlighting financial and economic crises (RE support measures in the UK and Spain; support for smart technologies in Greece) as well as fossil fuel prices (RE support measures in the UK). Financial and economic crises were considered to be a barrier. Volatility of international fossil fuel prices was mentioned as a barrier. However, fossil fuel prices such as natural gas prices can also function as an enabler for accelerating RE deployment.

Finally, the case studies suggest that contextual factors are not isolated but may influence each other, e.g. intensify or mitigate the effects. For example, financial and economic crises forced introduction of austerity measures in some member states, thereby slashing budgets for RE support. At the same time, faster-than-anticipated decreases of technology costs, such as those of solar PV, prevented the governments from maintaining the initial level of support via Feed-In Tariffs. It is possible that both economic and technological conditions caused frequent changes to the policy instrument designs.

4.3 Attitudes, behaviour and lifestyle

The third category of attitudes, behaviour and lifestyle was identified with the following seven sub-factors in the literature survey:

- collective environmental beliefs and norms,
- demographic attitudes and other parameters,
- public perception,
- behavioural predisposition at the individual level,
- knowledge and experience,
- financial resources, and
- social capital

Four case studies confirmed the influence of four of these factors, such as demographic attitudes and other parameters, public perception, behavioural predisposition at the individual level, and knowledge and experience.

The impacts of *demographic attitude parameters* such as age, education, and familiarity with internet-based and automated technologies are less known and have not drawn much attention from stakeholders except policymakers (support for smart technologies to improve EE in Greece). Although more information is needed to determine the nature of their effects, policymakers in Greece are concerned that demographic factors can be a barrier.

The factor that received the highest attention in this category is *public perception,* with four sub-factors: (i) a lack of strong public opinion on development of renewables, (ii) projected costs to final consumers and indirect social costs (both from RE support measures in Croatia), (iii) a Not In My Back Yard (NIMBY) attitude, and (iv) right-wing media (both from RE support measures in the UK). The last two sub-factors were regarded as barriers. For the first two factors, if absence of strong public opinion means disinterest or indifference or lack of support, this can be a barrier. If it means acceptance without vocal opposition, it can be an enabler, as was initially the experience in regards to Croatian RE

policies, where lack of public interest meant that policies met with little opposition. The public tends to be particularly sensitive to societal effects of new policy instruments and costs to final consumers. They would see new taxes or levies as barriers. If these taxes or levies are earmarked and re-invested for societal goods, however, the public may consider them enablers. (see also *constellation of stakeholders* in the category, "institutions and governance").

Behavioural predisposition at the individual level was observed in terms of new patterns of electricity generation and use (support for smart grids in the Netherlands) as well as a lack of consumers' awareness of building innovation technologies for energy conservation (support for smart technologies in Greece). Extreme demand peaks triggered by new types of electric appliances were regarded as an enabler. Low maturity and awareness of consumers can be considered a barrier.

Knowledge and experience were noted with a focus on awareness at a city level regarding funding opportunities (support for smart technologies in Greece). Lack of knowledge and awareness prevented city administrations from exploiting the available resources, which implies a barrier.

Falling outside the case studies were *collective environmental beliefs and norms, financial resources* at a household level and *social capital*. As the preliminary list of seven factors in the literature survey was, however, longer in this category than others, this does not necessarily mean that social factors were less represented in case studies. Yet, it is assumed that it is more difficult to collect information or measure data concerning the remaining three factors, compared with the prominence of *public perception* or acknowledgement of public administration about *knowledge and experience*.

4.4 Pre-existing conditions or reactions?

Section 1 of this paper suggests that "contextual factors" imply such conditions as shaping the environment for policymakers to make decisions beyond their direct control. Reflecting case study results on the list of contextual factors, however, led to questions about whether the tested factors or the new ones emerging from interviews are indeed "contextual factors".[6] Certain environments existed or were created at the time of policy introduction, meaning that they do not exist in vacuum. Other factors appear to be direct reactions, responses to the specific aspects of the policies adopted or implemented. On the one hand, national institutions, a technological innovation system, or the macro-economic environment exist independent from energy policies with their own dynamics. More complex are the market and regulatory frameworks as well as policy continuity, which builds on the accumulation of past energy policies. On the other hand, a constellation of stakeholders or public perception is shaped and triggered by specific aspects of policies, which may divide supporters and sceptics or opponents.

