The Case for a Wider Energy Policy Mix in Line with the Objectives of the Paris Agreement

Shortcomings of Renewable Energy Auctions Based on World-wide Empirical Observations

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1. Executive Summary

1.1 Paving the way for an unprecedented scaling up of renewables

The global average mean surface temperature has already increased by 1.3°C compared with pre-industrial levels (Copernicus Climate Change Service/ECMWF 2020). This leaves us little more than a decade to decarbonize the worldwide economy and energy systems in order to meet the 1.5°C target laid down in the Paris Agreement and avoid catastrophic climate change.[1] A number of studies have shown that a 100% renewable energy-based electricity system is technically and economically feasible on a global scale (Bogdanov et al., 2019; Brown et al., 2018; Jacobson et al., 2019). Other studies have found that very high shares of electricity from renewables can already be achieved by 2035, as shown by the case of the USA (Phadke et al., 2020).

Even though the exact timeline for full decarbonization and the precise share of renewables in the worldwide electricity and energy mix vary from one scenario to the next, there is a broad consensus around two central facts:

- **First, renewables will need to provide the lion's share of electricity, heating, cooling and transport-related needs.**
- **Second, renewables need to be scaled up at an unprecedented rate to achieve this objective. Even to decarbonise the world economy by 2050, it is estimated that global deployment rates of renewables will need to increase at least six-fold (IRENA 2018).**

The current growth trajectory of renewables is linear rather than exponential, and recent years have seen a stagnation of capacity additions (see Section 2.2). This indicates that **the current renewable energy policy mix is failing to deliver.** The deployment targets for renewables and the associated **procurement levels of capped auctions are far too low to meet the objectives of the Paris Agreement.** Thus, in order to achieve the required level of growth in renewables, **a fundamental re-think of the current policy toolkit is needed.**
In previous decades, the renewable energy policy debate was frequently dominated by the debate between quota-based instruments and feed-in tariffs (in the 1990s and 2000s) and between auctions and feed-in tariffs (or feed-in premiums) in the 2010s. **These dichotomies need to be overcome.**

Now that renewables have become least-cost in many markets around the world, the traditional argument about needing to constrain their growth in order to protect ratepayers no longer stands: accelerating the growth of renewables can provide individuals and businesses worldwide with cheaper and cleaner energy. What is ultimately needed are policy frameworks that will **simultaneously incentivize investment from all types of actors and investors, across a wide range of technologies and project sizes.** This can enable a ramping up of renewables at an unprecedented rate, triggering the exponential growth needed for climate protection. In order to achieve this, a new and more diverse mix of policies will be necessary.

1 To meet the 1.5°C objective of the Paris Agreement, a remaining carbon budget of 580 Gt was estimated in 2018 (IPCC 2018). For Europe and Germany, for instance, this would require carbon neutrality by 2035 (SRU 2020).

This report analyses policy instruments for grid-connected renewable energy deployment in the electricity sector, focusing on the shortcomings of auctions and novel ways of combining them with administratively set feed-in premiums or feed-in tariffs.[2] The report therefore focuses on the most widely used policy instruments for the deployment of renewable energy in the electricity sector, with both instruments being used in more than a hundred jurisdictions worldwide.

We state the case for a broader policy mix, including feed-in tariffs for small and medium sized projects and auctions for large-scale installations. The question is no longer about the right choice of one policy instrument in the policy toolbox, but rather about the right combination of a variety of instruments, taking into consideration the advantages and shortcomings of both auctions and feed-in tariffs.

1.2 Shortcomings of auctions based on empirical observations

Auctions have become an important ingredient in the renewable energy policy toolkit. However, while acknowledging that all policy instruments have their strengths and weaknesses, in this report we focus on the shortcomings of renewable energy auctions in order to counter widespread overestimates of their capacity to achieve their goals. Sufficient time has passed since auctions were first introduced in a large number of countries. Accordingly, conclusions can now be drawn on a broad basis of empirical knowledge.[3] This empirical evidence needs to be recognized and more widely-known if the renewable energy policy debate is to retain its claim that it is evidence-based. (see below)

2 Other relevant parts of the policy design, including grid integration, market design and sector coupling, are not discussed in this report, nor do off-grid policies for renewable energy deployment form part of the analysis.

3 The analysis of the shortcomings of auctions was based on empirical findings in a large number of countries and regions around the world, including Argentina, Australia, Brazil, Chile, Colombia, Denmark, France, Germany, India, Italy, Jamaica, Japan, Mexico, the Netherlands, Peru, Portugal, Spain, Saudi Arabia, South Africa, Taiwan, the United Kingdom, and the United States.

