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What will be the main challenges for the design of renewable electricity policy in the EU?

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Context

Both EU and national policy makers face a difficult task: how to support renewable electricity deployment successfully (i.e. effectively and efficiently) in the short and medium terms and, in particular, in a 2030 horizon. Such main task is directly and negatively affected by certain factors or challenges which have to be dealt with. Some of these challenges which affect renewable electricity deployment might not be strictly circumscribed to the renewable energy realm or even to the functioning of electricity markets. For example, the economic crisis has put a greater pressure on governments around Europe to promote renewable electricity cost-effectively. There are challenges related to electricity markets and others are associated to external developments. Renewable electricity policies may still be adopted to cope with some of those challenges. However, those challenges are not the focus of this Policy Issue and are addressed in other work packages of the Towards2030 project.

This Policy Issue focuses on the challenges related to policy design (choice of renewable electricity instrument and design element) for future (2030) renewable electricity policy in Europe. Renewable electricity policy challenges are understood as those challenges which comply with two conditions. First, they are directly and indirectly related to factors which affect deployment in a 2030 timeframe in the EU. Since we are interested in those challenges which can be tackled by support policies, a second condition applies: the challenges can be influenced by renewable electricity policy.

The challenges identified are of different types, and include technologically-related challenges, macroeconomic challenges, those associated to the current policy discussion, to administrative barriers and social acceptance. More specifically, the following challenges have been initially considered:

- how to adapt support levels to trends in renewable energy technology costs and the uncertain evolution of resource potentials,
- how to appropriately combine R&D support and deployment support for less mature technologies,
- how to cope with lower budgets for renewable electricity support,
- problems in accessing finance (credit restrictions),
- institutional challenges related to the implementation of market-based instruments (MBIs) in general and auctions in particular,
- making auctions and other market-based instruments effective and efficient,
- challenges related to target setting (an EU target without MS targets and an EU target with MS targets),
- merit order effect reducing wholesale prices and revenue for renewable energy technologies ,
- trade-offs between a greater stability and flexibility to adapt to new circumstances,
- delays in administrative procedures,
- trade-offs between NIMBY related to renewable electricity concentration and allocative efficiency,
- social rejection of high or escalating support costs and
- costs falling disproportionately on a given group of the population.

This report proposes some policy measures to mitigate the problems associated to those challenges, focusing on instruments and design elements. Many of these issues are rather complex, however, and, thus, have no simple solution. Therefore, a combination of interventions (in short, policy mixes) will be required. Future research and forthcoming reports within the Towards2030 project will further specify the type of policy measures and policy mixes required to meet those challenges effectively and cost-effectively.

What will be the main challenges for renewable electricity support in a 2030 timeframe?

The identification of challenges for renewable electricity policy in a 2030 perspective has been based on a literature review. The perspectives of policy makers are assumed to be reflected in policy documents, both European and MS. In order to restrict the search to the most relevant sources of information, we have only considered renewable energy policy and energy policy documents. Publicly available EU documents and information sources at MS level have been consulted. In addition to those official documents, country case studies in energy and energy policy journals, relevant information in the "grey literature" and reports from other EU-funded projects have been taken into account (see del Río and Peñasco 2014 for further details on the methodology).

The resulting list of documents and articles has allowed us to identify relevant challenges, which have been classified in different categories: technology-related, macroeconomic-related, related to current policy discussions, administrative barriers and social acceptance. However, we have not tried to rank the relevance of those challenges. The perspective adopted is mostly that of renewable energy policy-making at MS level.

Technology-related policy challenges

Technological development determines whether renewable electricity sources are available on the market (Boie et al., 2014). Renewable electricity deployment critically depends on technology development and cost reductions (EC, 2013). A set of challenges are related to the evolution of the costs and maturity of the technologies. In this respect, the most important technologies to take into account are renewable energy technologies themselves.