Although it is beyond the scope of this paper to question and re-examine one by one whether the identified or proposed factor can qualify to be "contextual", there are some

[6] The authors are grateful to Henry Derwent for his helpful comments on this topic.

hints for future studies on how to deal with this question. Depending on the degree of the factor being contextual or reactive, policymakers may need to adopt different approaches. The case studies presented in this paper, especially factsheets in Appendices to Fujiwara, Williges and Tuerk (2017), could be useful in exchanging and sharing views on not only challenges but also possible approaches. For example, "pre-existing conditions" such as national institutions, a technological innovation system, or the macro-economic environment are indeed beyond and outside energy policymakers' control, as most cases showed with the (albeit hopefully rare) example of the financial crisis having drastic effects on both RE and EE policies. However, they may have some leverage against factors such as the market and regulatory framework and policy continuity (as in Croatia, where policy continuity was recognised early on as an important factor, and planned for via their non-stochastic approach to RE policies) by partly shaping the environment in which policies are implemented. Policymakers could have more direct control over reactive factors such as the constellation of stakeholders and public perception (e.g. in the case of Greece, where political will and commitment were stressed in driving the diffusion of EE technologies), determining the specific issues by offering possible solutions to address their concerns.

Table 3. Categorisation of contextual factors based on case studies.

Contextual factors	Explanation	Sub-factors	Description of effects (how the contextual factor affected climate policy)
Institutions and governance			
Institutional coordination	Climate change mitigation policies can fall under the competences of more than one governmental authority (e.g. the Ministries of environment, energy or finance) at a national level, and between regional (e.g. EU), national and sub-national governments. Coordination across Ministries and between different levels of government affects coherence in policy formulation and effectiveness, as well as efficiency in policy implementation.	No single governing body to govern energy & no agency with mandate to design policy (Barrier)	HR (Croatia): Seen by stakeholders as having high importance, both in terms of historically being a hindrance to efficient / effective policymaking, and also a factor that was considered and addressed, notably through the creation of the new Ministry of Environment and Energy. While the factor may not have been considered at the outset of policymaking, the conflicts and inefficiencies which arose were addressed over the course of the evolving renewables policy.
		Difficulty of coordination between national and EU-level institutions (Barrier)	HR: In addition to coordination between national ministries, a factor highlighted repeatedly was the interaction of EU-level agencies and the national level, particularly in regards to inter-agency communication, with experts emphasising the difficulty of national ministries to understand and implement directives from supra-national institutions.
		Ministerial coordination (Barrier)	GR (Greece): Lack of coordination and collaboration between different ministries was reported to significantly affect the ability of Greek policy makers to design and dispatch financial incentives for energy efficiency (especially when other needs/objectives need to be met through the same structural funds such as the case of digital policy). Notably, this issue was only raised by the representative from the Greek Energy Agency.
Constellation of stakeholders	Stakeholders may emerge as supporters or sceptics of a mitigation option. A constellation of stakeholders may limit or streamline the uptake of mitigation options.	Political will & commitment (Enabler)	GR: One independent policy expert stressed out the importance of a strong political will and commitment in driving the diffusion of such technologies. A strong political commitment from the side of the Ministry of Energy has recently played a significant role in introducing an EEO (Energy Efficiency Obligation) scheme in an effort to strengthen the existing policy mix to meet with the targets of Article 7 of the Energy Efficiency Directive. This also denotes the Ministry's efforts to shift the utilities' and general market interest