DIVERSITY OF ACTORS – see Section 3.1

Auctions fail to provide fair access to everyone and deter small-scale actors

Auctions have shown a tendency to favour large-scale actors. This is in line with theoretical expectations due to transaction costs, economies of scale favouring larger projects, the need to bear the sunk costs of unsuccessfully bid projects and the costs of capital, all of which create competitive advantages for the larger actors.

DIVERSITY OF PROJECT SIZES – see Section 3.2

Auctions do not promote a variety of project sizes, as the larger projects are typically successful in outbidding the smaller ones; small and medium-size projects are therefore frequently excluded

Auctions will typically steer investors towards the largest possible projects because these allow project developers to achieve higher economies of scale. Experience from jurisdictions around the world confirms that auctions have been broadly unsuccessful at encouraging different project sizes simultaneously.

MARKET CONCENTRATION – See Section 3.3

By favouring financially strong and large actors, auctions foster market concentration

While the participation of small actors in the renewable energy sector is generally acknowledged to be an important ingredient of a just and fair energy transition, small actors have difficulties entering the sector via auctions for a number of reasons. The available evidence shows that auctions lead to higher market concentrations of a few incumbent firms and international project developers, to the detriment of small or new actors.

PUBLIC ACCEPTANCE – See Section 3.4

In deterring small actors, auctions impair important conditions that support the acceptance of new projects

The further expansion of renewables, in particular onshore wind, depends on sufficient acceptance among local stakeholders and the surrounding communities. Small actors like community energy groups frequently cannot spread the risk of potentially unsuccessful bids due to small project portfolios and a weak capital base. Economies of scale are limited because the projects are generally rather small, and such actors mostly limit their search for land to a close regional area. However, well-conducted community energy projects can support local acceptance by emphasizing procedural and distributive fairness (e.g. allowing local citizens to participate in planning decisions and to invest). Such projects also permit an easier integration of local concerns and adaption to local conditions.

TARGET ACHIEVEMENT – See Section 3.5

Auctions often suffer from undersubscription, project cancellations or delays, hampering the timely achievement of renewable energy expansion targets

Many countries around the world have established targets for renewable energy deployment. The empirical evidence shows that auctions have a poor track record in achieving such deployment targets. Ineffectiveness refers to both the auctioned volume being undersubscribed (so-called "ex-ante ineffectiveness") and to delays and underbuilding (so-called "ex-post effectiveness"). In contrast to their image as policy instruments guaranteeing firm political control over expansion levels, auctions set maximum targets which in reality are frequently missed. Theoretically, capped policy instruments could lead to the necessary deployment of renewables if only the deployment targets and schedules were in line with the objectives of the Paris Agreement. However, empirical evidence shows that currently deployment targets are far below the necessary deployment in line with the Paris Agreement.

COST REDUCTION – See Section 3.6

Contrary to received wisdom, auctions do not guarantee low remuneration levels, nor have they caused the recent cost reductions of renewables

Instead, a surge in the global deployment of renewable energy (and the associated experience curves), combined with the unprecedented decline in global interest rates, drove the bulk of the cost declines we experienced during the last decade. It is these declines that were subsequently reflected in auction results around the world.

1.3 Auction shortcomings cannot simply be overcome by design modifications

Many countries have implemented auctions, often replacing feed-in tariffs wholly or partially, assuming that auctions can deliver the same results, but in a more efficient manner. However, the assessments in sub-sections 3.1 to 3.6 show that auctions have certain inherent shortcomings that are difficult to be overcome by changes to their design. Design modifications always entail trade-offs, and an attempt to overcome one deficiency is often made at the expense of increasing another. In other cases, design modifications have simply failed to achieve their goals (see Section 5.1).

Accordingly, we argue that the shortcomings of auctions analysed in this report cannot simply be eliminated by changes in auction design. Instead, they demon-strate the need to implement a combination of policy instruments (see Couture et al., 2015; IEA RETD 2016b, del Río 2014).