Adapting support level to trends in technology costs

Renewable energy technologies can be located along a continuum from already mature to immature technologies. For simplicity, they can be grouped in two categories. Some are high-cost or relatively less mature (e.g., wind off-shore and CSP) whereas others are already mature and close to being able to compete with other conventional technologies (e.g., wind on-shore). In principle, and according to innovation theory, the lower the maturity level of technologies, the greater the costs reductions and improvements in the technology that can be expected. This has been the case in the last decades (IEA 2012). Adapting support costs to the evolution of technology costs in order to avoid overcompensation (or too low support) is a challenge for policy makers. Likewise, the costs of renewable electricity deployment may also be affected by changes in material prices. For example, variations in the price of silicon and steel were important in explaining those changes in the past in the case of solar PV and wind (Panzer, 2012). There are also concerns that shortages of rare earth metals (such as indium, tellurium and silver for the deployment of PV technologies) and carbon fiber (for the offshore wind industry) are likely to drive up the prices and hence will escalate installation costs in the short to medium term (Zyadin et al., 2014). All these trends would certainly affect deployment of renewable electricity.

Appropriate combination of R&D support and deployment support for less mature renewable electricity technologies

Also according to innovation theory, the sources of cost reductions, technology improvements and, in short, innovation can be expected to differ per renewable electricity technologies, depending on their maturity level. For immature technologies, basic and applied R&D is critical, whereas in the last stages of the innovation pipeline incremental improvements and dynamic economies of scale are much more relevant (see section 2 and del Río et al., 2012b). This represents a challenge for policy-makers in that they have to adapt the type of renewable electricity policy to the specifics of the technology in question in order to induce those cost reductions and innovation. Some renewable electricity technologies will require more emphasis being put on R&D investments, whereas for others mass deployment will still make more sense. Some responses of countries to the Green Paper on a 2030 framework for climate and energy policies claim that technology neutrality should be aimed at. This neutrality means limiting the policy intervention to the introduction of a CO_2 price. However, elsewhere it has been shown that a CO2 price without dedicated support for renewable electricity will not provide a sufficient push for the uptake of renewable electricity technologies (Resch et al., 2013).

Obviously, innovation spillovers in renewable energy technologies are likely. This means that those cost-reductions, improvements in the technology and innovation may be the result of policies and activities outside the EU region. If, as a result, costs do not evolve as expected, this represents a challenge for policymakers in the EU, since the renewable electricity target will either be reached at higher costs than expected (inefficiency) or will not be fulfilled at all (ineffectiveness). If costs are higher than expected, then the renewable electricity target may not be achieved, or it may be achieved at greater costs than initially envisaged. If costs are lower than envisaged, then the renewable electricity target would be more easily reached, but, under certain instruments and design elements (FITs or FIPs), it could even be exceeded, which would lead to very high total support costs. This was the case, for example, in some countries with solar PV promotion. In both cases, renewable electricity policies will probably have to be adapted accordingly and it will certainly be a challenge for policymakers to do so. Adaptation might be more likely to occur under some instruments and design elements than under others.

The above suggests that the balance between R&D support and deployment support for less mature technologies represents a critical challenge, both at the EU and MS levels. There is a role to be played by national policymakers. As mentioned above, improvements and cost reductions for these technologies are a result of, both, R&D support and deployment support. The latter is certainly in the hands of Member States. But countries also have budgets dedicated to R&D, although R&D programs at EU level would probably be more effective, given the economies of scale in research and innovation activities. This means that less mature technologies will need EU-wide research and innovation policies. However, in the short to medium terms, it is MS which have to decide on the appropriate combination of both types of support. It seems that, in the past, the balance has been clearly tilted towards deployment support, which has been orders of magnitude greater compared to R&D support. For example, in Spain total public R&D support for solar PV amounted to 400M€ in the whole 1974-2009 period, according to the IEA (2011). Solar PV deployment incentives only in 2009 amounted to 400M€.

Adapting to the uncertain evolution of factors affecting the competitiveness of renewable energy technologies: resource potentials, fossil fuel prices and costs of competing technologies

Since EU renewable energy targets are set as a percentage of final energy consumption, they are affected by variables either influencing renewable electricity generation or electricity demand. Renewable electricity generation would be affected by resource endowments. A lower than expected quality of renewable energy resources (wind speeds, levels of solar radiation, rainfall levels…) would entail a lower than expected electricity production, ceteris paribus. It is certainly a challenge to estimate with absolute precision the amount of those resources a long time ahead, although this is probably not a major factor, i.e. its relative importance is lower compared to other variables.