			from RES to EE as well by setting the ground for introducing energy services and savings as a commodity in the Greek energy market.
Innovation and investment			
Contextual factors	**Explanation**	**Sub-factors**	**Description of effects**
Presence of a technological innovation system	A technological innovation system is a network of agents that operates under institutions in a specific technology area. Market formation is one of the functions in a technological innovation system, which generates and diffuses technologies. Others include entrepreneurial experimentation, knowledge development and development of external economies (Hekkert et al., 2011). The concept of the innovation system stresses that the flow of technology and information among people, enterprises and institutions is key to an innovative process (Hekkert et al., 2011).	Lack of a technological innovation system (Barrier)	HR: No government incentives for technological innovation systems (such as a proactive technology policy) were seen to exist during the policymaking process. Researchers in academia do collaborate with the private sector and government, but not in an organised framework, although it is somewhat incentivised by environmental ministry funding, to a small extent. It is impossible to speculate what if any effect such a system would have had on policymaking, but it was not seen as a factor in development of the renewables policy.
		Level of ICT development (Enabler)	NL: The Netherlands has a well-developed Information and Communication Technology infrastructure and knowledge field, and ICT is a crucial component of a Smart Grid.
		Limited capacity of new market actors (Barrier)	GR: The existing market workforce in Greece (i.e. auditors and technology providers, installers) for the promotion and installation of smart technologies to save energy is viewed by Greek policy implementers as being rather low. The need to strengthen role of property asset evaluators during audits in buildings was also raised in one of our interviews.
		Decrease of technology costs, particularly solar PV (Barrier/Enabler)	HR: There was some disagreement to what extent they were taken into account by policymakers. Researchers maintained that costs were taken into consideration to a large extent via consultation with modelers and engineers who tried to explicitly and accurately assess costs. However, due to a lack of transparency in the policymaking

			process, others felt that there was not much information or explanation as to how and why goals and prices were set, a view which is seen as improving with increased political will. UK: Mentioned by all interviewees; while falling costs are, theoretically, beneficial (enabling) for RES deployment, in the UK case it led to rising costs (i.e. RES incentives did not reflect the falling costs) and subsequent policy changes which were detrimental to investment stability. ES (Spain): While decreasing costs of production are beneficial for investors and RES deployment, but combined with the government's sponsored price incentives it led to drastic and detrimental policy reversals. The unanticipated rapid pace of decreasing costs led to an unexpected expansion of RES, particularly solar, rising costs for the government as RES incentives did not reflect the technology costs trends. The unsustainable (€26 billion) tariff deficit unleashed drastic policy changes, which were detrimental to investment stability and led to a considerable reduction in investment flows into the sector.
Market and regulatory framework	Market frameworks can enable or limit investment in low-carbon policies, namely through the commercialisation barriers or a lack thereof that new technologies face compared with mature ones, regulatory frameworks that may be prohibitive and other factors (e.g. access to information, capital and transaction costs).	National framework for decentralised renewables production (Enabler)	NL: Dutch small and medium-sized enterprises (SMEs) and start-ups explore the market of smart appliances: smart thermostats, electric mobility, aggregating flexibility, charging infrastructure, etc., which may have value added in a system with increasing decentralised renewables production.

		The structure of the electricity market (Barrier/Enabler)	UK: Several interviewees mentioned the inability of the current electricity market design to deal with the increasing RES share. One interviewee argued that the market as well as the RES support instruments in Britain had been set up to benefit the big utilities which are still dominant on the UK market and whose business model does not fit the production patterns of RES, thus limiting their interest in those technologies. ES: The electricity market was first favorable for RES. The core barriers are the low prices, but once producers have adapted to the present market conditions, RES should be expanding fast. Despite all the barriers, investors are still buying permits for future RES production.
		Lack of maturity and innovativeness in the energy services market & construction sector (Barrier)	GR: As conveyed in one of our interviews, the Greek energy services market is still in its infancy and utilities and other energy service companies (ESCOs) are following state stipulations rather than leading developments in the market. The construction sector in Greece also needs to develop and specialise in smart technologies to drive investments to reduce energy consumption. Private market actors also placed great emphasis on the importance of developing a market for energy services for the promotion of energy efficient services and technologies in the domestic sector.
		Need to integrate public support for investments in households (Barrier)	GR: To strengthen the motivations for households to invest in smart technologies, representatives from the Greek ministry highlighted the need to properly absorb EU structural funds. Whereas the interviewee from the Greek Energy Agency drew attention to the role of energy utilities to provide appropriate incentives and energy services to their consumers (through the energy savings obligation scheme), due to the limited government expenditures and the absorption of EU structural funds being oriented towards areas with greater priority.
		Lack of a private investment framework & sustainable financing schemes (Barrier)	GR: The role of the Greek banking sector has been limited thus far in driving investments in energy saving technologies only through public support programs. Other forms of financing schemes such as Energy Performance Contracting (EPCs) are still not available