1.4 Shortcomings of feed-in tariffs and feed-in premiums re-visited

Administratively set remuneration schemes, such as feed-in tariffs and premium feed-in tariffs, also have their shortcomings. In the 2000s, the main criticisms of administratively set remuneration approaches made by conservative policymakers were (Cointe & Nadaï, 2018):

1. The difficulties of setting the right tariff levels, given the well-known problem of asymmetric information
2. … leading to difficulties in managing market growth in schemes without capacity caps
3. … leading to difficulties in controlling the overall policy costs

These shortcomings of feed-in tariffs and premiums led policymakers around the world to re-consider their policy options and switch to auctions. However, in the past decade several aspects of the renewable energy technology sector have changed, in the process mitigating many of the previous shortcomings of feed-in tariffs. These developments are opening the door to a re-assessment of their potential merits, for instance, for small and medium-scale projects. An overview is given in the following table.

Table 1. Shortcomings of feed-in tariffs re-visited

	Perceived shortcomings of feed-in tariffs in the 2000s	Re-visiting shortcomings of feed-in tariffs in the 2020s
Managing market growth	• Rapidly growing shares of renewable energy capacity in countries without annual capacity caps, exceeding conservatively formulated political goals in some instances • Sharp increases in installed capacity, especially in the case of solar PV, due to short lead times, modularity and large potential for cost reductions along the learning curve which was perceived as problematic due to policy costs	• Higher market growth required due to Paris Agreement objectives • Availability of design options like tariff degression, growth corridors, etc.
Cost control	• High costs of solar PV, leading to high policy costs • The financial crisis of 2008 increased policymakers' concerns as regards the cost burdens on rate-payers • Policymakers pulled back, looking for options that allowed for stricter control of costs and market growth	• The cost of rapidly deployable technologies (solar PV) has fallen rapidly, but the pace of the cost reductions has slowed down • Solar PV and other renewable energy technologies are now least-cost technologies • Therefore, exceeding deployment targets will no longer lead to ex-cessive costs for rate-payers
Setting tariffs appropriately	• Challenges resulting from infor-mation asymmetries between project developers and policyma-kers, especially for technologies (PV) with rapidly declining costs • Difficulties to adjust tariff levels fast enough • Limited data for tariff calculation because of rather small markets	• Improved data availability due to larger national and international markets • Data collection effort by IRENA and research institutes • Availability of auction results to inform tariff-setting • Improved implementation of auto-matic tariff reduction elements

Source: authors

1.5 Overcoming the old dichotomies: Combining auctions with feed-in tariffs in more innovative ways

A better understanding of the shortcomings of auctions should enable policymakers to calibrate the mixture of renewable energy policy instruments more effectively, to identify the comparative advantages of auctions, and to use them in particular contexts. This can allow policymakers to support a wider range of investor types, project sizes and renewable energy technologies simultaneously.

A particular weakness of the current policy landscape is that it is failing to create viable investment opportunities in medium-sized projects (which, depending on the definitions used, can range from 1-10MW up to 60MW). Creating an additional market segment based on medium-sized projects (remunerated via administratively set feed-in premiums or feed-in tariffs) has a number of potential benefits (as discussed in section 2.3):

- Easing grid integration
- Fostering regional diversity and distribution of projects
- Enhancing actor diversity and public acceptance
- Counterbalancing market concentration
- Easing access to capital for regional actors, and increasing local value creation
- Increasing the speed of renewable energy deployment

Globally and nationally, an over-reliance on auctions can entail insufficient RE deployment levels. Deployment targets which are reflected in procurement schedules under capped auctions are too low to meet the objectives of the Paris Agreement. In order to address this, more open-ended (i.e. less "volume-constrained") renewable energy development is needed, in particular for small and medium-sized projects.

We therefore propose to use different policy instruments for different market segments:

- Continued use of auctions for large-scale projects
- Use of feed-in tariffs or feed-in premiums for small and medium sized projects
- Use of self-consumption policies for very small-scale projects

This is only a starting point for a debate we deem necessary. Other criteria may also be appropriate in determining the relative suitability of feed-in schemes or auctions, such as the intended degree of local participation, the level of transaction costs for particular projects, instances where the application of renewables is mandatory (for instance, on the rooftops of new buildings) or other aspects.