An important variable, although also mostly beyond renewable electricity policy, are fossil fuel prices. Their influence on renewable electricity deployment can be substantial. Since this depends on their relative profitability, i.e. compared to those technologies fired by fossil fuels. While it is beyond the boundaries and scope of renewable electricity policy, those prices have to be taken into account when setting targets and policies for-renewable electricity. It is certainly a challenge to predict the trends in those prices, so that support costs for renewables are neither too low nor too high. The challenge is compounded by the fact that different types of renewable electricity and fossil fuel sources are substitutable to different degrees regarding peak and base loads. This could be an issue with some instruments and design elements (i.e., fixed FIPs), but not with others. It would certainly not affect those which provide an upper and/or a lower limit on the level of remuneration (maximum and minimum TGC prices, sliding FIPs, FIPs with cap-and-floor prices). It would also not be an issue with FITs, whose level is not affected by the volatility of the (wholesale) electricity price.

A somehow related topic is the trends in the costs of competing technologies. While, again, clearly beyond the realm of renewable electricity policy, an accurate calculation and prediction of the evolution of these costs should be made in order to appropriately set support levels for renewable electricity, a challenge on its own. A particularly relevant factor for renewable electricity deployment is the price of gas, which is often directly linked to the price of oil through indexation formulas in long-term contracts) and likely to be affected in the future by the shale gas phenomenon and the significant increase in gas supply as a result.

Macroeconomic-related policy challenges

Providing support under strict fiscal conditions

There is a widespread perception that the economic and financial crisis has negatively affected renewable electricity deployment. This is especially (or maybe exclusively) the case in Southern and Eastern Member States. On the one hand, the slowdown in economic activity has led to greater public expenditures in some countries related, among others, to unemployment benefits and the debt service. This has particularly been the case in the South of Europe. The austerity programs adopted to cope with the public deficit have involved a reduction of budget-financed renewable electricity support, although in most countries renewable electricity is predominantly supported through a surcharge on electricity bills. For example, in Spain, a 7% electricity generation tax (for all electricity generation technologies, not only renewable electricity) was adopted in 2012 in order to increase revenues for the public budget, with a negative impact on investors of 0.7% on the internal rate of return (del Rio et al 2014). The degree of the uncertain economic recovery in the short and medium terms will influence renewable electricity policy and, thus, renewable electricity deployment. A main challenge for renewable electricity policy makers is to provide support even under strict fiscal conditions. This will certainly increase pressure for policymakers to adopt cost-effective policies.

Difficulties in access to credit

On the other hand, the financial crisis has led to credit restrictions which have affected all types of productive investments and, particularly, renewable electricity investments. The cost of capital has risen in several MS (EC 2013). This has involved a difficulty to access loans in order to finance those investments and/or substantially increase total capital costs[1]. In some countries, and particularly in the South of Europe (Portugal, Spain…), capital is relatively more expensive.

A main challenge for renewable electricity policy is to mitigate these restrictions and facilitate access to affordable finance for renewable electricity investors and, particularly, for the smaller ones. Facilitating access to credit to renewable electricity developers can be part of renewable electricity policy e.g. by means of government-backed loans, although the financial environment/situation of a country does escape the boundaries of renewable electricity policy indeed. New financing instruments or arrangements might be required to trigger renewable electricity investments. The cost of capital is sensitive to risk perception by investors. EU policy can influence risk perception through more stable regulatory frameworks, through loan guarantees, long-term power purchase agreements, contracts for differences, capacity markets and through cofounding by financial institutions such as the European Investment Bank (EIB).

[1] According to Bloomberg/NEF, investment in renewables reached a peak in 2011 of 123$Mlrd and decreased thereafter to 53$Mlrd in 2013.

Administrative-related policy challenges

Improving and reducing the duration of the administrative procedures.

Administrative barriers are a crucial factor affecting the uptake ofrenewable electricity. Their relevance has been highlighted by several EU-funded projects and by the European Commission itself[2]. For example, article 6 of Directive 2001/77/EC already highlighted the negative effect of administrative barriers on renewable electricity deployment and exhorted Member States to take action to reduce them. The European Commission (2005) assessed the (inadequate) progress made in reducing these barriers in most Member States and made five precise recommendations. These were for Member States to establish, among others: 1) One-stop authorisation agencies to take charge of processing authorisation applications and providing assistance to applicants; 2) Clear guidelines for authorization procedures with a clear attribution of responsibilities[3] and; 3) Pre-planning mechanisms in which regions and municipalities are required to assign locations for the different renewable energies. In 2008, the European Commission stated that, with respect to administrative barriers, little progress had been made to date in most Member State, that the effectiveness of support schemes was affected by the existence of those barriers and that Member States should therefore continue to implement measures to reduce them (European Commission, 2008, p.16).