			restraining thus flexibility in funding options for such investments. The regulatory framework for EPCs still inhibits their use from municipalities (i.e. contracting is viewed as a deficit in a city's public budget).
		Presence of the EU regulatory framework (Enabler/Barrier)	NL: There are strict limits to its cooperation with commercial parties such as large and small energy suppliers. Smart Grid solutions, however, such as flexible pricing and user 'uploading' energy back into the grid, require cooperation with the separated energy companies. GR: Although the influence of this factor was not mentioned explicitly, representatives from the Ministry repeatedly mentioned updates in EU regulations to drive domestic policy developments and subsequently developments in the energy efficiency market. Recast of the Directive 2010/31/EE on the energy performance of buildings was particularly mentioned as influential in driving policy and technological developments for building innovation technologies.
		Unclear regulatory frameworks for RES support mechanisms (Barrier)	HR: The market framework in Croatia was found to have a detrimental impact on investment in renewables, as information on regulatory frameworks was lacking, which deterred investors and was not adequately addressed by policymakers.
		Lack of energy policy planning (Barrier)	ES: The lack of a roadmap and of a coherent strategy has led to increasing uncertainty for investors.
Policy continuity	It is important for investors that a policy or support framework is not unexpectedly changed.	"Non-stochastic" or linear approach to policies and growth (Barrier)	HR: Interviewees did not see (a lack of) policy continuity as having a large effect in this case. The government has emphasised a "non-stochastic" or linear approach to policies and growth, and alterations which occurred in the past due to overly-high incentives further reinforced the idea that it may be better to establish annual changes in quotas etc., to better respond to changing economic and other conditions.
		Frequent changes to policy design (Barrier)	UK: Both Renewable Obligations (RO) and FIT had frequent changes to either the remuneration level or the design of the support instrument.

		Frequent changes to policy design – Moratorium on renewables (Enabler/barrier)	ES: After initial strong legislative pushes to encourage investment in RE for electricity production, the year 2010 saw a reversal in the policy, which first eliminated subsidies and then introduced taxes on RES.
Macroeconomic environment	In EU and particularly in EU accession countries, the macroeconomic framework environment supports or limits the public or private sector's capacity to invest. The broader condition of the macroeconomic environment, outside the specific sectors relevant to climate change mitigation, can promote or limit the public or private sector's capacity to invest in low-carbon technologies. Changes in other sectors, e.g. in availability of capital, expected returns on investment, expectations of future economic conditions and investor confidence, can lead to indirect effects on the ability to invest in low-carbon technologies.	Financial and economic crisis (Barrier)	UK: Several interviewees mentioned the unanticipated consequences of the global financial crisis of 2007/2008 as a significant contextual factor, which had an impact on the functioning of the electricity markets all across Europe. ES: Financial crisis reduced demand and thus revenues, while support policy costs grew. Politicians could not bring prices up during the economic crisis. The consequence was an unsustainable tariff deficit. GR: Greek policy decision makers recognised the economic crisis as a predominant factor restraining market liquidity and investments. The economic downturn continues to restrain general liquidity and availability of funds in the banking market as well as households' disposable income. This setting constitutes investments in building innovation technologies for householders scarce.
		Fossil fuel prices (Barrier/enabler)	UK: Several interviewees mentioned the volatility of international fossil fuel prices as factors outside of the direct control of policy makers, which also affected the functioning of the electricity markets, particularly concerning the competition between RES, coal and gas.
Attitudes, behaviour and lifestyle			
Contextual factors	**Explanation**	**Sub-factors**	**Description of effects**
Public perceptions	The public may react to a climate change policy or project differently, as influenced by perceptions of personal (dis)advantages, perceptions of inequity in distributing costs	Lack of strong public opinion on development of renewables (Barrier/Enabler)	HR: Interviewees stated that this factor had little bearing on initial policymaking, as most of the general public was seen as not holding strong opinions on the development of renewable energy in the country. However, this is believed to be changing.