1.6 Balancing the shortcomings of auctions through a parallel use of feed-in tariffs and feed-in premiums

The shortcomings of auctions we have identified can be balanced by applying feed-in tariffs and feed-in premiums for small- and medium-sized projects in parallel (see Section 5.4):

Increasing effectiveness: Meeting ambitious deployment targets on time
A combination of capped auctions with uncapped or flexibly capped feed-in tariffs can be a solution to balancing the advantages and disadvantages of the two approaches

Increasing the diversity of project sizes: Supporting small, medium, and large-scale projects simultaneously
By using auctions for large-scale projects and feed-in tariffs or feed-in premiums for small and medium-sized projects, the diversity of project sizes (and actor diversity) can be increased

Increasing actor diversity: Activating investments by all potential stakeholders
We have not found any evidence that auctions have been able to sustainably promote a diversity of actors, even with modifications to auction design. However, there is widespread evidence that feed-in tariffs have been able to promote actor diversity and the participation of community projects in a number of countries.

Increasing efficiency: Keeping short-term prices low
Combinations of auctions and feed-in tariffs or feed-in premiums can help increase the efficiency of remunerating renewable energy projects. This can be done, for instance, by running auctions and feed-in tariffs in parallel, using administratively set remunation to determine ceiling prices for auctions, and using auction results to inform remuneration levels for feed-in tariffs.

Increasing local and national value creation: Development of domestic industry and local value creation
Especially in emerging markets, the implementation of auctions can lead to a situation in which new national actors cannot beat the low bids of international project developers. Policymakers can establish an additional market segment by focusing on medium-scale projects with remuneration based on feed-in tariffs or feed-in premiums, to be realized by local domestic actors.

1.7 Increasing policy options for member states in the European Union

In order to achieve the energy transition outlined by the European Green Deal to achieve climate neutrality by 2050, an immediate and rapid uptake of renewable energies is necessary. This is creating an urgent need to improve the current framework of support to renewable energy projects in the EU.

- Scrutinizing state aid should be restricted, and member states should regain full flexibility when giving state aid support to use, e.g., feed-in premium mechanisms without time-consuming and imposed auctioning systems.
- Member states should recognise that producing energy from renewables is a most important public service and should be recognised as Public Service Obligation – hence the need to remove scrutiny of state aid.

2. Rapidly Scaling up Renewables and the Need for a New Policy Mix

2.1 The challenge ahead: Scaling up renewables at an unprecedented rate

The global average mean surface temperature has already increased by 1.3 °C compared with pre-industrial levels (Copernicus Climate Change Service/ECMWF, 2020). This leaves us little more than a decade to decarbonize the world's economies and energy systems in order to meet the 1.5°C fixed in the Paris Agreement and avoid catastrophic climate change.

A number of studies have shown that a 100% renewable energy-based electricity system is technically and economically feasible on a global scale (Bogdanov et al., 2019; Brown et al., 2018; Jacobson et al., 2019). Other studies have found that very high shares of electricity from renewables can already be achieved by 2035, as shown by the case of the USA (Phadke et al., 2020). Even though the exact timeline for full decarbonization and the exact share of renewables in the world-wide electricity and energy mix varies from one scenario to another, there is a wide consensus on the role to be played by renewable energy sources in all future scenarios:

1. **Renewables will need to provide the lion's share of electricity and energy by 2050.**

2. **Renewables need to be scaled up at an unprecedented rate to achieve this ob-jective. Global deployment rates of renewables will need to increase at least six-fold (IRENA, 2018).**

Renewable forms of energy have become the cheapest technologies in many markets around the world (IRENA, 2020c). Already today, adding new renewable energy capacity is cheaper than running existing fossil fuel-based power plants in many situations. As of 2018, 35% of coal capacity costs more to run than building new re-newables, a percentage expected to increase to 96% by 2030 (Carbon Tracker, 2018). The costs of other energy transition technologies, including storage technologies and hydrogen, are also plummeting (IEA, 2020b; Phadke et al., 2020). In 2019, all renewables accounted for 75% of net annual capacity additions in the power sector, and more than 200 GW of renewable energy capacity was added to electricity systems in that year alone (REN21, 2020).

However, from a policy perspective additional measures are necessary, as the existing policy mix and the scope of these policies do not seem to be delivering the scaling-up of renewables at the required pace, as the data provided in the next section suggest.

2.2 The inconvenient reality: Renewable energy deployment is far too slow, with stagnating expansion in recent years

Even though the growth rates and the cost reductions of modern renewable energy technologies are impressive, renewables have not (yet) fundamentally altered the global energy landscape in recent decades. Between 1990 and 2020, the share of renewables in total final energy consumption stagnated at around 17% to 18% (World Bank, n.d.). In the power sector, renewables only accounted for 27% of production in 2019 (REN21, 2020), a modest increase compared to the figure of about 19% thirty years earlier (World Bank, 2018).[4] Despite rising faster than other energy sources, the growth in renewables did not even suffice to compensate for the increasing demand for energy, of which it soaked up less than a third (REN21, 2020). In addition, an increasing demand for power can be expected due to sector coupling and the related use of electricity in the transport and heating/

4 Hydro accounts for the largest share (15.9%), whereas non-hydro renewables only represented 11.3% of worldwide electricity generation as of the end of 2019 (REN21 2020).

cooling sectors.

