Market Uptake of Solar Thermal Electricity through Cooperation

Analysis of the barriers to the use of the cooperation mechanisms for renewable energy in the EU

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ABOUT THE PROJECT

In the light of the EU 2030 Climate and Energy framework, ***MUSTEC- Market uptake of Solar Thermal Electricity through Cooperation*** aims to explore and propose concrete solutions to overcome the various factors that hinder the ***deployment*** of concentrated solar power ***(CSP)*** projects in Southern Europe capable of supplying renewable electricity on demand to Central and Northern European countries. To do so, the project will analyse the ***drivers and barriers*** to CSP deployment and renewable energy (RE) cooperation in Europe, identify future CSP ***cooperation opportunities*** and will propose a set of concrete ***measures*** to ***unlock the existing potential***. To achieve these objectives, MUSTEC will build concrete CSP ***case studies*** based on the experience and knowledge generated around the cooperation mechanisms and CSP industry developments . Thereby we will consider the present and future European energy market design and policies as well as the value of CSP at electricity markets and related economic and environmental benefits. In this respect, MUSTEC combines a dedicated, comprehensive and multi-disciplinary analysis of past, present and future CSP cooperation opportunities with a constant ***engagement*** and ***consultation*** with ***policy makers*** and ***market participants***. This will be achieved through an intense and continuous ***stakeholder dialogue*** and by establishing a tailor-made ***knowledge sharing network***.

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1 INTRODUCTION

1.1 Background and motivation

The goal of MUSTEC is to assess the opportunities that renewable energy cooperation may bring to the future market uptake of CSP in Europe. To achieve this goal, one of the first tasks consists in looking back to identify and better understand those factors that have influenced renewable energy cooperation in the past and, as such, may also influence the market uptake opportunities that renewable energy cooperation may bring for CSP in Europe.

According to many voices, renewable energy cooperation is expected to play a corner stone role as a way to ensure an effective and affordable energy transition in the EU, taking advantage of trade within the internal market, safeguarding security of energy supply, coordinating climate adaptation measures and optimising the cost-effectiveness of actions. In this context, Europe wants to promote a cooperative RES deployment where the resources are most abundant, where the overall system costs would be minimized (e.g.: reduced need for backup, avoided grid investments, etc) or where overall social benefits would be maximised (e.g.: increased security of supply, GHG savings, avoided local air pollution, employment effects, innovation effects, etc) (DG-ENER, 2018)

The Cooperation Mechanisms of the Renewable Energy Directive 28/2009/EC[1] were originally designed as a way to achieve the 2020 EU RES target in a cost-effective manner while providing Member States (MS) with some flexibility to meet their National RES targets. However, as discussed in chapter 2, various hurdles of heterogeneous nature have prevented their wider use of the cooperation mechanisms among MS (since 2009 only four cooperation mechanisms have been used). As of today, a renewed interest in the cooperation mechanisms emerges as the 2020 deadline to meet the 2020 National RES target approaches and the prospects of achieving the 2020 targets of some countries are unclear but also as an option for MS to fulfil their National Energy and Climate Plans in the post 2020 time frame.

According to some authors (Resch et al. 2015), not opting for a cooperative approach in meeting the National or EU RES target constitutes a missed opportunity that translates into higher costs and/or reduced benefits for European consumers, taxpayers and citizens. Additionally, these costs are expected to increase in the future when higher shares of RES (in accordance to the EU commitment under the Paris agreement) also imply higher grid and integration costs unless an optimisation of RES deployment across Member States is undertaken. In this context, the utilization of the Cooperation Mechanisms can be understood as “second best” and somehow as a step forward towards a fully integrated electricity market in the EU.

Some authors have attempted to identify the range of factors that may have influenced renewable energy cooperation in the past (Ecofys, 2014; Caldés et al. 2016; Lilliestam et al., 2016; Held et al.

[1] Described in articles 6, 7, 9 and 11 of the Directive 28/2009/EC

2014). Building on this knowledge, the work presented here goes one step forward and contributes to enlarge the existing body of knowledge around cooperation mechanisms and renewable energy cooperation in general in various ways. First, the period covered by this study is wider (since 2009 to 2017) than previous contributions and, as such, it considers new evidence of both failed and successful attempts. Second, as a result of this wider and more recent evidence base, a larger list of potential factors has been identified and analysed. Such comprehensive, all-encompassing perspective of all possible drivers and barriers is, in itself, an added value of this work. Third, compared to previous studies, the work presented here proposes new analytical frameworks to characterize and analyse such factors. Finally, and most important, the results of this work are based on a consultation with Member States that took place in May 2018 through a survey questionnaire.

1.2 Objective and structure of the report

Taking the above context into consideration, the aim of this report is to first identify, classify and assess the relevance of the potential determinants (drivers and barriers) that may explain the use of the cooperation mechanisms of the Renewable Directive 28/2009/EC in the past. As introduced before, the analysis of such historical evidence constitutes a very useful knowledge base to understand the factors that will likely determine the future of renewable energy cooperation in the future.

Within the MUSTEC project, the results of task 4.1 presented in this report (Analysis of the barriers to the use of the cooperation mechanisms for renewable energy in the EU) will be combined with the results of task 4.2 (Determinants for the uptake of CSP in Europe in the past) with the objective to identify and better understand those factors that will likely shape the opportunities that renewable energy cooperation can bring to the market uptake of Concentrated Solar Power (CSP) technologies. This combination and integration will be the goal of task 4.3.

As to the structure of this report, the first chapter includes an introduction followed by a section on the three-step methodology that has been applied to identify, classify and analyse the potential determinants (drivers and barriers) that explain the use of the cooperation mechanisms in the 2009-2017 period.

The second chapter of the report is devoted to introduce the cooperation mechanisms of the Renewable Energy Directive 28/2009/EC, present the four successful cases and, finally, outline what the future renewable energy cooperation landscape may look like in the future.

The third chapter presents the results from the three methodological steps. First, based on a comprehensive literature and expert consultation, a list of more than forty possible factors influencing MS in their decision to cooperate will be presented. Next, a classification and analysis of such factors according to a set of classification criteria will be presented. Finally, as a way to validate and, most important, rank the importance of different drivers and barriers which have

been identified in previous research, the outcomes of a survey questionnaire to MS will be presented.

The fourth and last section presents the conclusions of the report.

1.3 Methodological approach

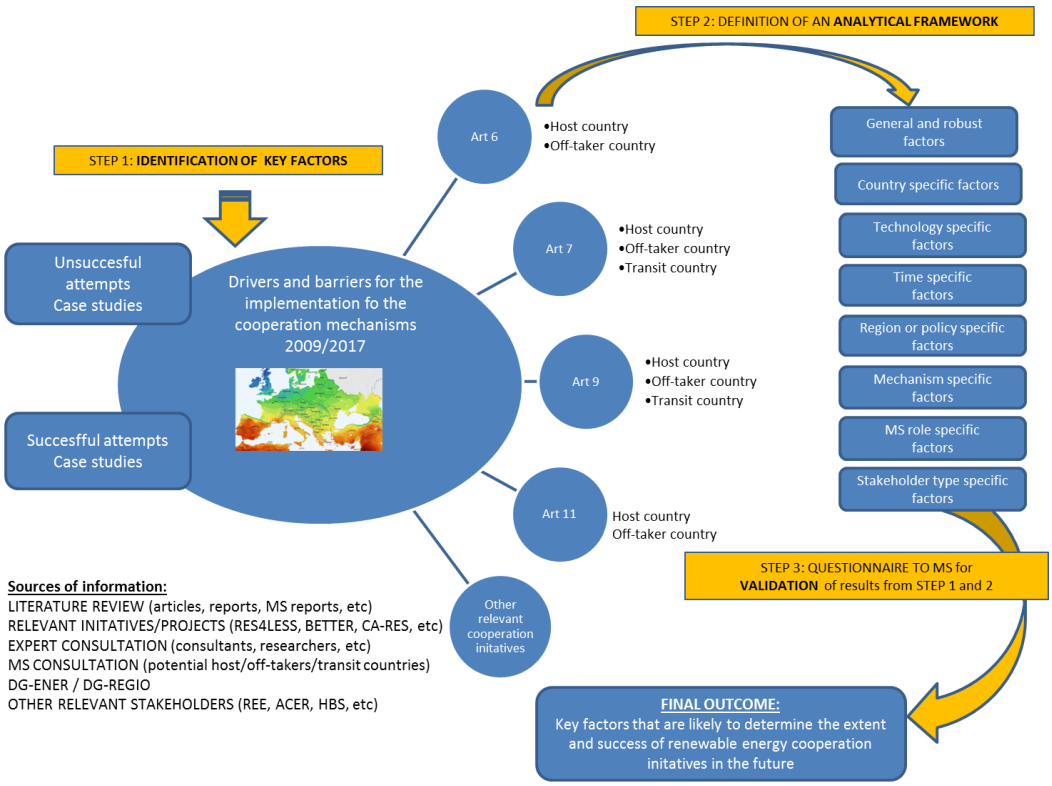
The goal of this task – that is the identification and analysis of the factors influencing the use of the cooperation mechanisms-, is fulfilled in three methodological steps (illustrated in figure 1)

STEP 1: Literature review and expert consultation → **Identification of factors** that could have potentially determined the use of the cooperation mechanisms.

STEP 2: Elaboration of an analytical framework → **Characterization and analysis** of identified factors in step 1.

STEP 3: Survey Questionnaire to MS → **Validation** and **assessment of the relative importance/relevance of the identified factors by MS**.

Figure 1: Proposed methodological steps.



Source: Own elaboration.

The rest of this subsection discusses each step of the methodology in greater detail.

STEP 1: The aim of this first step is to identify potential factors that may have influenced, either in a positive or negative way, the interest and feasibility of Member States in using the cooperation mechanisms of the Renewable Energy Directive during the period 2009-2017. To do so, a meta-analysis of the existing literature on renewable energy cooperation has been conducted. Such extensive literature review included peer reviewed articles, relevant project reports –i.e.: RES4LESS, BETTER, CA-RES, ECOFYS (2014)-, as well as grey literature. Additionally, other sources of information include semi-structured interviews with some MS representatives as well as European authorities in Brussels and in the context of the CA-RES[2] project meetings in Zagreb and Warsaw. A project-internal cross-check was carried out. As a result of this first step, more than forty factors have been identified and the list of these factors is presented in section 3 of this report. Obviously, the relevance and magnitude of such factors cannot be generalized as it depends on the country specificities, context of the considered cooperation agreement, etc. Each contribution stresses the relevance of a particular driver or barrier to the use of the cooperation mechanisms. Furthermore, a comprehensive, all-encompassing perspective of all possible drivers and barriers is often missing. In any case, having an inventory of such a variety of factors highlights the complexity and heterogeneous nature of the aspects potentially affecting Member States feasibility and willingness to embrace a renewable energy cooperation agreement in Europe.

STEP 2: This step allows us to classify and better understand the factors identified in the previous step. In order to do so, a set of classification criteria has been proposed based on the literature review and our own judgment (see table 1).

Based on the inventory of factors and the characterization criteria, all factors have been characterized and coded. For example, and as shown in section 3, as result of the application of the analytical framework, it has been possible to analyse, among other aspects, which factors have played a barrier or driver role, the nature of those factors (i.e.: political, economic, technical, legal, social acceptance, etc.) and if those factors that are expected to be relevant are dependent upon the role of the country (i.e.: either as a “host”, “off-taker” or “transit” country).

[2] (www.ca-res.eu)

Table 1: Proposed factor characterization criteria and coding

STEP 2: CLASSIFICATION CRITERIA OF KEY FACTORS AND CODING		Explanation
Drivers/Barriers	1=Driver, 2=Barrier, 3=Both	If the factor acts as a driver or as a barrier for the use of coop. Mechs
Type of driver/barrier	1=political; 2=technical; 3=legal;4=geopolitical; 5=social; 6=econom; 7=climate related	What is the nature of this factor?
Host/Off-taker/transit country	1=Host; 2=Off-taker; 3=both; 4=transit; 5=EU	Is this factor relevant for host/off-takers/transit countries or all?
Coop.mech. Relevant	1=Art 6; 2=Art 7; 3=Art 7 with PT; 4=Art 11; 5=Art 9; 6=All	Is this factor relevant for Art6/7/9/11/all cooperation mechs?
Country specific	Country name; 1=all	Is this a country specific relevant factor?
Region specific	1=Southern; 2=Central; 3=Northern; 4=Islands; 5=all	Is this a regional specific relevant factor?
Technology specific	1=PV; 2=wind; 3=biomass; 4=CSP; 5= hidro; all=6	Is this a technology specific relevant factor?
Time specific factors	1=2009-2017; 2=2018-2020; 3=post 2020; 4=all	Is this a time specific relevant factor (past/present/future/all)?
Stakeholder type specific	1= MS gov; 2=industry; 3=TSO; 4=civil society; 5=EC repres; other	Is it a stakeholder specific relevant factor?
Particular case study	1=Nor/Sw; 2=Germ/Den; 3=Lux/Est; 4=Lux/Lith	Was this factor relevant for any of the success/failed case studies?
Source	1=scient. Art; 2=CA-RES; 3=Research proj.; 4=expert cons	Where did we get this information from?
STEP 3: Survey to MS representatives and experts		Explanation
Stakeholder relevance	"-3=important barrier; -2=important barrier; somehow important barrier=-1; not relevant=0; somehow important driver=1; important driver= 2; very important driver=3"	Answer to teh following question: "How relevant each of these factors has been for the ue of the cooperation mechanisms in your country in teh period 2009-2017?"
Interviewed	Name of the person	
Country	Country.	
Date of survey	Date	

Source: Own elaboration

STEP 3: Finally, in order to validate the key factors identified in the previous steps and most important assess the actual relevance that the identified factors have played in the current interest toward the use of the cooperation mechanisms, a dedicated survey questionnaire has been designed and filled by Member States (see annex 1). The questionnaire was distributed to 28 Member States and one representative of the Energy Community during the CA-RES[3] meeting in Warsaw on April 25-26th 2018. At the date of finalization of this report, the response rate was about 60%. As such, the results presented here are based on the answers to eighteen questionnaires that were analysed throughout the month of May 2018. In turn, the results of this analysis will be presented to MS representatives in the next CA-RES meeting expected to take place in Vienna in November 2018. The Concerted Action on the renewable energy directive (CA-RES)[4] is an instrument of the Horizon2020 Programme, which supports the transposition and implementation of the RES Directive.