	and benefits or conflicting beliefs, and oppose a climate change policy usually by causing delays or even halting policy and project implementation (Lilliestam et al., 2016). Policy-makers also tend to consider public perceptions when making decisions over energy tax, carbon tax or subsidies at a national level.	Projected costs to final consumers and indirect social costs (Barrier/Enabler)	HR: This reflects a growing consideration of how increasing renewables will have broader societal effects (e.g. employment levels, inequality in distribution of costs and benefits), as well as more consideration of the costs to final consumers. Recently there was an announcement that the levy for renewables will increase and this was accepted very negatively by the public.
		Not in my back yard (NIMBY) attitude (Barrier)	UK: Three stakeholders mentioned the negative consequences of public opinion for UK RES development. One interviewee suggested that this was the main reason the UK Government focused on offshore wind when introducing the RO technology band, since onshore wind was not palatable to many rural constituencies which also happened to be Conservative party heartlands.
		Right-wing Media (Barrier)	UK: Three interviewees mentioned the hindering role of British mainstream media when it comes to RES development. Often, debates about prices and RES support were believed to be distorted by the right-wing media which is traditionally pro-status quo (nuclear, fossil fuels) and against expanding use of RES.
Demographic attitudes and other parameters	Demographic attitude parameters comprise the collective characteristics of specific target groups (e.g. private households, immigrant settlements, high-income households and farmers). Societal and community demographic parameters, like the physical environment where the householders are living, may affect intended policy outcomes, such as energy consumption patterns or technology adoption (Pothitou et al., 2014; see also van den Bergh, 2008).	Demographic factors (e.g. age, education, familiarity with internet-based and automated technologies) (Barrier)	GR: The impact of demographic and behavioural factors in the diffusion of energy efficiency and smart technologies has not yet drawn the attention of policy stakeholders in Greece. And this type of factor was only mentioned during our interview with the policy implementer from the Energy Agency. An implicit reference to the demographic and behavioural factors was made by stakeholders from the ministry recognising the need to conduct regular surveys on the household sector.
Behavioural predisposition at the individual level	Behavioural predisposition at the individual level concerns the behaviour of potential adopters (of policies), which is dictated by individual motives, norms, values, characteristics and strategies. This may	New patterns of electricity generation and use (Enabler)	NL: Electric appliances such as electric cars and heat pumps create new consumption patterns, such as increased overall electricity consumption and its timing, creating extreme demand peaks. This development asks for new solutions which Smart Grids are able to provide.

	include individual interests and motives, the motivation or prioritisation of a company or SME that guides decision-making (driven by profit-related criteria or social responsibility values) or the values and belief system of a single household. Adopters' different interests and motives or habits (e.g. household daily routines, occupants' heating patterns and lifestyle) may affect the possibility of a potential adopter taking up a climate-friendly behaviour.	Lack of consumers' awareness on building innovation technologies for energy conservation (Barrier)	GR: Low maturity and awareness of consumers were consistently raised by all stakeholders participating in our consultations.
Knowledge and experience	Knowledge and information: Adopters' knowledge regarding environmental issues and access to information on policies is considered to be linked to positive environmental behaviour and further potential for environmentally-oriented purchasing behaviour (Gadenne et al., 2011).	Awareness at a city level regarding funding opportunities (Barrier)	GR: Cities have a central role to play in driving sustainable energy investments in the household building sector (with the largest cost-effective opportunity for savings) through their local action plans. This issue was raised by the two private sector representatives. One of the two noted that despite the availability of funding opportunities for cities (i.e. soft-loans), cities are largely unaware of such opportunities and have failed thus far to exploit them.

.