Furthermore, in recent years, deployment of and investment in modern forms of renewable energy have started to stagnate. In the past five years, newly installed wind energy capacity globally hovered around 60 GW per year. Hydro-power deployment decreased from almost 40 GW of new deployment in 2014 to less than 20 GW in 2019 (REN21, 2020). The exponential growth rates that characterized many renewable energy technologies earlier in the 2000s are no longer on the horizon.

Even the installation rates of solar PV, for a long time the fastest growing energy technology world-wide, are no longer accelerating. In the 2000s, newly installed annual PV capacity increased from about 290 MW in 2000 to 7.3 GW in 2009. In the first half of the 2010s, the annually installed PV capacity increased from about 17 GW in 2010 to 76 GW in 2016. In the second half of the decade, however, newly installed PV capacity globally stopped increasing exponentially, sticking at about 99 GW in 2017, 102 GW in 2018 and 116 GW in 2019 (Sönnichsen, 2020).

This does not begin to match the installed capacity needed to transform the global energy system in the coming decades. According to a recent IEA publication, the annual solar PV capacity additions world-wide will need to increase from about 100 GW today to 470 GW on average every year from now until 2070 (IEA, 2020b). The International Renewable Energy Agency (IRENA) estimates that 8500 GW of solar PV capacity will need to be deployed between now and 2050, with annual global solar PV additions reaching 270 GW in 2030 and 372 GW in 2050 under the REmap scenario (IRENA, 2019a).

Similarly stagnant trends can be observed in the sums invested in renewable energy. Between 1995 and 2004, annual investment in renewable energy capacity increased exponentially, from about USD 7 billion to about USD 30 billion (REN21, 2005). Subsequently, investment increased from about USD 60 billion in 2005 to USD 265 billion in 2014 (UNEP & Frankfurt School, 2020). However, in the last five years, investment has stagnated and even decreased. The USD 300 billion threshold was passed for the first time in 2015. However, in the following years, global in-vestment stopped increasing and fell to around USD 280 billion in both 2018 and 2019 (UNEP & Frankfurt School, 2020).

Certainly this decline in investment is also due to falling investment costs: **the same capacity** can be installed for fewer dollars. Nonetheless, the stagnating growth in investment contrasts strongly with actual investment needs. IRENA has calculated that, in the power sector, an accumulated investment of almost USD 22.5 trillion in new renewable energy capacity is required by 2050, which translates into annual investments of more than USD 660 billion (IRENA, 2019b).

2.3 Overcoming old dichotomies: An innovative policy mix for the rapid transition of global electricity systems

The stagnating expansion of renewables in recent years indicates that maintaining the existing renewable energy policy mix is not likely to deliver the required extra capacity.

> Policymakers will need to establish policy frameworks that will **simultaneously** incentivize investment from all types of actors and investors, for all types of renenewable energy technologies and all project sizes. Therefore, a new and innovative mix of policies will be necessary.

In previous decades, the renewable energy policy debate was frequently dominated by confrontational views and preferences for or against certain policy instruments. In the 1990s and 2000s, the controntation between proponents of quota-based mechanisms and supporters of feed-in tariffs was at the center of the policy debate (Butler & Neuhoff, 2008, Elliott, 2005;

Fouquet, 2007; Menanteau et al., 2003). In the 2010s, the debate moved to discussions of some of the drawbacks attributed to feed-in tariffs (which were mostly due to solar PV booms in some European countries and their increasing support costs) and the possible role that auctions could play in controlling those costs (del Río & Linares, 2014; European Commission, 2013; Newbery, 2016). Auctions were regarded by many as potentially superior to avoid the problem of asymmetric information with feed-in tariffs and feed-in premiums that are set administratively, which would lie behind the relatively high support costs.[5] The debate was sometimes triggered by ideological battles (e.g. so-called "market-based approaches" versus so-called "regulatory approaches").