Directive 2009/28/EC also requires Member States to take adequate measures to achieve national overall targets, including cooperation between local, regional and national authorities (art. 4) and lays down rules for administrative procedures (art. 13). In particular, article 13 states that, Member States shall take the appropriate steps to ensure that: (c) administrative procedures are streamlined and expedited at the appropriate administrative level and rules governing authorisation, certification and licensing are objective, transparent, proportionate, do not discriminate between applicants and take fully into account the particularities of individual renewable energy technologies.

More recently, the renewable energy progress report of the European Commission (EC, 2013) stresses that at EU and MS level, further efforts are needed in terms of administrative simplifications and clarity of planning and permitting procedures. It is stated that progress in removing the administrative barriers is still limited and slow.

Since administrative procedures have been and are a barrier for the penetration of renewable electricity, there is no reason to think that they would not be a main determinant of renewable electricity in a 2030 horizon. Thus, a main challenge for policy-makers is to improve and streamline those procedures in order to facilitate the uptake of renewable electricity.

Social-acceptance related policy challenges

Mitigating the NIMBY of renewable electricity projects.

Public opinion is of particular importance for the deployment of renewable electricity (Boie et al., 2014). The social acceptance of renewable electricity in a 2030 perspective has two sides. On the one hand, it may refer to the not-in-my-backyard (NIMBY) phenomena for renewable electricity deployment. Renewable energy projects bring, both, benefits for the local population and costs. The former may refer to an increase in employment levels and rural/regional development opportunities. The latter is usually associated to negative environmental impacts, i.e. visual intrusion, soil occupancy etc. This issue would become more problematic with an increasing

[2] Two projects worth mentioning in this regard are ADMIRE-REBUS (see Uyterlinde et al., 2003) and OPTRES (see Ragwitz et al., 2007).

[3] Authorisation procedures must be based on objective, non- discriminatory criteria which are known in advance to the undertakings concerned, in such a way as to circumscribe the exercise of the national authorities´ discretion, so that it is not used arbitrarily.

penetration of renewable electricity, which would be the case in 2030 if there was a concentration of renewable electricity deployment in certain places and for certain technologies.

The magnitude of the necessary changes will require public consent to a variety of policies, which in turn implies increased efforts to raise public awareness of renewable energy (Mitchell et al 2011). Some case studies have recently stressed the role of social acceptance and the role that some policies may have in this context. For example, Mendonça et al. (2010) found that steady, sustainable growth of renewable electricity would require policies that ensure diverse ownership structures and broad support for renewable electricity and they argued that local acceptance will become increasingly important as renewable energy technologies continue to grow in both size and number (Mendonça et al., 2010). A key challenge for policy makers lies in developing effective public participation strategies, and in gaining a better understanding of local attitudes and how participatory approaches in renewable electricity planning can facilitate further deployment ofrenewable electricity.

Of course, it could make sense to implement instruments and design elements that avoid a concentration of renewable electricity project in a given location, i.e. that lead to a dispersed deployment of renewable electricityin order to mitigate the risk of NIMBY. However, the downside of this is that allocative efficiency would be negatively affected since the places with the best renewable energy resources would not be exploited first and, thus, generation costs would not be minimized.

Addressing social rejection to high or escalating support costs.

On the other hand, social acceptance may be related to the costs of public support. If these are too high or experience a substantial increase in a given year, this would lead to a social backlash against the renewable electricity deployment support scheme. This suggests that a major challenge for policy-makers is to keep the costs of renewable electricity policy within reasonable levels. Social acceptance may not only be related to the total amount of policy costs, but on their distribution among different actors (i.e. equity). If those costs fall disproportionately on a given group of the population, social rejection is more likely, especially if this group is well-organised and has considerable negotiation power. Certainly, a challenge for governments is to appropriately inform the people about the costs and benefits associated to the public promotion of renewable electricity deployment.

Challenges for policy design

A category of challenges, which are slightly different from the aforementioned ones, are those related to policy design.