5 Discussion

This study started by asking the ways by which contextual factors actually affect the outcome of policy instruments (e.g. if identified factors are relevant, and to what extent). Some insights were obtained through stakeholder interviews carried out across six countries (the Netherlands, Croatia, the UK, Spain, Greece, Thailand) on two main topics, namely measures to support RE deployment and smart technologies including smart grids.

All of the case studies succeeded in illustrating the effects of the selected contextual factors on the adoption or implementation of the relevant policy instruments. These effects were not measured but qualitatively described on the basis of experts' inputs. Some factors emerged as barriers with others as enablers. The third group of factors were listed as either barriers or enablers: either a barrier or enabler in different case studies; changing from one type to another over a period of time; showing both features (i.e. mixed results) at the same time; or exhibiting either characteristic depending on specific conditions. Among others, five contextual factors addressed in several case studies deserve special attention.

In the category of innovation and investment:

- the presence of a technological innovation system with an emphasis on decreasing technology costs;
- market and regulatory framework, especially the structure of the electricity market and the presence of the EU regulatory framework;
- policy continuity;
- the macroeconomic environment with a reference to economic crisis; and

in the category of attitudes, behaviour and lifestyle:

- public perception.

The concentration of the identified contextual factors on the category of innovation and investment can be explained on the ground that the chosen topics, measures to support RE deployment and smart grids or technologies, have more synergy with this category, for example, compared to an ecological tax reform. Nevertheless, the overwhelming recognition of public perception as a major contextual factor means that the social or behavioural category should feature more in future policy implementation. Likewise, the acknowledgement of the market and regulatory framework as another major contextual factor implies the need to consider the aspects of institutions and governance in an integrated manner.

The main results presented in this paper can provide some hints for future application, such as the need to ensure diversity and complementarity in selection of experts and the direct involvement of the sectors or organisations that are regarded as central to the chosen policy areas. Not all of the case studies were able to explain how these contextual factors can be accounted for in the current policy-making processes, which possibly requires identification of those experts who are inside and have direct access to the policy-making processes (policymakers) or those who used to be in and maintain contacts with

them (ex-officials). Instead, the format of cases applied enabled case study leaders to engage a diverse group of experts and stakeholders. This decision was partly based on the understanding that the chosen topics, deployment of RE and smart technologies, envisages a decentralised business model and fragmented markets involving millions of local producers and consumers dispersed across Europe. In particular, it was essential to ensure a balanced representation of stakeholders including market participants in discussion on the emerging markets such as decentralised renewable energy production and smart appliances. It was not a surprise to see the presence of the EU regulatory framework, part of the market and regulatory framework as one of the main contextual factors identified in case studies, given the EU's emphasis on the need for coordination between EU and national measures to support RE and support for additional national measures to improve EE of buildings (see 'Governance of the Energy Union'[7]).

The above decision over the methodology did not require a rigorous selection of experts or a large size of interviews or meetings to be carried out for each case study. This small body of experts for each case was expected to inform the case study leaders from complementary viewpoints rather than provide data for comparison or aggregation. Some interesting stakeholders however closest to the subject matter had not been identified or contacted for these interviews. Such stakeholders may include representatives of sub-national administration and the banking sector as well as journalists.

Lastly, the case studies not only contribute to identification and categorisation of contextual factors, but also offer practical suggestions for policymakers. The presence of technological innovation systems and their adaptability to a changing environment need to be seriously considered in energy policies. Policymakers should place more emphasis on assessing a range of scenarios under the macro-economic environment, when designing and implementing policies. The electricity market and EU regulatory frameworks were also found to be major determinants of policy success or failure, in some cases spurring development of EE policy (in the case of Greece), and in others limiting the possible success of Smart Grids (in the Netherlands) Policy continuity requires a balance to be struck between flexibility and stability. Moving beyond communicating and disseminating information or training, a more focused and targeted approach based on the household behaviour could be effective.