[3] CA-RES project (www.ca-res.eu)

[4] www.ca-res.eu

2 RENEWABLE ENERGY COOPERATION IN EUROPE

The first objective of this chapter is to introduce the Cooperation Mechanisms of the Renewable Energy Directive 28/2009/EC while the remaining parts of the chapter are structured around two questions: (i) what have we learned from both successful and unsuccessful past attempts to use the cooperation mechanisms? and (ii) what can we expect from regional cooperation in the future?.

2.1 Cooperation mechanisms of the RES Directive 28/2009/EC

The **Renewables Energy Directive2009/28/EC** (also known as the RED directive), defined an EU 20% RES target as well as National binding RES targets expressed as a percentage of RES gross energy consumption. Such targets were set based on "flat rate approach" that only considered MS gross domestic product and their historical RES deployment. As a result, National targets were not necessarily correlated with MS RES potentials nor with their RES generation costs. As a result, some MS with scarce RES resources or high generation costs found it challenging to meet their targets domestically while for others –with abundant resources and/or cheaper generation costs- it was easy to meet their target and even go beyond such target. In order to provide MS with more flexibility and achieve the EU target in a more cost-effective way, the RED Directive 2009/28/EC set the legal framework for the use of cooperation mechanisms. While the Directive specified the general accounting rules of these mechanisms, it is important to note that their design and implementation is left to the cooperating MS (Caldés and Díaz-Vazquez, 2018).

As described in articles 6, 7, 9 and 11 of the Directive 28/2009/EC, there exist four possible cooperation mechanisms that MS can choose from (box 1).

While articles 6, 7 and 11 are suitable for cooperation agreements within the European territory, article 9 is only suitable for cooperation agreements between EU MS and Neighbouring countries. The main difference between the European cooperation mechanisms and article 9 is while the later requires the electricity to be physically imported to the European territory, such requirement does not exist in Europe and is left to the decision of the involved MS (for example, you may find a joint project defined in article 7 with or without physical transfer of the electricity).

Given the geographical scope of MUSTEC, from now onwards, we will only consider "statistical transfers" as defined in article 6, "joint projects" (with or without physical transfer of the electricity) as defined in article 7 and "joint harmonization schemes" as defined in article 11 of the Directive 28/2009/EC. For more information on the opportunities and barriers to renewable energy cooperation with neighbouring countries as allowed by article 9 of the RED directive, see the work conducted within the BETTER project[5].

[5] www.better-project.net

Box 1. Cooperation mechanisms of the RES Directive (2009/28/EC)

- ***Article 6: Statistical transfers***

In this case, renewable energy (electricity, heat or transport energy) which has been produced in one MS is virtually transferred to the RES statistics of another MS, counting towards the national RES target of that MS.

- ***Article 7: Joint Projects between EU MS***

Allows EU MS to finance a RES project jointly thus sharing the costs and benefits of the project and developed under framework conditions jointly set by two or more MS (i.e. a specific new plant is identified and the output of the plant is shared (statistically) between two cooperating MS). The involved MS define which share of the energy production counts towards which MS target.

- ***Article 9: Joint Projects with third countries***

Joint projects can also be implemented between MS and third countries (i.e.: countries outside the EU). A precondition is that an amount of electricity that equals the electricity amount generated from RES and subject to this joint project is physically imported in the EU (for more information on this option, see www.better-project.net).

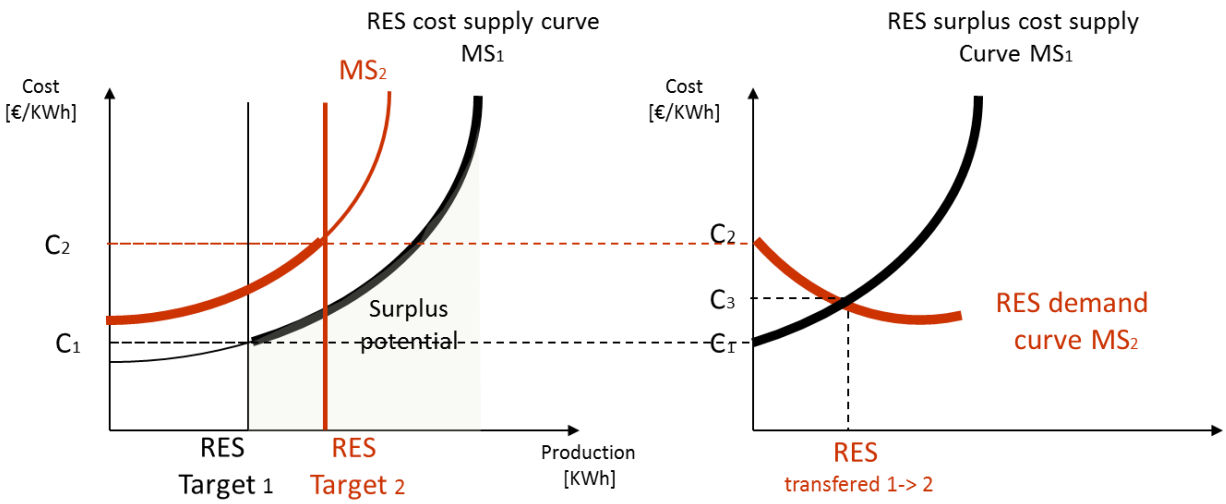
- ***Article 11: Joint Support Schemes***

Under this scheme, MS merge or coordinate (parts of) their RES support schemes and jointly define how the renewable energy produced is allocated to their national targets.

Source: BETTER project.

Figure 2 illustrates, with a simplified example, the efficiency gains that could be obtained from the use of the cooperation mechanisms. For example, let´s consider a MS with cheap and/or large potential for RES-E generation (MS1) that comes together with another MS with limited and/or expensive potential for RES-E generation (MS2). Furthermore, let´s assume that MS1´s RES target is less ambitious than MS2´s RES target (such situation is illustrated by the different renewable cost supply curves of the two MS and the different RES targets). In this situation, a certain share of the RES-E generation target in MS2 could be achieved by the surplus generation from MS1. Such transaction would lead to cost savings for MS2 while the support cost in MS1 would increase (at a lower rate than the support costs decrease in MS2). As a result, net support cost savings can be realized through cooperation (Caldés and Díaz-Vázquez, 2018).

Figure 2: Economic rationale from cooperation



Source: Caldés and Díaz-Vázquez (2018)

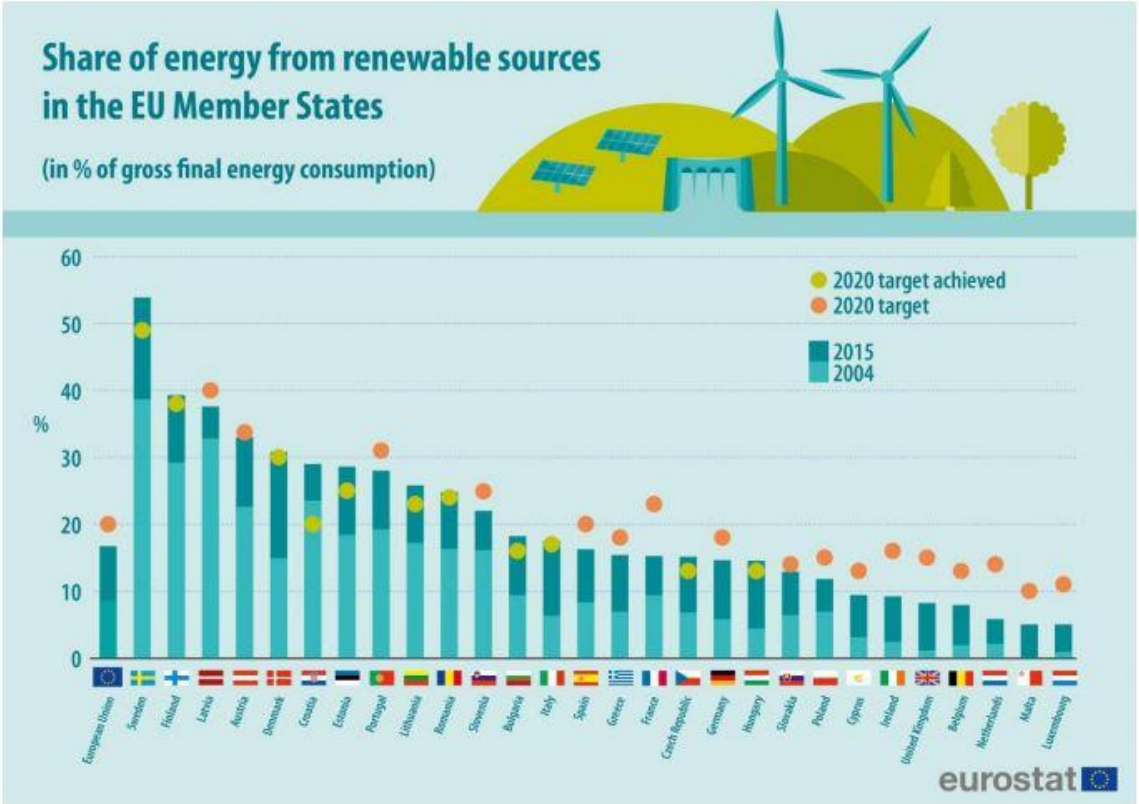
As for the benefits from the use of the cooperation mechanisms, several studies have demonstrated, from a theoretical point of view, the efficiency gains of the use of the cooperation mechanisms (see Resch et al. 2015 as well as reports from the Re-Shaping, RES4LESS and BETTER projects).

Such studies assessed different cooperation scenarios which led to different magnitudes of efficiency gains. For example, in the Re-Shaping project, the "strong cooperation" scenario compared to pure "national thinking" as specified in the case of "limited cooperation" reduced additional generation cost and capital expenditures as well as significantly decreased support expenditures (-10.8% or 31bn€ over the whole period up to 2020 at EU level compared to "limited cooperation"). The "moderate cooperation" scenario, which seemed more realistic considering MS preferences, still showed reductions in support expenditures of -5,8% (17bn€) over the whole period up to 2020 at EU level (Resch et al. 2015).

When considering potential interested off-taker countries in Europe, according to consulted experts and the information provided in the Renewable Energy Report that includes MS current progress towards their indicative RES targets (EC, 2017), those countries likely interested in using cooperation mechanisms as a way to meet their 2020 RES targets are Luxemburg, Ireland, the Netherlands, Cyprus, Germany, Malta and the UK. More recently, Eurostat published new data on MS progress towards the 2020 targets (figure 3). According to the Eurostat (2018), the countries that appear not to be on track include: Latvia, Portugal, Slovenia, Spain, Greece, France, Germany, Slovakia, Cyprus, Ireland, United Kingdom, Netherlands, Malta and Luxemburg.

It must be taken into consideration that **Figure *3*** is based on 2014 and 2015 figures. Therefore, as of today, some Member states have already implemented measures with which it is expected that they will meet their renewables 2020 target. For example, in the Spanish case, as a result of the latest 8000 MW renewable energy auctions, it is expected that Spain will meet its 20% target by 2020.

Figure 3. MS progress towards the 2020 RES target



Source: Eurostat (2018)

It is important to note that from now on, in this report we will refer to potential "host countries" those countries that have already met their 2020 target (marked with a yellow dot in the figure above) or are on track to meet their target by 2020. In both cases, it is assumed that those countries could potentially generate surplus renewable electricity that could be used by another MS to achieve their targets using one of the cooperation mechanisms. Croatia, Sweden or Lithuania, for example, would be perfect examples. On the other side, those countries for which it seems very unlikely that they will be able to meet their 2020 RES target are considered as potential "off-taker" countries (marked with orange dots in the figure above). Such countries would potentially be interested in using the cooperation mechanisms as a way to partially meet their targets. Examples of potential "host countries" would be Netherlands, Luxemburg or Ireland.

Furthermore, it is important to acknowledge that as a result of State Aid decisions, some countries may opt for cross-border opening as a way to remedy discrimination[6] under Articles 30/110 of the Treaty (discriminatory charges on goods). Besides Germany (see box below), other countries may follow the same example such as Luxemburg, Denmark, Estonia, Romania, Greece, Italy, Portugal and Belgium.

Box 2. The German revised Cross-Border Renewable Energy Ordinance

In June 2007, the German Cabinet adopted the revised Cross-Border Renewable Energy Ordinance (GEEV) in order to implement the requirements of the 2017 Renewable Energy Sources Act (EEG 2017), according to which 5% of new renewables capacity to be installed each year (approx. 300 megawatts) would be opened up to installations in other EU MS in auctions. This was the result of an agreement with the EC in the context of the state aid approval procedure for the Renewable Energy Sources Act.

The first opened pilot auctions were put in place for ground-mounted photovoltaic installations with Denmark but the new GEEV also makes possible cross-border auctions for energy installations and further cross-border auctions are planned to be carried out (subject to the successful conclusion of negotiations with partner countries).