Institutional adaptation to the implementation of market-based instruments

Three recent communications from the European Commission provide recommendations to MS on the use of renewable electricity support instruments and, thus, have an impact on the future of renewable electricity support in the EU. These are the European Commission Guidance for the Design of Renewables Support Schemes published on November 5th 2013 (EC 2013), the Communication from the Commission on January 22nd 2014 on a policy framework for climate and energy in the period from 2020 to 2030 (EC 2014a) and the Guidelines on State aid for environmental protection and energy 2014-2020 (EC, 2014b). The latter is the most relevant document, as support schemes have to comply with its rules for state aid clearance. It states that renewable support schemes should normally be market-based. Market-based instruments are expected to increase cost-effectiveness and mitigate the distortions on competition. Competitive bidding (i.e. auctions) will have to be implemented in order to provide support to all new installations from 2017 onwards[4].

[4]According to the Guidelines (126 and 127), aid for at least 5 % of the planned new electricity capacity from renewable energy sources should be granted in a competitive bidding in the transitional phase 2015-2016. From 1 January 2017, aid

Arguably, this move to market-based instruments in general and auctions in particular will represent a challenge for policy makers, i.e. the institutional adaptation to a new instrument.

How to design auctions to lead to effective and efficient deployment of renewable electricity.

In addition, the choice of design elements for the new market-based instruments in general and auctions in particular, in order to ensure an effective and efficient deployment of renewable electricity represents a main challenge. This last point is highly relevant since auctions for renewable electricity can be designed in many different ways (see del Río and Linares, 2014).

Past experiences with auctions for renewable electricity show that auctions have not always led to effective and cost-effective renewable electricity deployment. Other instruments have been preferred to promote less mature technologies and to encourage the participation of smaller actors (see del Río and Linares, 2014; Held et al., 2014). Indeed, the aforementioned European Commission Guidelines on State Aid envisage some exceptions to the use of auctions: 1) Small installations or technologies in an initial stage of development[5]; 2) that MS could show that auctions would lead to a non-satisfactory outcome because they only promote a few projects or sites, because they would result in higher support levels or because they would be ineffective.

All in all, the success of tenders, as with other instruments, depends to a large extent on how they are designed (del Río and Linares, 2014). In addition, since the Guidelines for State Aid provide some leeway for MS to continue to use FITs (e.g., for smaller installations), it will be a challenge for national policy-makers not to replicate past negative experiences in this sense (see, e.g., the case of FITs for solar PV in Spain, del Río and Mir-Artigues, 2014). In addition, the shift to other market-based instruments is also associated with substantial design challenges (see, e.g., Held et al., 2014).

Target setting

On the other hand, different target setting options represent different types of challenges for renewable electricity policy design, mostly at the EU level. Although the January 22nd 2014 communication by the EC does not envisage the existence of national targets, the October 23rd 2014 European Council conclusions mentions that the EU binding target will be fulfilled "through Member States contributions guided by the need to deliver collectively the EU target without preventing Member States from setting their own more ambitious national targets and supporting them". The existence of a binding EU target without binding national targets in a context in which the responsibility for renewable electricity policy instruments remains solely at the MS level raises the issue of how those MS policies can be expected to contribute to the EU target when there is no responsibility for a national amount of renewable electricity deployment. Lack of national targets may increase uncertainty (at least initially) in relation to proportions of renewable electricity on the system (CEER, 2013). This would affect the whole value chain for renewable energy technologies, including technology providers and project developers. Obviously, the alternatives (i.e. MS targets and an EU-wide target) also bring challenges, mostly in terms of cost-effective deployment across the EU, if the renewable electricity targets are set only partially considering renewable energy resource potentials in MS (i.e. when they are mostly set according to the economic capacity of countries).

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should be granted in a competitive bidding process unless Member States demonstrate that only one or a very limited number of projects or sites could be eligible or that higher support levels or low project realisation rates would result from the competitive bidding process. The bidding process can be limited to specific technologies where a process open to all generators would lead to a suboptimal result which cannot be addressed in the process design in view of, in particular: the longer-term potential of a given new and innovative technology; the need to achieve diversification; network constraints and grid stability; system (integration) costs or the need to avoid distortions on the raw material markets from biomass support. Aid may be granted without a competitive bidding process to installations with an installed electricity capacity of less than 1 MW (6 MW for wind installations), or demonstration projects.

[5] According to the Guidelines, small renewable energy installations are those with an installed electricity capacity of less than 1 MW. The threshold for wind plants is 6 MW.