Acknowledgments

The authors acknowledge contributions to case studies from Zahar Koretsky (Radboud University) on the Netherlands, Stefan Bößner (Stockholm Environment Institute (SEI)) on the UK, Jorge Núñez Ferrer and Monica Alessi (Centre for European Policy Studies (CEPS)) on Spain, Niki-Artemis Spyridaki, Vassillis Stavrakas, and Alexandros Flamos (University of Piraeus Research Center (UPRC)) on Greece, and Mengyin Hu (SEI) on Thailand.

[7] https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/governance-energy-union (last accessed on 8 February 2018)

Appendix

Table 4. Which country, which topics, which partners, which method, when (month & year) and where (location and sectors on which experts are based).

Country	Topic	Case leader	Methods applied	Timeframe	Location	Stakeholders interviewed
Netherlands	Evolution of smart grid policies	Radboud University	Literature review, semi-structured interviews	January – April 2017	Nijmegen, Utrecht, the Hague and Delft	Industry (2) Policymakers (1) Academia (3)
Croatia	Renewable energy support scheme from 2008 - present	University of Graz	Literature review, semi-structured interviews	March 2017	Zagreb, Croatia	Academia (2) Industry (1) Government (1) NGOs (1)
UK	Wind support scheme	Stockholm Environment Institute	Literature review, semi-structured interviews	April – May 2017	Phone interviews with UK stakeholders	Academia (2) Government (3) NGOs (2)
Spain	Feed-in-tariffs and the evolution of policies that altered support measures for renewables	Centre for European Policy Studies	Literature review, semi-structured interviews	May-June 2017	Phone interviews with Spanish stakeholders	Academia (1) associations (2) consultancy (2)
Greece	Policies encouraging energy efficiency in buildings	University of Piraeus	Literature review, semi-structured interviews	February – May 2017	Athens, Greece	Interviews: -Government (2) Private sector (3)
Thailand	Renewable energy support instruments	Stockholm Environment Institute	Literature review, semi-structured interviews	April – May 2017	Bangkok, Thailand	public sector (1) consultancy (1) government agencies (3) international organisations (2) NGO (1) private sector (1) research institutes (3)

References

Fujiwara, N., A. Tuerk, N.-A. Spyridaki and K. Williges (2017), Contextual factors affecting EU climate policies and their outcomes. CARISMA Discussion Paper No.1. http://www.carisma-project.eu/Portals/0/Documents/CARISMA%20Discussion%20Paper%20No.%201%20-%20Contextual%20factors%20affecting%20EU%20climate%20policies%20and%20their%20outcomes.pdf

Fujiwara, N., K. Williges, and A. Tuerk (2017), Report on the knowledge gaps about key contextual factors. CARISMA Deliverable 6.3. a report with contributions from Z. Koretsky, S. Bößner on the UK, J. Núñez Ferrer and M. Alessi, N.–A. Spyridaki, V. Stavrakas, A. Flamos, and M. Hu. http://www.carisma-

project.eu/Portals/0/D6.3%20Report%20on%20the%20knowledge%20gaps%20about%20key%20contextual%20factors.pdf

Gadenne, D., B. Sharma, D. Kerr and T. Smith (2011), "The Influence of Consumers' Environmental Beliefs and Attitudes on Energy Saving Behaviours", *Energy Policy*, Vol. 39, No. 12, pp. 7684–7694.

Hekkert, M., S. Negro, G. Heimeriks and R. Harmsen (2011), "Technological innovation system analysis", Utrecht University, November (http://www.innovation-system.net/wp-content/uploads/2013/03/UU_02rapport_Technological_Innovation_System_Analysis.pdf).

Lilliestam, J., S. Ellenbeck, C. Karakosta and N. Caldés (2016), "Understanding the absence of renewable electricity imports to the European Union", *International Journal of Energy Sector Management*, Vol. 10, No. 3, pp. 291–311.

Pothitou, M., A.J. Kolios, L. Varga and S. Gu (2014), "A framework for targeting household energy savings through habitual behavioural change", *International Journal of Sustainable Energy*, Vol. 35, No. 7, pp. 686–700.

Van den Bergh, J.C.J.M. (2008), "Environmental Regulation of Households: An Empirical Review of Economic and Psychological Factors", *Ecological Economics,* Vol. 66, No. 4, pp. 559–574.