According to the Renewable Energy Sources Act, three requirements must be fulfilled for cross-border opening: the opening must be based on the principle of reciprocity, i.e. the German funding system can be opened to installations from other EU MS only if the other MS also open their funding systems to installations in Germany. For this purpose, intergovernmental agreements need to be concluded between the cooperation partners. Furthermore, it must be possible to physically import the electricity to Germany, i.e. a real impact on the German electricity market must be guaranteed.

Source: https://www.bmwi.de/Redaktion/EN/Pressemitteilungen/2017/20170614-kabinett-verabschiedet-novelle-der-grenzueberschreitenden-erneuerbare-energien-verordnung.html

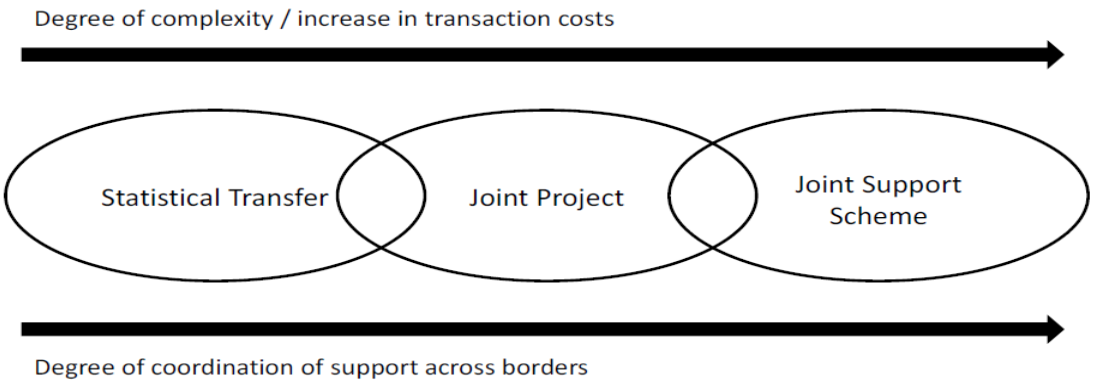
2.2 What have we learned from the past?

The limited use of the cooperation mechanisms since 2009 demonstrates that beyond cost-savings and compliance with State aid decisions, there exist other direct and indirect drivers and hurdles that must be taken into account when considering a cooperation agreement. Examples of those include, among others, grid-related bottlenecks, avoided local and global air pollution, security of supply, employment effects, innovation effects, etc (Caldés and Díaz-Vazquez, 2018).

[6] Articles 30 and 110 of the Treaty on the Functioning of the European Union (TFEU) prevent Member States from imposing charges or taxes that discriminate against imports.

Furthermore, the priorities and constraints of each MS as well as the particularities of each cooperation case may also determine the feasibility as well as interest towards a particular cooperation mechanisms and its design choice. In general terms and as shown in figure 4, for intra-European cooperation agreements, the choice of mechanisms is often done based on the consideration of the trade-off between the degree of complexity and the degree of coordination of the support instrument which both increase along the spectrum of possible mechanisms (Klessmann, 2014)

Figure 4. Choosing between alternative intra-European Cooperation Mechanisms.



Source: Ecofys, 2013

As discussed in Caldés and Díaz-Vazquez (2018), the three intra-European cooperation mechanisms provide opportunities for different depth, scope and duration of cooperation between MS. Thus, when MS choose the type of cooperation mechanisms and its design, they first need to clearly identify what is their interest for cooperation. According to (Held et al, 2014; Ecofys, 2013; CA-RES), some of the most commonly reported reasons to cooperate include: (i) lowering the costs of reaching the national 2020 RES targets, (ii) closing the potential gap between RES production and RES target and/or interim target, (iii) cooperation for technology development and (iv) long term cooperation and electricity imports/exports.

According to Held et al, (2014), **statistical transfer** is particularly suitable to quickly achieve cost-efficient fulfilment of the RES targets. There is no direct effect on domestic support schemes and, compared to the other cooperation instruments, it is easy to establish. As the 2020 deadline approaches, this option seems to be the preferable one. On the other side, **joint projects** can be suitable to jointly develop technologies, save costs of RES target fulfilment and prepare long-term electricity imports/exports. They have a higher complexity degree but they are suitable for a limited amount of projects with some kind of strategic component. Finally, **joint support schemes** provide the highest degree of cost-efficiency as well as policy and market integration. The downside is that they require deep cooperation between MS, which often implies that they share similar technology preferences and have well integrated electricity markets (Ecofys 2013).

In any case, once the typology of cooperation mechanisms has been chosen, its specific design must be defined from a wide range of options to address the involved MS needs and

particularities. In this regard, the EC's Guidance on the Use of Renewable Energy Cooperation[7] (EU SWD (2013)) and Held et al. (2014) provide very useful information for MS in this respect.

Table 2. Example of the cooperation mechanisms design options

Design element	Example of alternative options
Type of cooperation	Number of involved parties, single or multi-project cooper.
Scope of cooperation	Technology and duration of the support
Flow of support	Determination of support level/transfer price
Contractual arrangements	Arrangements for non-compliance

Source: Ecofys (2013)

As mentioned earlier, since 2009, the cooperation mechanisms have not delivered as expected and, as of today, only four cooperation mechanisms have successfully been implemented in Europe. In an attempt to explain such low implementation and derive some useful insights for the CSP cooperation projects, the next section presents, according to the literature review and consulted stakeholders, a preliminary list of barriers and drivers that may have determined the use of the cooperation mechanisms in Europe. Furthermore, the four successful cases of cooperation mechanisms in Europe will be presented.

2.2.1 Drivers and barriers to the use of the Cooperation Mechanisms

Compared to a fragmented approach in meeting the MS renewable targets, the utilization of the cooperation mechanisms may bring various advantages. As shown in **Table 3** based on the various studies as well as consulted experts and MS representatives, various benefits could emerge as a result of a renewable energy cooperation agreement (Held et al. 2014, Gephard et al. 2015; RES4LESS, Lilliestam et al. 2016, Caldes et al. 2015, CA-RES reports; Ecofys 2013; Lilliestam et al. 2016; Caldés and Díaz-Vázquez, 2018).

Table 3. Drivers for enhanced RES-E cooperation within Europe (Art. 6, 7 and 11)

Drivers for importer/off-taker countries	Drivers for exporter countries
• Achieve RES targets more cost-efficiently • Foster economic relations with other MS	• Generate revenues from domestic resources • Attract foreign investments/support to deploy new

[7] https://ec.europa.eu/energy/sites/ener/files/documents/com_2013_public_intervention_swd05_en.pdf

• Benefits for domestic industry (open new markets) • Diversify energy portfolio & supply regions - increasing security of supply. • Get flexible renewable power supply to complement own variable RES-E (e.g.: in the case of CSP) • When applicable, comply with National legislation as to the obligation to open RES support schemes.	RES plants without compromising domestic funds. • Create new jobs and industrial opportunities • Foster technology research and knowledge transfer • Create economic and political interdependences with other MS • Contribute to the decarbonisation of the domestic energy mix in the longer term. • Create economies of scale in RES-E deployment (that lead to improvements in technology performance and cost reductions)
Drivers for both cooperating countries and for the EU as a result from mutual cooperation	
• Cooperation with regards to specific technologies of interest and thus focus on technology developments and industrial policies. • Jointly test new support scheme elements (e.g.: the introduction of specific premium calculations in a FIP system or the introduction of auction schemes for specific technologies). • Enable savings of different kinds compared to purely national RES deployment (Resch et al. 2015). • From an EU perspective, support costs savings because RES installations are built at preferable sites in a wider geographical region, requiring less support to be economically feasible • From an EU perspective, reductions of capital expenditure: with the cooperation of several countries, better sites require less RES capacity to produce the same amount of electricity. • From an EU perspective, it can help increase the tights and foster other type of collaborations between MS and regions across Europe • From an EU perspective, it is a way to improve energy policy coordination of MS, policy convergence and move towards the creation of the internal energy market.	

Source: Caldés and Díaz-Vazquez (2018).

As introduced before, despite the potential benefits mentioned above, the use of the cooperation mechanisms has been very limited with only four intra-European cooperation mechanisms in place and not a single cooperation mechanism with neighbouring countries.

There exist many reasons of diverse nature that explain this underutilization of the cooperation mechanisms which will be described in the detail in the remaining of this section (and later validated thanks through the MS questionnaire). Given the distinct nature of the barriers, this section focuses on the barriers that have prevented the use of intra-European cooperation mechanisms (Articles 6, 7 and 11). According to Held et al. (2015), some of the most remarkable barriers include: (i) social opposition (ii) lack of physical interconnections, (iii) discrepancy of electricity market design and specific rules for market access and operation of power plants across MS, (iv) regulated energy prices, (v) oligopolies (lack of realized competition), (vi) different RES support schemes across Europe which prevent a more efficient allocation of RES investments, (vii) MS disparities towards their preferred energy mix and their resistance to lose control over their

energy policy. For more information on barriers to implement Article 9 -that is cooperation with neighbouring countries-, see Lilliestam et al. (2016) and Caldés et al. (2015).

Building on the work presented above, the results presented in this report constitute an update and enlargement of the existing body of knowledge in terms of the barriers and drivers to the use of the cooperation mechanisms in Europe

2.2.2 Existing cooperation initiatives

As of today, four cases of cooperation mechanisms exist in Europe summarized in **Table 4**[8].

Table 4. Existing cases of use of cooperation mechanisms in Europe

Cooperating Countries	Coop. Mechs.	Type of agreement	Technology	Year
Sweden/Norway	Art. 11	Joint Certificate Scheme	All RES technology	January 2012
Germany/Denmark	Art. 11	Mutually-opened auctions	Ground Mounted PV installations	July 2016
Luxemburg/Lithuania	Art.6	Statistical Transfer	All RES technologies	October 2017
Luxemburg/Estonia	Art.6	Statistical Transfer	N/A	November 2017

Source: Caldés and Díaz-Vazquez (2018)

Based on Caldés and Díaz-Vázquez, the remaining part of this chapter describes the most outstanding features of the four successful cooperation mechanisms between Sweden and Norway, Germany and Denmark, Luxemburg and Lithuania and Luxemburg and Estonia.

- **Sweden and Norway (Joint support scheme/2012/Article 11)**

In January 2012, the first cooperation mechanism was formally signed between Sweden-Norway with the form of a joint certificate scheme (corresponding to Article 11 of the RED Directive). Sweden´s participation in the scheme implied extending the electricity certificate scheme that had been operating since 2003. In Norway, the revenues from certificates replace the former investment support for wind farms provided by the government.

As described in Held et al. (2014), the green certificate scheme rules implied that for every unit of electricity produced, the State offered green certificates to RES generation facilities. Each issued certificate represented 1 mega-watt hour (MWh) of electricity. In turn, the certificates were

[8] For more detailed information on such agreements as well as on the failed attempts between other MS, see Gephard et al. (2015).

commercially tradable assets and increased the income for renewable producers. Companies that sold power had the obligation to sell a certain share of electricity produced from renewable sources and needed to buy a certificate to prove that by redeeming the respective amounts with the government agency once per year. The final costs were then passed on to the end consumer bills. Despite both countries operate a joint support scheme together, the two countries decided that they didn´t have to agree on every detail such as tax regimes, regulations, etc. so that each country implemented the scheme slightly different.

The common goal for the joint market was to increase electricity production based on RES in Sweden and Norway by 25.4 TWh from 2012 to 2020 so that both countries have the responsibility of realizing an additional production of 13.2 TWh independently of where the production capacity is built. In this way, the electricity produced by the plants included in the common electricity market would be equally divided between the two parties.

The expected benefits from such agreement include: (i) a better functioning of the market, (ii) increased cost efficiency and (iii) increase long term stability. Such outcomes would benefit both countries in a way that Sweden has lower support costs and Norway can join an existing support scheme and have more installed RES capacity developed in their country.

As for the lessons learned, Held et al. (2014) concluded that the fact that both countries have similar RES cost was important for the success of the joint support scheme. Furthermore, another key to success was the existing interconnection between the two countries and operation in a common electricity market. As for hurdles along the way, there were difficulties in agreeing to a burden sharing arrangement until a political agreement to share the costs and benefits 50-50 unlocked the negotiations.

Source: Held et al. (2014)

- **Germany and Denmark (Joint support scheme/2016/Article 11)**

The second cooperation mechanism took place in July 2016 between Denmark and Germany in the form of mutually-opened auctions for ground-mounted PV installations (Article 11). Under this agreement, both partners agreed on the main principles for their cooperation but every country implemented its own auction and was free to design the auction itself (price system, maximum amount, auctioning kW or kWh, etc.). However, as regards the local investment conditions (e.g.: licensing law, permitted areas and sites) the terms and rules of the country of location apply (for example: the rules of the country where the installation will be built)

As described by BMWI (2016), "in a joint auction, the partner countries conduct one joint auction that is opened to installations in both partner countries and funding for the renewables installations is provided from the existing national support schemes of the two countries. A predetermined distribution rule is used to determine the country from which a successful bidder will receive support. Partner countries have to agree on the auction design before conducting the auction. With regard to location-specific aspects (planning and construction rules, taxes and levies, etc.), the conditions of the country where the installation will be located will apply unless otherwise

agreed by the partner countries. Consequently, bidders will have the necessary information about the funding terms and investment conditions when they submit their bid. The only thing bidders will not know ahead of the bid is which funding scheme they will be assigned to (who will pay the bill)".

As for the involved players in the agreement, on the German side, the cross-border support was disbursed directly by the Transmission System Operator (TSO) managing the closest interconnector. The distribution system operator of the partner country where the installation is located supplies the necessary data to the German TSO. In Germany, the regulatory body for inviting the bids is the Federal Network Agency (BNetzA).