The impact of the merit order effect on the competitiveness of renewable energy technologies

Furthermore, it is usually argued that past and future reductions in the costs of solar PV and wind will make these technologies cost-competitive with respect to their competing alternatives in the medium or long-terms (Piria et al., 2013). For some, this means that support schemes for wind and solar should be phased out. However, there is still a challenge for policy makers to encourage renewable electricity investments with the expected move to market-based instruments, since part of the revenues are received through the wholesale market and prices are reduced when a greater penetration of renewable electricity takes place (merit order effect). Therefore, even where the full costs of (variable) renewables are lower than average market prices, policy intervention may be needed to ensure that sufficient investment is attracted to renewable electricity projects (Piria et al., 2013).

Balancing stability and flexibility in renewable electricity support

Finally, a fundamental challenge for policy-makers is to balance the trade-off between greater stability for investors and flexibility of the support scheme to adapt to changing circumstances in order to avoid overcompensation to renewable electricity generators. Renewable electricity investors usually demand predictability and stability of the support scheme. As mentioned in section 2, this is critical to ensure lower risks for investors and, thus, the effectiveness and even the efficiency of the support scheme. While this has been a strong argument for price-based FIT/FIP systems, unexpected trends in, e.g., technology costs, may result in greater support costs than initially envisaged (in the absence of volume control in FIT/FIP systems). This overcompensation may result in a greater deployment level and, thus, much greater support costs than expected and those needed to trigger a certain renewable electricity capacity. Obviously, ex-post changes by the government in the support levels leading to retroactive cuts would increase risks for investors and lead to an unstable investment climate. As stated by EC (2013), changes that reduce the return on investments already made alter the legitimate expectations of business and discourage investments. This trade-off is possibly more likely under certain instruments and design elements than under others, i.e. under FITs without degression components.

Other challenges cannot be tackled directly by renewable electricity policy makers in the MS, but could be mitigated at EU level. One of the most relevant is the interaction of multiple targets (GHG reductions, renewable electricity deployment and energy-efficiency targets), which may lead to conflicts (see del Río, 2014). This is obviously a challenge for EU policy-makers. The setting of those targets should be coordinated, ensuring that they do not weaken each other. This issue is further addressed in other work packages of this Towards 2030 project (see WP6).

The above discussion has identified the main challenges which are common to most technologies, i.e. to renewable electricity in general. However, for reasons of simplicity it has not focused on the technology-specific challenges. These might be relevant. For example, the future of biomass is subject to uncertainties such as lack of biomass markets, transportation infrastructure and supply chains. In addition, requirements in terms of efficiency improvements and application of new combustion technologies will limit a strong deployment of this technology (Boie et al., 2014). In addition, challenges are likely to differ per region within the EU. For example, as mentioned above, some are likely to have more credit restrictions and budget constrains than others. Feedback from stakeholders on those technology-specific and regional-specific barriers would be useful.

What policy options can address those challenges?

Several policy options (instruments and design elements) can tackle (some of) the aforementioned challenges. We provide a general discussion of those policy design options, focusing on deployment instruments and design elements for these instruments. The main alternatives are described below[6].

Concerning the technologically-related challenges, several instruments and design elements may mitigate investors' and policy-makers' risks. Investors' risks are related to uncertain and low support levels, while high support costs and a sudden explosion of those costs seem to have been a main concern of some governments in the past and are likely to remain so in the future. Auctions have an in-built mechanism to control the supported RES volume while, if designed appropriately, they can provide sufficient certainty for investors once contracts are awarded. Generation caps, capacity caps and growth corridors could also be worthwhile to limit the risks of escalating policy support costs as a result of explosive growth in renewable electricity deployment, but they might entail significant investors' risks. Other instruments and design elements may offer a good balance between investors' and policy-makers' risks with regard to RES electricity market integration. In particular, sliding premiums and premiums with cap-and-floor prices are examples of exposing RES to market price signals while mitigating their revenue risks. Another technologically-related challenge (how to combine R&D and deployment support) depends on technological maturity, with less mature technologies requiring higher levels of R&D support. Technological assessments can provide guidance on the amount of support that should be channelled to both types of technologies, balancing deployment and R&D support. Obviously, these technology assessments should be conducted by independent parties and should be technology-specific.

Regarding the macroeconomic-related challenges, the economic and financial crisis and the concern on public deficits, particularly in the South of Europe, makes it recommendable to finance support through the electricity bill since this could provide more stability and certainty for investors than budget financing, which is more subject to political vagaries of the moment within a particular national economy. Access to credit should also be facilitated, especially for small investors which are more likely to finance projects with debt rather than equity and have more difficult access to credit in a context of financial restrictions, as currently experienced in many EU countries. Soft loans and government-backed loans could be a good instrument in this context.