The German ordinance for implementing this concept provided for the different design options and for possible deviations from the German auction design. The cooperation agreement between the partner countries defined specific conditions for each and every auction opened to EU MS. These specific auction conditions were published by the regulatory body inviting the bids. The agreement also included a balanced cost-benefit ratio and defined rules for accounting towards national and EU renewable energy targets in accordance with Directive 2009/28/EC[9] (BMWi, 2016)

Source: (BMWi, 2016)

- **Luxemburg and Lithuania (Statistical Transfer/2017/Article 6)**

The agreement signed between Lithuania and Luxembourg[10] on October 26th 2017 is the first ever cooperation agreement using a statistical transfer of renewable energy amounts (Article 6 of the RED). The agreement will help Luxembourg achieve its national renewable target for 2020 by receiving statistical transfer of a specified amount of renewable energy produced in Lithuania.

Lithuania´s national 2020 RES target is 23%. However, by 2015, Lithuania had already overpassed such goal as it reached 25,75% of renewable energy in its gross final energy consumption. Contrary, Luxemburg 2020 RES target was set at 11% while by 2015 Luxemburg had only achieved 5%. Not surprising, Luxemburg had already stated in its national renewable energy action plan as well as in its latest renewable energy progress report that it relied on using statistical transfers to reach its 2020 RES target[11]

The agreement foresees that, starting in 2018 up to 2020, Lithuania will transfer to Luxemburg a certain amount of its renewable energy surplus. According to consulted sources, a financial benefit that may amount to 10m€ will be invested in energy projects and scientific research in Lithuania.[12]

[9] The information included here was provided by BMWi. For more information, see BMWi, (2016)

[10] More information on this agreement is expected to be disclosed within the next few months.

[11] https://ec.europa.eu/info/news/agreement-statistical-transfers-renewable-energy-amounts-between-lithuania-and-luxembourg-2017-oct-26_en

[12] https://enmin.lrv.lt/en/news/an-agreement-between-lithuania-and-luxembourg-in-the-field-of-energy-is-the-first-contract-of-this-type-in-the-eu

Source: DG-ENER (2017)

- **Luxemburg and Estonia (Statistical Transfer/2017/Article 6)**

In this case, the agreement signed between Estonia and Luxembourg on November 13th is the second cooperation agreement using a statistical transfer of renewable energy amounts. According to the available information[13], the agreement stipulates that Estonia will transfer a minimum volume of renewable energy target amounts in 2018 and 2020 to help Luxembourg fulfil its 2020 national renewable energy target. The agreement includes the option for additional transfers in the future. According to consulted experts, the revenues received by Estonia from Luxembourg are going to be used to finance projects in the areas of renewable energy or energy efficiency. As for their renewables target trajectories, Estonia's national renewable energy target for 2020 is 25%. In 2015, Estonia achieved a share of 28.6% of renewable energy in its gross final energy consumption. On the other side, Luxembourg's national renewable energy target for 2020 is 11%. Luxembourg achieved a 5% RES share in its gross final energy consumption in 2015.

Source: DG-ENER (2017)

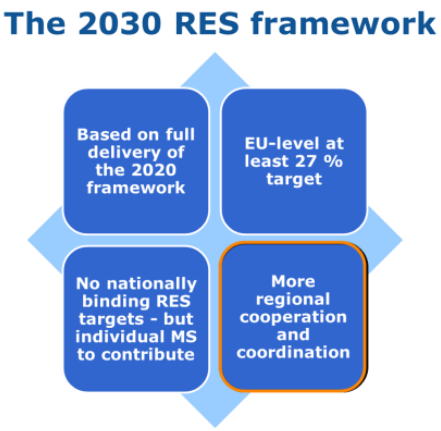
2.3 Renewable cooperation in the post 2020 framework: What to expect?

As the 2020 deadline approaches, MS are already feeling the urgency to find ways to comply with their 2020 National RES targets. As a result, the use of the Cooperation Mechanisms is likely to increase as the trajectory becomes steeper. According to consulted experts and Member States´ representatives, Statistical transfer agreements will likely be the most popular cooperation mechanism due to its ease of implementation and the limited time remaining until 2020.

However, when MS energy policy makers consider renewable cooperation agreements with other MS, they must look beyond 2020 and consider what will be the regulatory framework affecting renewable cooperation agreements in the post 2020 period so that the appropriate decisions are taken. According to Gephard et al. (2015) and as shown in the figure 5, “a more coordinated European approach will be a cornerstone to achieve a more climate-friendly, affordable and secure energy system for the EU. In this context, regional cooperation is expected to open up the black box of national energy policy-making and bridge gaps between the EU and national levels”.

[13] https://ec.europa.eu/info/news/second-agreement-statistical-transfers-renewable-energy-amounts-between-estonia-and-luxembourg-2017-nov-13_en

Figure 5. Pillars of the 2030 Renewable Energy framework



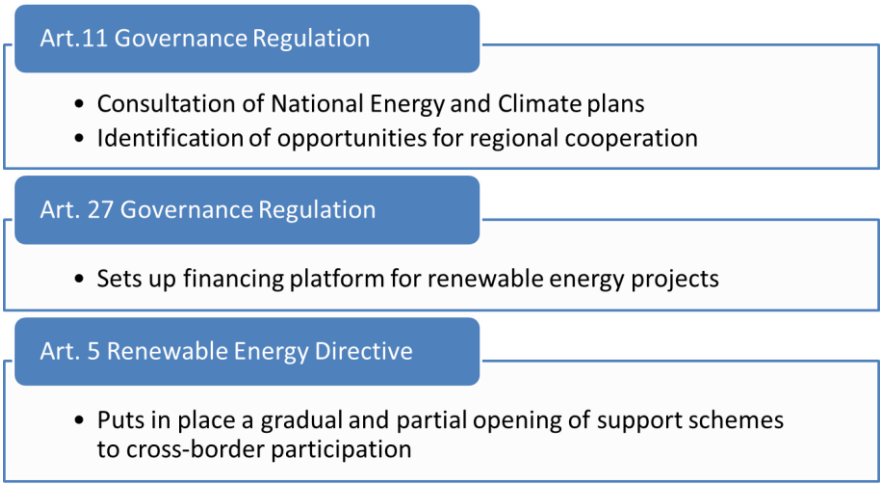
Source: EC (2016)

Despite the important role that regional cooperation is expected to play in the 2030 framework, the way in which this cooperation is going to be incentivized and regulated is still under discussion. Despite this uncertainty, the purpose of this section is to provide a glimpse of what seem to be the key points in the proposed legislation that may determine the regulation affecting regional cooperation.

Despite the European 2030 renewable energy target is already set at 27%, the accompanying legislative framework is not yet finalized. In this regard, in November 30th 2016, the EC presented the "Clean energy for all Europeans´ package" legislative proposals that covers various aspects such as, among others, energy efficiency, renewable energy, the design of the electricity market, security of electricity supply and governance rules for the Energy Union (COM(2016) 860 final).

Out of the various pieces of legislation that conform the Clean Energy for all Europeans package, the proposed revised Renewable Energy Directive and the Energy Union Governance are the most relevant elements that shape renewable energy cooperation in the post 2020 framework in Europe.

Figure 6. Cooperation in the Clean Energy for All Europeans package



Source: revised Renewable Energy Directive

On the one side, the proposed regulation on **Governance of the Energy Union**[14] (COM (2016) 759 final/2) has been designed to integrate and simplify planning, reporting and monitoring obligations of the EC and the EU MS in the 2030 Climate and Energy Framework. The regulation mandates the creation of national energy and climate plans to be prepared by MS biannually on the basis of binding templates and monitored annually by the EC. It also lists some measures that the EC can take to ensure that MS collectively meet their RES energy and energy efficiency targets. In particular, the governance system is expected to be reliable and should encourage enhanced regional cooperation and consultation as well as exchange of information and best practices in constructive dialogue between MS and the EC[15] (EPRS, 2017). The regulation also empowers the EC to request additional measures from MS in the event that the 2030 climate and energy goals risk not being met. To this end, the EC may request MS to adjust the share of renewable energy used and/or contribute financially towards setting up a financing platform at the EU level to develop renewable energy projects. MS would be required to contribute to this financing platform if they fail to meet their baseline share of energy from renewable sources.

Consulted experts indicate that the prosed Governance will have to compensate for the lack of national binding targets after 2020 as the EC leaves it entirely to MS to ensure that their contributions add up to the EU target.

As for the proposed **revised Renewable Energy Directive** (COM(2016) 767 final/2), its objectives are to: (i) lower the overall system costs of reaching the 27% RES target and (ii) drive a gradual alignment of support schemes (at discretion of MS) and generate fewer distortions in the internal market. In this sense, Article 5 of the proposed revised Renewable Energy Directive indicates that "*MS shall open support […] to generators located in other MS under the conditions laid down in*

[14] https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/governance-energy-union

[15] http://www.europarl.europa.eu/RegData/etudes/BRIE/2017/599279/EPRS_BRI(2017)599279_EN.pdf

this Article". The proposal indicates that it should apply to at least 10% of newly-supported capacity over 2021-2025 and 15% over 2026-2030. Furthermore, it indicates that the allocation between MS of electricity supported through opened schemes shall be subject to a cooperation agreement "*following the principle that energy should be counted towards the MS funding the installation*". Finally, the proposal also states that EC may propose to increase those percentages based on the assessment of the benefits by 2025.

Again, according to consulted experts, current discussions focus around (i) the mandatory vs voluntary nature of the opening of the RES support, (ii) the percentage of newly-supported capacity and (iii) the possibility to linking such obligations to the actual interconnection levels or limiting the obligations to direct neighbours.

Besides the ongoing discussions around the Governance of the Energy Union and the Directive recast, the industry and Member States have urged the EU to look into options for EU funding for joint projects and encourage their uptake (DG-ENER 2018).

In order to overcome MS coordination failures and incentivize regional RES cooperation, the EU consulted with stakeholders the possibility16 and just recently proposed17 to develop, as part of the Connecting Europe Facility (CEF)18, a new instrument to support cross-border RES cooperation named "Cross-border Renewables Projects" (previously known as Renewable Energy Projects of European Interest; RES-PEIs).

As was discussed in a recent workshop held in Brussels 19, the concept of cross-border renewable energy projects emerges as a way to foster the Europeanization of renewables policy, underpinning the new EU level renewables target and the opining of support schemes as proposed by the Commission in the Renewables Directive and paving the way for further voluntary cooperation in the field.

Specific enabling action for cross-border renewable energy projects (implying a cooperation between at least two MS) on a joint RES investment or their cooperation involving any RES technology could foster the uptake of such cross-border renewable projects and generate positive cross-border impacts for the region, inter alia in terms of cost-effective RES deployment, enhanced system integration, smoothened-out variability over a larger region (DG-Ener 2018).

While still under discussion, the projects that meet the cross-border renewable energy eligibility criteria, could potentially access dedicated funds for pre-feasibility analysis and, eventually, some form of grants to deploy the project.

Finally, as to future barriers for renewable energy cooperation in Europe, consulted European authorities suggest that, besides the country specific barriers to cooperation, the future

[17] COM(2018) 438 final

[18] The Connecting Europe Facility (CEF) is a key EU funding instrument to promote growth, jobs and competitiveness through targeted infrastructure investment at European level. https://ec.europa.eu/inea/en/connecting-europe-facility/cef-energy

[19] Stakeholder consultation workshop (March 5th, Brussels).

optimization of RES deployment in the form of regional cooperation is likely to be prevented by two main reasons: (i) coordination failures between MS and/or different stakeholders and (ii) currently limited tools at the EU level to ensure the collective 2030 EU RES target is met in a cost-effective way and to incentivize regional RES cooperation.

3 RESULTS

Based on the literature review and expert consultation (STEP 1), a list of potential factors positively or negatively influencing MS decision to use of the cooperation mechanisms has been identified for the period (2009-2017). Similarly, using the proposed analytical framework (STEP 2), the identified factors have been characterized according to a set of criteria.

The most relevant results from both STEP 1 and 2 will be presented and discussed in this first section of the results chapter. Next, the results of the survey questionnaire (STEP 3) will be used to assess the direction and degree of relevance of the identified factors.

3.1 Characterization of the identified factors

STEP 1 has resulted in a list of more than forty factors (which can play either a barrier or a driver role depending, among others, on the role the country is playing as well as the context). These forty factors have been classified according to seven categories: (i) political factors, (ii) technical factors, (iii) legal factors, (iv) geopolitical factors, (v), public acceptance and (vi) economic factors and (vii) environmental factors.

Political and policy factors would encompass two different albeit interrelated factors. On the one hand, political factors include those issues related to the cooperation mechanisms that matter for policy makers at the national, regional or local level and that would, in turn, affect their support or opposition towards the cooperation mechanisms. Note that given their relevance and distinctive nature, the economic and environmental issues that matter for policy makers have been classified separately into **political-economic** and **political-environmental factors**. In addition, issues related to policy features (uncertainty on the future policy framework, ambition of targets and design options to implement the cooperation mechanisms) have been included in this category.

Technical factors relate to the physical or technical restrictions or enablers that affect the successful implementation of the cooperation mechanisms. Among others, this category includes: improvement of system management through the import of dispatchable electricity, the possibility to foster technology research and knowledge transfer, lack of market and grid integration, challenges in quantifying indirect associated costs and benefits, etc.

Legal factors refer to legal or regulatory barriers/drivers. According to Browne et al. (2012) the following aspects could be included in this category: (a) regulatory gaps, (b) trade barriers, (c) potential legal challenges and (d) planning restrictions. Specific relevant legal factors to the use of the cooperation mechanisms, legal factors include: uncertainty on state aid compliance, heterogenous regulated energy prices and support schemes across MS, obligation to open support schemes and lack of sanctions for non-compliance with 2020 RES targets.

Geopolitical factors relate to those issues that affect two or more countries in terms of political power, commercial relations, etc. Among others, this category includes: the possibility to foster

political and economic relations with other MS, security of supply issues, possibility to jointly test new support schemes, potential resistance from transit countries, "first-mover" risk/advantage, etc.

Public acceptance factors relate to those factors that positively or negatively influence the social perception towards the cooperation mechanisms. Such perception may determine the support or opposition civil society as voters, local residents and employees/labour unions, media and other opinion leaders. The interests of these groups, whose degree of acceptance can be a driver or a barrier to the utilization of the cooperation mechanisms, incorporate the soft institutions like norms and ethics from the TIS. Media also plays a role in this group by shaping opinions and providing information to the public (Dutschne, 2018). Examples of such factors are: public reaction in off-taker country (ie: due to investing tax-payers´money abroad), public reaction in host country (ie: due to the so-called NIMBY[20] effect), public reaction in transit country (visual impact of electricity grid), public perception of environmental benefits (ie: decarbonisation), public perception of socio-economic benefits (ie: jobs, economic activity, etc), etc.

Finally, as mentioned before, within political factors, a distinction has been made between **economic factors** (such as cost savings in MS RES target achievement, generation of revenues from domestic resources, attract foreign investments to deploy domestic plants, new domestic jobs and industrial opportunities, costs savings at the EU level, etc) and **environmental/climate related factors** (such as contribution to long term decarbonisation, alignment with the Paris Agreement objectives, climate leadership, etc)

Based on the literature review and expert consultation, table 5 below groups the identified factors according to the above mentioned categories. Furthermore, the table shows the role (as driver/barrier/not relevant or not conclusive) that those factors are expected to play depending weather the country is a host country (where the project will be deployed), an off-taker country (where the electricity will be accounted for) or a transit country (that is the country is not directly involved in the cooperation agreement but the electricity will pass through its territory using their grid system). A colour legend has been used following the following logic: barrier is shown in red, driver is shown in green, not relevant in grey and barrier or driver depending on the case specific circumstances are shown in orange.

Some factors will always affect negatively MS decision to cooperate regardless of the country role (for example, the difficulties in communicating benefits from cooperation to citizens or difficulties in quantifying indirect costs and benefits) whereas other factors will always have a positive impact (such as the possibility to foster economic relations with the other cooperating countries). On the other side, some factors will impact differently depending on the country role. For example, the possibility to reduce costs in MS target achievement will be relevant for off-taker countries while it will not be relevant for transit or host countries.

[20] "Not in my backyard" effect

Table 5: Classification of potential influencing factors based on different categories and their possible role for different country types.

	Country role		
POLITICAL	Off-taker	Host	transit
Political support at the National level			
Uncertainty about the design options to implement coop. Mechs			
Difficulties in communicating benefits			
Uncertainty about the post 2020 regulatory framework			
Unambitious post 2020 RES targets			
Political support at the regional level			
TECHNICAL	Off-taker	Host	transit
Import/supply dispatchable/flexible RES (to improve system management)			
Foster technology research and knowledge transfer			
Contribute to improve tech. performance and cost reductions			
EU guidance in implementing the cooperation mechanisms			
Lack of market and grid integration			
Challenges in quantifying indirect associated costs and benefits			
Limited interconnection capacity between some MS			
LEGAL	Off-taker	Host	transit
Uncertainty on state-aid compliance			
Heterogeneous regulated energy prices and support schemes across MS			
Obligation to open support schemes			
Lack of sanctions for non-compliance with 2020 RES targets			
GEOPOLITICAL FACTORS	Off-taker	Host	transit
Foster political and economic relations with other MS			
Domestic industrial interests			
Improve security of supply (diversification of RES sources)			
Jointly test new support schemes			
Move towards creation of an internal energy market			
Potential resistance from transit countries			
Resistance to loose sovereignty and control over energy market			
"First mover risk"			
PUBLIC ACCEPTANCE FACTORS	Off-taker	Host	transit
Public reaction in off-taker country (investing taxpayers money abroad)			
Public reaction in host country (NIMBY)			
Public reaction in transit country (visual impact of electricity grid)			
Public perception of environmental benefits			
Public perception of socio-economic benefits (jobs, econ activity, etc)			
Public perception of Energy Security issues			

Public perception of pro-European values (cooperation, integration, etc)			
ECONOMIC FACTORS	Off-taker	Host	transit
Cost savings in MS target achievement			
Generate revenues from domestic resources			
Attract foreing investments to deploy domestic plants			
New domestic jobs and industrial opportunties			
Cost savings at the EU level			
Oligopolies (lack of realized competition)			
ENVIRONMENTAL FACTORS	Off-taker	Host	transit
Contribute to the long term decarbonization of the energy mix			
Alignment with Paris Agreement objectives			
Climate leadership			
Access to finance under the EU sustainable Finance Action Plan			
Public concern for climate change as a foreign policy priority			

Note: colour legend (see text).

After this preliminary assessment of the potential factors influencing MS decision making process, the next section presents the results from a survey questionnaire aimed at assessing the degree of relevance –either as a barrier or driver- of the identified factors.

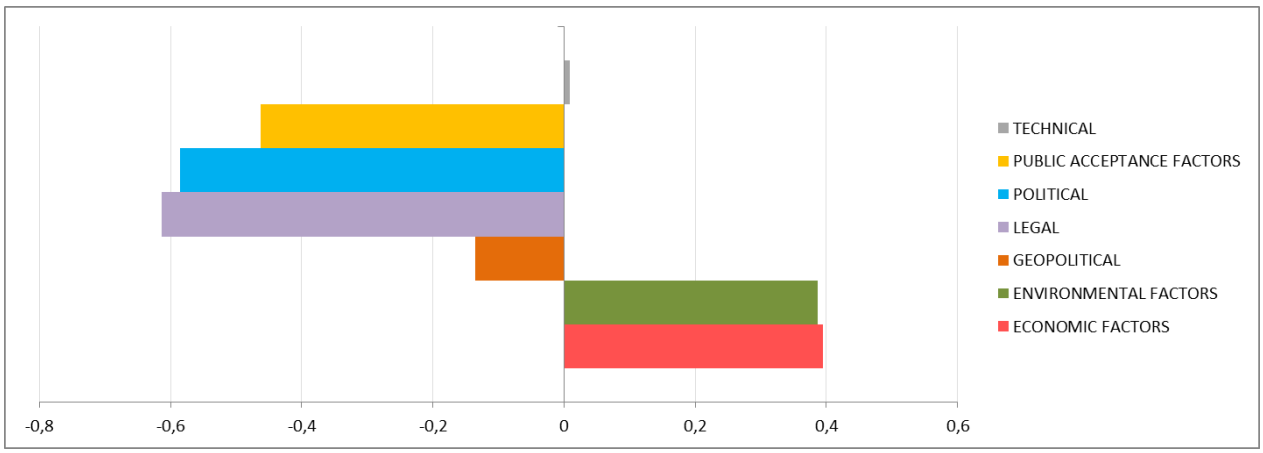
3.2 Survey results

At the time this report was finished, the survey questionnaire (see annex I) was answered by eighteen MS who were asked to answer the question: "*How has each factor influenced the use of the cooperation mechanisms in your country?*". Next, for each factor displayed in table 5, MS could choose from: -3 (very important barrier), -2 (important barrier), -1 (somehow important barrier), 0 (not relevant), 1 (somehow important barrier), 2 (important barriers) and 3 (very important barrier).

Table 7 shows what has been the average score by category. From this figure various conclusions can be derived. First, results show that, in line with the expectations, there have been more barriers than drivers influencing the use of the cooperation mechanisms (shown by the higher number of factor categories to the left than to the right of the axis but also by the higher negative values). This result could partially explain the limited uptake of the cooperation mechanisms.

Among the categories that negatively influence MS decision to cooperate, legal, political, public acceptance and geopolitical factors stand out (in that order). On the other side, the categories that appear to have positively influenced MS decision to cooperate include environmental and economic factors.

Figure 7. Average results of the survey questionnaire by factor category



Complementary to this aggregate information, figure 8 provides the average score for each one of the considered factors. To facilitate the analysis, all factors belonging to the same category have the same colour legend. Again, looking at these results, it is possible to identify (on average) what factors have played a more important role (either as barrier or driver). Again, one can observe a higher number and longer lines on the left side (barriers) than to the right side (drivers) indicating the more intensive role played by the former compared to the later.

Among the most relevant barriers to cooperation, the top five barriers include: (i) public reaction in off-taker countries (investing taxpayers money abroad), (ii) Heterogeneous regulated energy prices and support schemes, (iii) Difficulties in communicating the benefits of cooperation, (iv), Resistance to loose sovereignty and control over national energy market and (v) Uncertainty about the design options to implement the cooperation mechanisms.

Among the most relevant drivers to cooperation, the top five enablers include: (i) cost savings in MS target achievement, (ii) Contribution to improve technology performance and cost reductions, (iii) EU guidance in implementing the cooperation mechanism (iv) New domestic jobs and industrial opportunities and (v) move towards the creation of an internal energy market.

As mentioned before it is important to highlight that the average score obtained by the top five barriers (1,2) is higher than the score of the top five drivers (0,6). Again, this fact supports the idea that there have been not only more but more important barriers to cooperation than drivers in the past. This result is important for the decission making process because it implies that if policy makers would like to activate the drivers or mitigate the barriers for the use of the cooperation mechanisms, they will have to implement different types of initiatives (ie: policy mix) that go beyond energy policies.

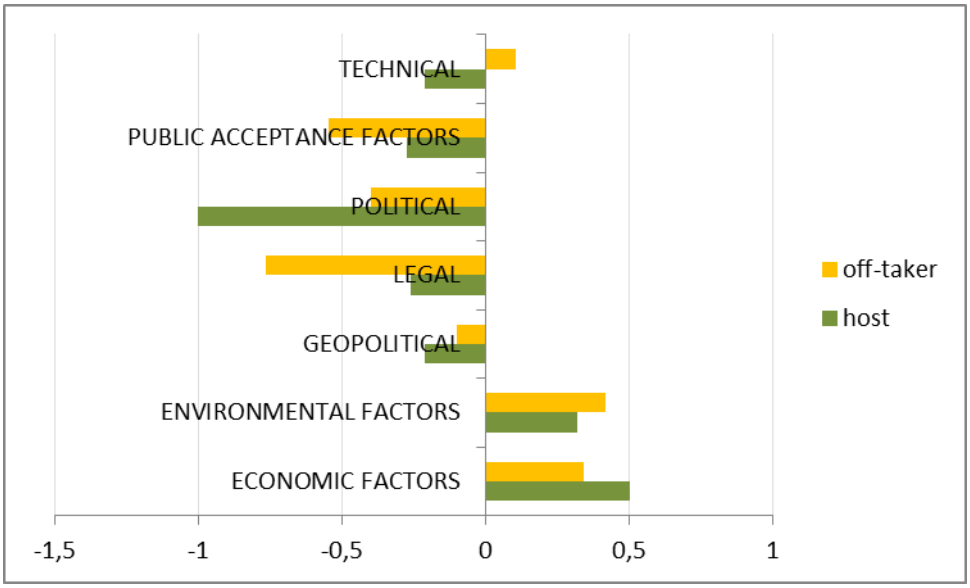
Another finding from these results is that “political” and “public acceptance” factors are the most important categories which could partially explain the limited use of the cooperation mechanisms in the 2009-2017 period. On the contrary, “economic” and “environmental” factors categories are, on average, the stronger drivers for cooperation but in a lower absolute value than the barriers.

To further understand the differences within each category, Annex 2 shows, by category, the number of answers of each punctuation obtained in each of the considered factors being negative values barriers and positive values drivers.

Figure 8. Average results of the survey questionnaire by factor category

The next figures show the different answers obtained by those countries that have renewable energy surplus (and thus could be potential host countries) versus those countries that are facing difficulties in meeting their 2020 RES target domestically (could potentially play an off-taker role in a cooperation agreement). Such differentiation has been made based on the progress reports from Eurostat (2018) shown in figure 3.