On the other hand, current discussions on policy support for renewable electricity in the short, medium and longer term emphasise the importance of the choice of design elements in market-based instruments (auctions combined with feed-in premiums and quotas with TGCs). Again, the need to balance trade-offs between effectiveness and cost-effectiveness, between investors' and policy-makers' risks, between a greater stability and flexibility to adapt to changing circumstances suggests the convenience to apply design elements such as sliding premiums and cap-and-floor prices (in feed-in premiums), maximum and minimum TGC prices (in quotas with TGC schemes) and flexible degression (for small installations in feed-in tariffs). They also point to the need to appropriately design auctions, choosing best practice from EU and non-EU countries, such as prequalification requirements, penalties, financial guarantees and ceiling prices. Most importantly, they should adapt to the specific context (technological, national and market context) to which they are applied, e.g., one size does not fill all. Furthermore, trade-offs between different objectives and design elements will be unavoidable. The relatively recent experience with auctions for renewable electricity suggests, however, that the capacity to learn should be allowed to feed back on the design of future auction schemes. Allowing for some flexibility to adapt to new changing circumstances is highly recommendable in this context.

Other challenges are related to administrative and social acceptance barriers. Administrative barriers to renewable electricity deployment should be dealt with by improving and reducing the duration of the administrative procedures. Social-acceptance of renewable electricity deployment and deployment support could be

[6] This section heavily draws on work performed under the EU-funded Beyond2020 project (del Río et al., 2012a). See Annex I, del Río (2012) and Held et al. (2014) for further details.

enhanced in several directions. NIMBY problems can be mitigated by avoiding excessive concentration of renewable electricity projects in certain locations (e.g. by using stepped feed-in tariffs, although this would interfere with allocation efficiency), by informing the local people about the local benefits of renewable electricity deployment and by facilitating public participation in renewable electricity deployment strategies. Social backlash might also be related to the costs of renewable electricity support, which could trigger an increase in electricity bills or taxes (in case of budget-financed support). Two complementary alternatives to address this social rejection would be information campaigns on the national benefits of renewable electricity deployment and mechanisms (instruments and design elements) limiting the increase in support costs.

Of course, we are aware that some of the challenges will require more than simply applying one or another instrument or design element. Some of those challenges are quite complicated to tackle and a combination of measures is likely to be needed, going beyond the discussion on instruments. However, the aim of this task is only to provide an initial list of policy options, to be further developed and analysed in subsequent tasks (see del Río and Peñasco 2014 for further details).

Table 1 Relating challenges and policy options.

Challenge	Type of challenge	Policy options addressing the challenge (examples)
Adapting support levels to trends in renewable energy technology costs	Technology-related	Flexible degression (FITs), tenders
Precise combination of R&D support and deployment support for less mature technologies	Technology-related	It depends on the technology (independent technology assessments)
Uncertain evolution of resource potentials	Technology-related	Contract-for-differences
Lower budget for renewable electricity support	Macroeconomic-related	Decouple support from changes in budget (consumer-financed support might be more stable than budget-based support).
Access to finance (credit restrictions)	Macroeconomic-related	Specific instruments facilitating access to credit.
Implementation of market-based instruments in general and auctions in particular	Current policy discussion	Use existing institutional structures to the extent possible
Making auctions and others MBIs effective and efficient	Current policy discussion	Appropriate design elements (see text)
An EU target without MS targets	Current policy discussion	Inherent trade-off
An EU target with MS targets	Current policy discussion	Inherent trade-off
Merit order effect reducing wholesale prices and revenue for renewable energy technologies	Current policy discussion	CfD, sliding FIPs, FITs, capacity payments

Balance the trade-off between a greater stability and flexibility to adapt to new circumstances.	Current policy discussion	Flexible degression under FITs and FIPs
Delays in administrative procedures	Administrative-related	Streamline administrative procedures
Trade-off NIMBY related to renewable electricity concentration vs. allocative efficiency	Social-acceptance	Stepped FITs or other locational signals (but inherent trade-offs) Public participation strategies.
Social rejection of high or escalating support costs	Social-acceptance	Information campaigns on the local benefits of renewable electricity deployment Cost-containment mechanisms in support schemes.
Costs falling disproportionately on a given group of the population	Social-acceptance	Provide compensations to losers.

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