Figure 9. Factor categories analysis by host or off-taker countries

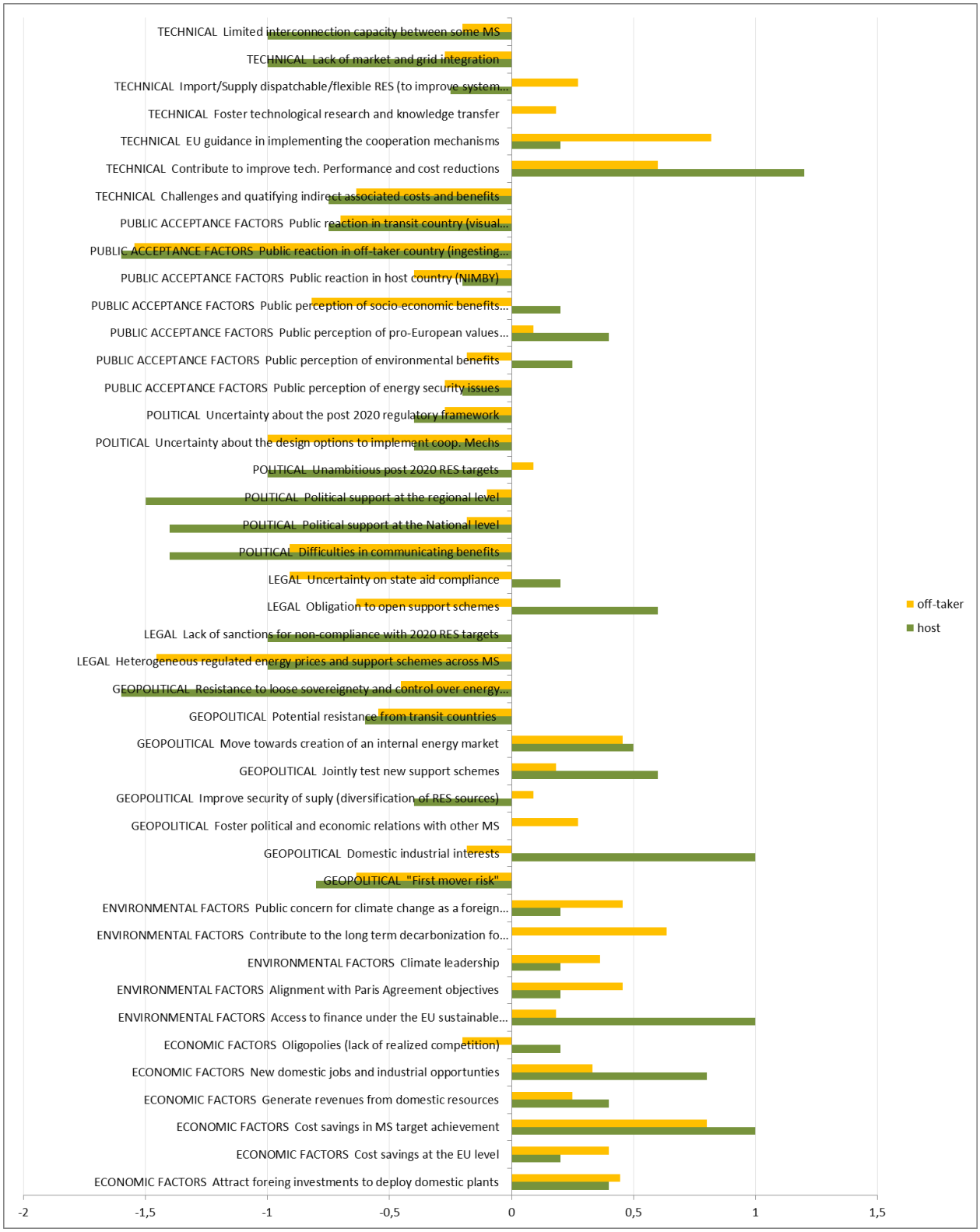


What can be concluded by the results displayed in the figure above is that most factor categories play the same role (either as barrier or as a driver) independently if the country is a host or off-taker country. However the intensity of the effect is different. For the driver categories (economic and environmental factor categories), economic factors are more relevant for host countries while for the environmental factors, it plays a more important role for off-taker countries. As for the barriers, legal and public acceptance factors are more relevant for off-taker countries than they are for host countries. On the other side, political and geopolitical barriers are more relevant for host countries than for host countries. The only category for which here is a significant (in direction and intensity) difference among host and off-taker countries is technical factors. For host countries, technical factors constitute a barrier while for off-takers they constitute a driver.

In order to better understand the reason behind these different results,

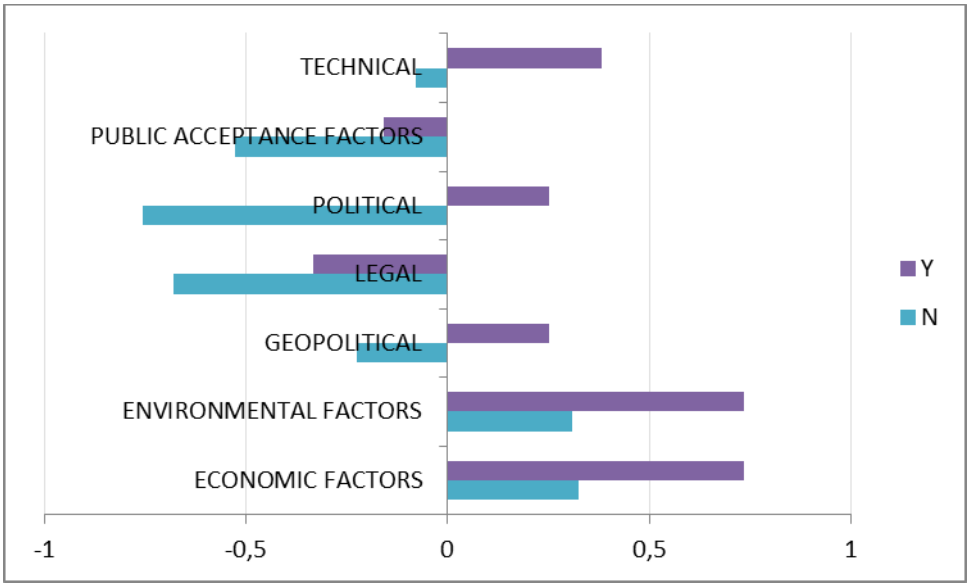
Figure 10 below shows the differences between host and off-taker countries by individual factors.

Figure 10. Factor analysis by host or off-taker countries



The next figure displays the different answers obtained from those countries that were actually involved in the cooperation mechanisms (YES) and those countries that were not (NO). Interestingly, the results show significantly different patterns. As for technical aspects, those countries that were involved in cooperation indicated that, on average, technical factors played an enabler role while those that were not involved in any cooperation mechanism, stated that technical factors, on average, contributed to prevent their participation in cooperation mechanisms. Similarly, political factors played a positive role for those countries participating in cooperation agreements while negatively affected the decision to engage in cooperation agreements for those that did not participate. This result is not surprising and reinforces the fact that political support (at all levels) is fundamental both in positive and negative terms. This can be partially explained by the fact that the successful countries may have received positive support by their National government while this was not the case for those countries that did not succeed. The same applies for geopolitical factors which show a different direction between countries involved in cooperation (that show a positive effect) and those that did not engage in cooperation (for which geopolitical factors negatively affect their decision to cooperate. As expected, for the other categories that have had a negative effect (public acceptance and legal factors), the intensity is lower for those countries that have participated in a cooperation mechanisms. Also, as expected, for those categories that play an enabler role for both type of countries (environmental and economic categories), the intensity is larger for those countries actively involved in a cooperation mechanism.

Figure 11. Factor categories analysis by participating/non-participating countries.



In summary, for participating countries (in purple) the graph displays not only more bars to the right but also longer bars. Contrary, for those countries that did not participate in any cooperation agreement (in blue), **Figure 11** shows a higher number and larger bars to the left. This result is

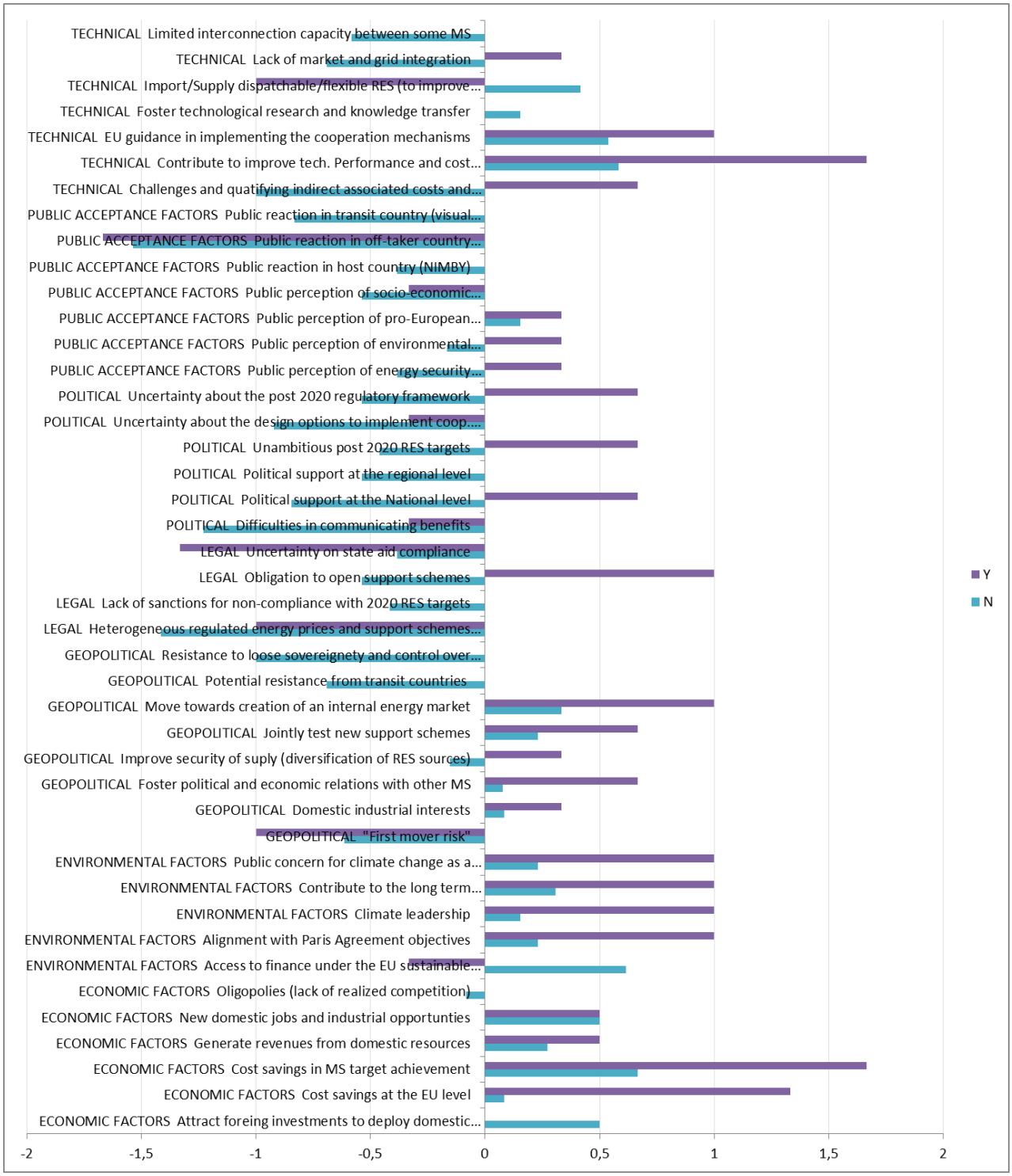
consistent with the expectations as for the latter group of countries it is expected that barriers must have exceeded the drivers.

To shed some further light to those differences, **Figure 12** below disaggregates the results by individual factors.

One of the most outstanding results is that among those countries that participated in a cooperation agreement (in purple), the more relevant enabling factors include: (i) Cost savings in MS RES target achievement, (ii) contribution to improve technological performance and cost reduction, (iii) obligation to open support schemes and (iv) move towards the creation of an internal energy market. On the other side, for the same countries, the factors that have played a more negative role include: (i) public acceptance issues (off-taker public opposition towards using tax-payers money to finance projects abroad), (ii) Uncertainty on state aid compliance, (iii) Heterogeneous regulated energy prices and support schemes, (iv) First mover risk.

As for those countries that did not participate in any cooperation agreement (in blue), the most outstanding enabling factors include: (i) cost savings in MS target achievement, (ii) Contribute to improve technological performance and cost reductions, (iii) EU guidance in implementing the cooperation mechanism, (iv) Supply of flexible electricity, and (v) foster technology research and knowledge transfer. On the other side, the most important hurdles include: (i) public acceptance (off-taker countries resistance to use tax-payers money to support a RES project abroad), (ii) Heterogeneous regulated energy prices and support schemes, (iii) difficulties in communicating benefits, (iv) resistance to loose sovereignety and control over the energy market, (v) Challenges in quantifying the indirect costs and benefits.

Figure 12. Factor analysis by participating/non-participating countries



4 CONCLUSIONS

The cooperation mechanisms of the Renewable Energy Directive 28/2009/EC were originally designed to grant MS with more flexibility to meet their 2020 RES targets while contributing to reach the EU 20% RES target in a cost-effective manner. Despite the initial expectations, since 2009, the use of the cooperation mechanisms has been very limited. As of today, only four cooperation mechanisms have been implemented in Europe (under article Articles 11 and 6) and none with neighbouring countries (as provided in Article 9 of the Directive).

Besides cost savings in meeting the RES targets, there exist multiple factors that determine Member States willingness to engage in a cooperation agreement which may partially explain the limited use of the cooperation mechanisms during the 2009-2017 time period.

In this context the purpose of this report has been to introduce the cooperation mechanisms of the Directive 28/2009/EC but, most important, identify and assess the range of factors that may have influenced the use of the cooperation mechanisms in the past. To achieve this goal, a literature review and expert consultation has been conducted to identify and characterize both drivers and barriers to cooperation in the past. Next, based on the Member States´ answers to a specially designed survey questionnaire, it has been possible to assess the actual importance of such factors.

As a result of the literature review and expert consultation, more than forty factors have been identified as having influenced MS decision to engage in a cooperation agreement. Next, these factors have been classified according to seven categories: political, technical, legal, geopolitical, public acceptance, economic and climate related factors.

According to the survey results, the number and relevance of those factors that played a “barrier” role is larger than for those factors playing an “enabler” role. Among the categories that negatively influenced MS decision to cooperate: political, public acceptance and geopolitical factors stand out (in that order). On the other side, the categories that appear to have positively influenced MS decision to cooperate include environmental and economic factors. When conducting an individual factor analysis, the top five barriers include: (i) public reaction in off-taker countries (investing taxpayers money abroad), (ii) Heterogeneous regulated energy prices and support schemes, (iii) Difficulties in communicating the benefits of cooperation, (iv), Resistance to loose sovereignety and control over national energy market and (v) Uncertainty about the design options to implement the cooperation mechanisms. On the other side, the most relevant drivers to cooperation are: (i) cost savings in MS target achievement, (ii) Contribution to improve technology performance and cost reductions, (iii) EU guidance in implementing the cooperation mechanism (iv) new domestic jobs and industrial opportunities and (v) move towards the creation of an internal energy market.

When assessing the differences between those countries that have a RES surplus (potential host countries) and those countries that have a RES deficit (potential off-taker countries), results show that most factor categories play the same role (either as barrier or as a driver) independently if the country is a host or off-taker country. However the intensity of the effect is different. For the driver categories -economic and environmental factor categories-, economic factors are more relevant for potential host countries while for the environmental factors plays a more important role for off-taker countries. As for the barriers, legal and public acceptance factors are more relevant for off-taker countries than they are for host countries. On the side, political and geopolitical barriers are more relevant for host countries than for host countries. The only category for which there is a significant (in direction and intensity) difference between host and off-taker countries is technical factors. For host countries, technical factors constitute a barrier while for off-takers they constitute a driver.

Finally, when assessing the different answers from those countries that have actually engaged in a cooperation agreement versus those countries that have not, some interesting results emerge. The most relevant enabling factors for those countries that actually cooperated are: (i) Cost savings in MS RES target achievement, (ii) contribution to improve technological performance and cost reduction, (iii) obligation to open support schemes and (iv) move towards the creation of an internal energy market. On the other side, for the same countries, the factors that have played a more negative role include: (i) public acceptance issues (off-taker public opposition towards using tax-payers money to finance projects abroad), (ii) Uncertainty on state aid compliance, (iii) Heterogeneous regulated energy prices and support schemes, (iv) First mover risk. As for those countries that did not participate in any cooperation agreement, the most outstanding enabling factors include: (i) cost savings in MS target achievement, (ii) Contribute to improve technological performance and cost reductions, (iii) EU guidance in implementing the cooperation mechanism, (iv) Supply of flexible electricity, and (v) foster technology research and knowledge transfer. On the other side, the most important hurdles include: (i) public acceptance (off-taker countries resistance to use tax-payers money to support a RES project abroad), (ii) Heterogeneous regulated energy prices and support schemes, (iii) difficulties in communicating benefits, (iv) resistance to loose sovereignety and control over the energy market and, finally, (v) Challenges in quantifying the indirect costs and benefits.

The results presented in this report are expected to shed some light to the complexity and number of reasons that explain the limited use of the cooperation mechanisms and may contribute to put in place the necessary measures to overcome the barriers of the past in order to foster renewable energy cooperation in the future. In this regards, our results suggest that different types of policy interventions will be needed in order to either activate the drivers or mitigate the barriers to the use of cooperation mechanisms for RES. Finally, and most relevant for the MUSTEC project, the results presented here are expected to contribute to materialize the opportunities that renewable energy cooperation may bring to solar thermal electricity projects in Europe.

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RES4LESSproject https://ec.europa.eu/energy/intelligent/projects/en/projects/res4less

6 LIST OF ABBREVIATIONS AND DEFINITIONS

CSP – Concentrated Solar Power

EC - European Commission

EDP - Energy Demo Project

ERDF - European Regional Development Fund

ESIF - European Structural and Investment Funds

ESTELA - European Solar Thermal Electricity Association

FOAK – First Of A Kind

JRC - Joint Research Centre

LCOE - Levelised Costs of Electricity

MS – Member State

RED – Renewable Energy Directive

RES – Renewable Energies

R&D – Research and Development

S3PEnergy – Smart Specialization Platform on Energy

STE – Solar Thermal Electricity

TSO - Transmission System Operator

7 APPENDIX 1: SURVEY QUESTIONNAIRE

We are going to show you a list of factors and we would like you to rate **how relevant each of these factors has been for the use of cooperation mechanisms** in your country for the period **2009-2020** and how do you think these factors are going to influence RES cooperation in your country for the **post 2020 period**.

For each factor, please indicate with an X the degree of importance (from -3, very important barrier to 3, very important driver). Before that, please answer the two questions below:

*First, please mark the type of cooperation mechanism that you considered for the 2009-2020 period (if any):

Art 6 (Stat Transf) / Art 7 (Joint projects) / Art 7 (Joint projects with phys trans) / Art9 (J.P with 3rd count) / Art11 (Joint support schemes)

POLITICAL FACTORS	***-3 (very important barrier)---0 (not relevant)---3 (very important driver)***														
	How has each factor influenced the use of the cooperation mechanisms in your country?								**How do you think these factors are going to influence RES cooperation in your country?**						
	2009-2020 time period								**Post 2020 time period**						
	-3	**-2**	**-1**	**0**	**1**	**2**	**3**		**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**
Political support at the National level															
Uncertainty about the design options to implement coop. Mechs															
Difficulties in communicating benefits															
Uncertainty about the post 2020 regulatory framework															
Unambitious post 2020 RES targets															
Political support at the regional level															
Other factors not included in the list:								**Comments**							

TECHNICAL FACTORS															
	How has each factor influenced the use of the cooperation mechanisms in your country?								**How do you think these factors are going to influence RES cooperation in your country?**						
	2009-2020 time period								**Post 2020 time period**						
	-3	**-2**	**-1**	**0**	**1**	**2**	**3**		**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**
Import dispatchable/flexible RES (to improve system management)															
Foster technology research and knowledge transfer															
Contribute to improve tech. Performance and cost reductions															
EU guidance															
Lack of market and grid integration															
Uncertainty in forecasting RES target															

compliance															
Challenges and quantifying indirect associated costs and benefits															
Limited interconnection capacity between some MS															
Uncertainty on state aid compliance															
Heterogeneous regulated energy prices and support schemes across MS															
Other factors not included in the list:							**Comments**								

LEGAL FACTORS

	How has each factor influenced the use of the cooperation mechanisms in your country?							How do you think these factors are going to influence RES cooperation in your country?						
	2009-2020 time period							Post 2020 time period						
	-3	-2	-1	0	1	2	3	-3	-2	-1	0	1	2	3
Uncertainty on state aid compliance														
Heterogeneous regulated energy prices and support schemes across MS														
Obligation to open support schemes														
Lack of sanctions for non-compliance with 2020 RES targets														
Other factors not included in the list:							**Comments**							

GEOPOLITICAL FACTORS

	How has each factor influenced the use of the cooperation mechanisms in your country?							How do you think these factors are going to influence RES cooperation in your country?						
	2009-2020 time period							Post 2020 time period						
	-3	-2	-1	0	1	2	3	-3	-2	-1	0	1	2	3
Foster political and economic relations with other MS														
Domestic industrial interests														
Improve security of suply (diversification of RES sources)														
Jointly test new support schemes														
Move towards creation of an internal energy market														
Potential resistance from transit countries														
Resistance to loose sovereignety and control over energy market														
"First mover risk"														
Other factors not included in the list:							**Comments**							

PUBLIC ACCEPTANCE FACTORS

	How has each factor influenced the use of the cooperation mechanisms in your country?							How do you think these factors are going to influence RES cooperation in your country?						
	2009-2020 time period							Post 2020 time period						
	-3	-2	-1	0	1	2	3	-3	-2	-1	0	1	2	3
Public reaction in off-taker country (ingesting taxpayers money abroad)														
Public reaction in host country (NIMBY)														
Public reaction in transit country (visual impact of electricity grid)														

Public perception of environmental benefits															
Public perception of socio-economic benefits (jobs, econ activity, etc)															
Public perception of pro-European values (cooperation, integration, etc)															
Other factors not included in the list:						**Comments**									

ECONOMIC FACTORS

	How has each factor influenced the use of the cooperation mechanisms in your country?								How do you think these factors are going to influence RES cooperation in your country?						
	2009-2020 time period								Post 2020 time period						
	-3	-2	-1	0	1	2	3		-3	-2	-1	0	1	2	3
Cost savings in MS target achievement															
Generate revenues from domestic resources															
Attract foreing investments to deploy domestic plants															
New domestic jobs and industrial opportunties															
Cost savings at the EU level															
Oligopolies (lack of realized competition)															
Other factors not included in the list:						**Comments**									

ENVIRONMENTAL FACTORS

	How has each factor influenced the use of the cooperation mechanisms in your country?								How do you think these factors are going to influence RES cooperation in your country?						
	2009-2020 time period								Post 2020 time period						
	-3	-2	-1	0	1	2	3		-3	-2	-1	0	1	2	3
Contribute to the long term decarbonization fo the energy mix															
Alignment with Paris Agreement objectives															
Climate leadership															
Access to finance under the EU sustainable Finance Action Plan															
Public concern for climate change as a foreign policy priority															
Other factors not included in the list:						**Comments**									

8 APPENDIX 2: FACTOR CATEGORIES DISAGGREGATION

Figure 13. Technical factors

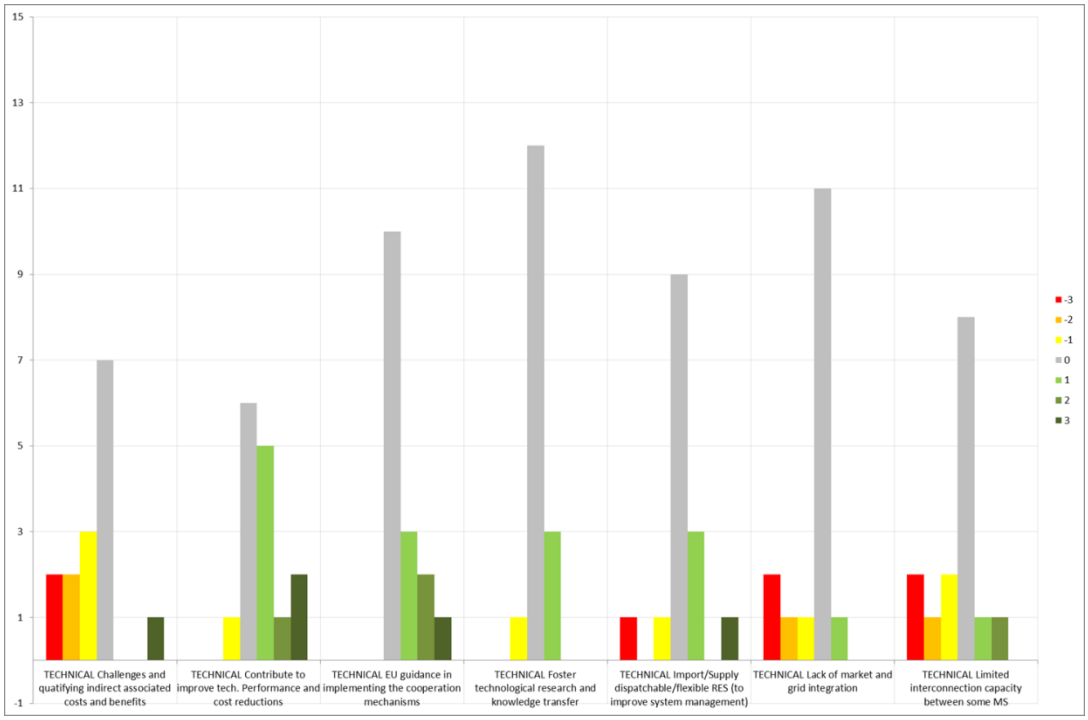


Figure 14. Public acceptance factors

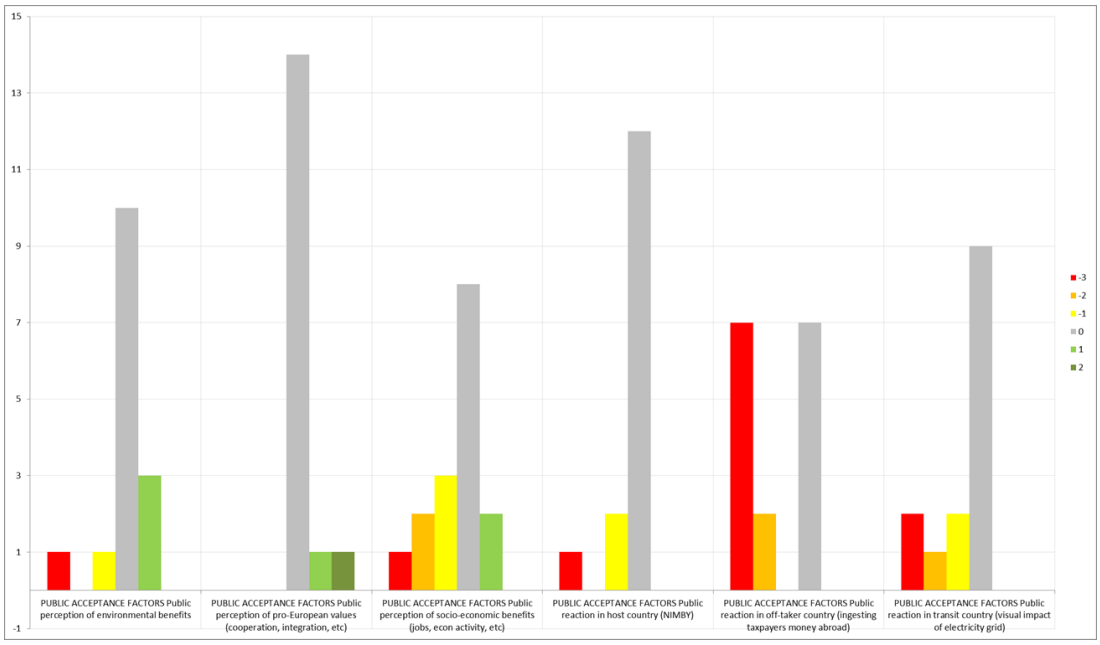


Figure 15. Political factors

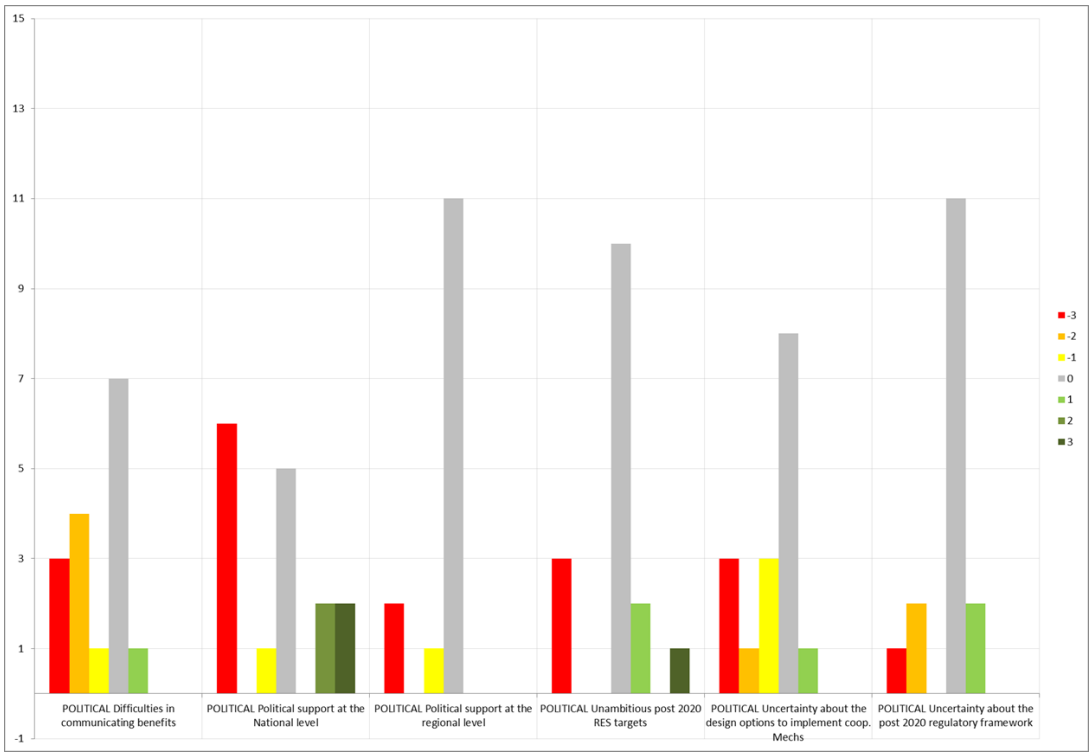


Figure 16. Economic factors

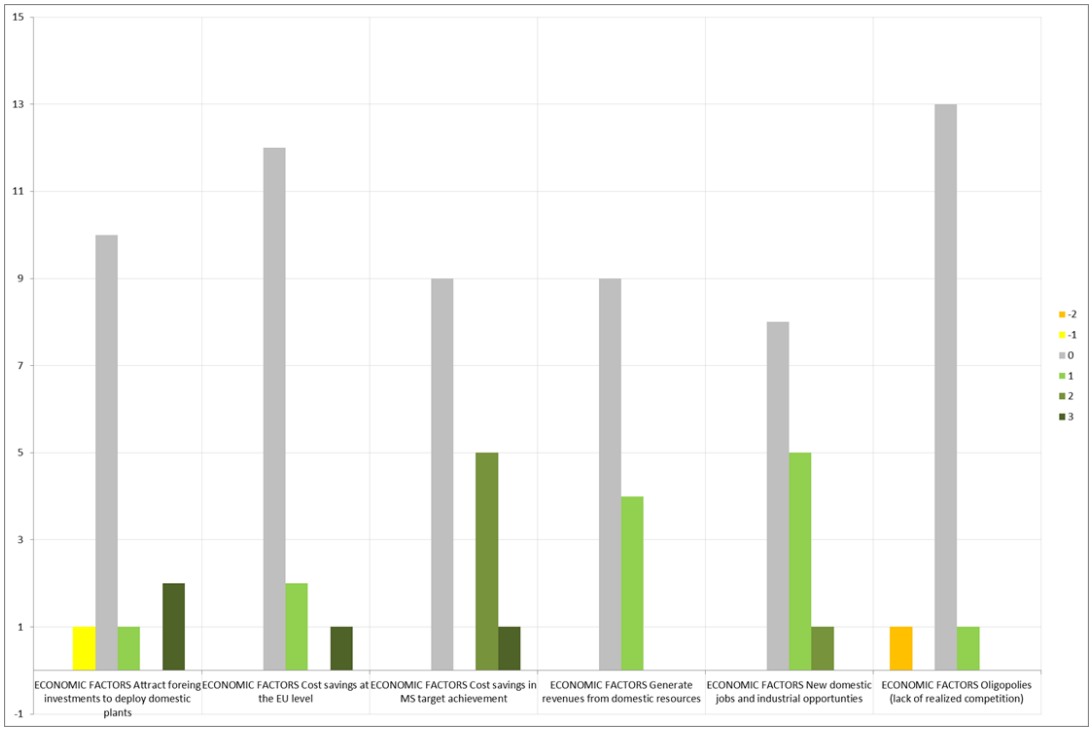


Figure 17. Legal factors

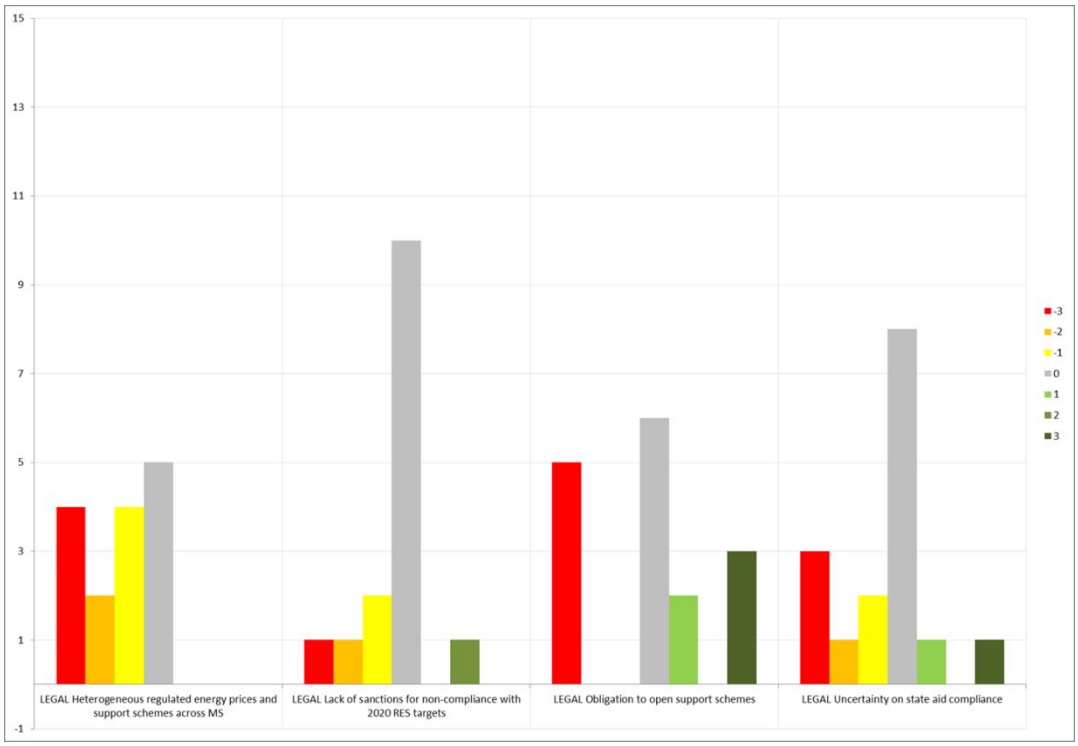


Figure 18. Geopolitical factors

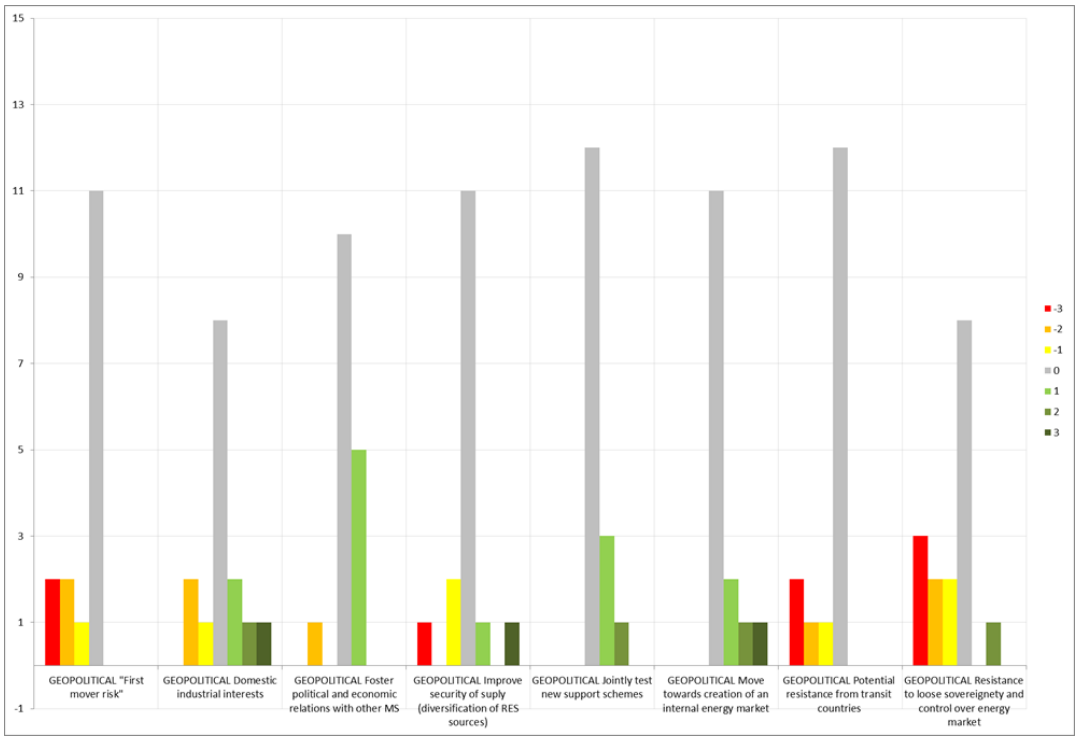
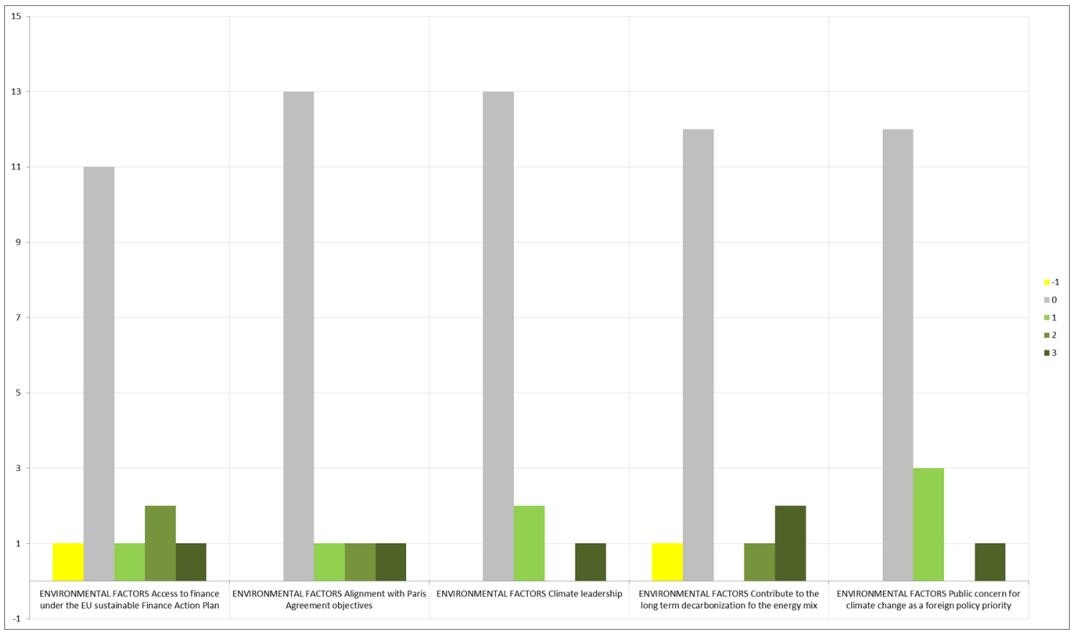


Figure 19. Environmental factors


15
13
11
9
7
5
3
1
-1
ENVIRONMENTAL FACTORS Access to finance under the EU sustainable Finance Action Plan
ENVIRONMENTAL FACTORS Alignment with Paris Agreement objectives
ENVIRONMENTAL FACTORS Climate leadership
ENVIRONMENTAL FACTORS Contribute to the long term decarbonization fo the energy mix
ENVIRONMENTAL FACTORS Public concern for climate change as a foreign policy priority
-1
0
1
2
3

WHO WE ARE

The MUSTEC consortium consists of nine renowned institutions from six European countries and includes many of the most prolific researchers in the European energy policy community, with very long track records of research in European and nationally funded energy policy research projects. The project is coordinated by Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas-CIEMAT.

Name	Country	Logo
Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas – **CIEMAT**	ES	
University of Piraeus Research Center – **UPRC**	GR	
Eidgenössische Technische Hochschule Zürich - **ETH Zürich**	CH	
Technische Universität Wien - **TU WIEN**	AT	
European Solar Thermal Electricity Association – **ESTELA**	BE	
COBRA Instalaciones y Servicios S.A – **COBRA**	ES	
Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. – **Fraunhofer**	DE	
Agencia Estatal Consejo Superior de Investigaciones Cientificas - **CSIC**	ES	
Fundacion Real Instituto Elcano de Estudios Internacionales y Estrategicos – **ELCANO**	ES	

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