These dichotomies need to be overcome. The old ideological battles will need to give space to policy mixes and policy designs that will include a diverse mix of policy instruments, using self-consumption policies, feed-in tariffs and auctions at the same time. The battles for market shares will need to give space to an understand-ing amongst policymakers that all renewable energy technologies, in all project sizes and by all types of investors and project developers are necessary to ramp up renewables at an unprecedented rate in the coming decades.

2.4 The diffusion of auctions and feed-in tariffs in light of the old dichotomies

In the 2000s, the renewable electricity landscape was characterized by a rapid uptake of feed-in tariffs worldwide, probably because they were regarded as the best instrument for kick-starting the market. In 2010, fifty countries and 25 states or provinces had feed-in tariffs, more than half having adopted them only since 2005 (REN21, 2010). The rapid adoption of renewable energy auctions started in the 2010s. At the start of the decade, only about thirty jurisdictions had used auction-based procurement as part of their renewable energy policy mix. This number increased to 109 jurisdictions having used auctions at some stage by 2019 (REN21, 2020). A similar number of jurisdictions now make use of feed-in tariffs.

Despite the fact that more and more jurisdictions have adopted various support policies for electricity from renewable energy sources, the increasing adoption of auctions has been treated in terms of the old dichotomies. Auctions have frequently been described as a good substitute for feed-in tariffs[6], being more cost-effective and allowing for better control of deployment (volume control). Only very few institutions and actors argued that the rise of auctions would complement the existing renewable energy policy toolkit and allow a finer calibration of policies in line with policy objectives.

However, this move to use only auctions can and should be questioned. Policymakers frequently assume that they can simply replace the existing feed-in tariff legislation with an auction-based support framework, not realizing that the project types (scale) and actors incentivized are quite different in the two cases, that their contributions to an effective and efficient energy transition differ, and that different instruments may be more suitable for some market segments than for others.

In other parts of the world, auctions (and low-cost auction results) have been promoted so

5 In reality, public support for renewables in the form of feed-in tariffs (which provide a total amount of support per kWh of renewable electricity generation) or feed-in premiums can be established by a government entity (administratively-set feed-in tariffs) or an auction. We use the terms "feed-in tariffs" (FITs) or "feed-in premiums" throughout this report to refer to administratively set remuneration.

6 What is frequently not communicated is the fact that a large part of renewable energy procure-ment world-wide is still incentivised using feed-in tariffs. Leading renewable energy countries in Asia also use feed-in tariffs for large-scale projects. In 2019, for instance, Japan deployed about 6 GW of solar PV capacity via feed-in tariffs, China about 30 GW and Vietnam about 4.5 GW.

widely, including by a number of international organizations, that policymakers may gain the impression that auctions are the only and best solution for renewable energy deployment in the renewable energy policy toolkit. Discussions based on policy objectives are generally rare, even though auctions are unlikely to meet all the policy objectives simultaneously.

2.5 The increasing diversity in policy objectives, actors and project sizes requires a broad mix of policies

Policy-makers in different countries have different objectives in mind when designing policy frameworks for renewable energy deployment in the electricity sector. The discussion about the "right" policy instrument and the "right" policy mix should therefore be guided by these very specific objectives, not by general preferences for certain policy tools.

The objectives related to energy policy-making have become increasingly heterogeneous and complex in recent decades. Whereas energy policy-making in the 1960s was largely guided by two major objectives – least-cost electricity generation and security of supply – several other policy objectives became more and more important for policy-makers over time. This includes environmental protection, climate protection, community participation and ownership, national and local socio-economic benefits such as industrial development and job creation, participation of prosumers, and others.[7]

Depending on the actual policy objectives in each jurisdiction (e.g. community ownership, least-cost procurement, public acceptance, focus on specific technologies, etc.) the actual policy design and policy mix will vary from one country to another. At the same time, a combination of policies for different market segments and different actors' groups will be necessary to reach the overarching objective of renewable energy policies: Rebuilding the world-wide power system with an unprecendeted scaling up of renewables.

2.6 The need for a new EU framework: Moving away from auctions as the default policy instrument

At the European level, there is an urgent need to improve the current framework for renewable energy projects and the diverse forms of flexibility needed to accelerate deployment. In order to achieve the energy transition outlined by the European Green Deal to achieve climate neutrality by 2050, an immediate and rapid uptake of renewable energies is necessary. Europe needs to re-focus on the strength of locally and regionally integrated projects, and to place the citizen at the heart of the systemic change. Earlier success stories of local renewable energy development and identification were stifled by the tendering mechanisms (see Section 3.1 and 3.4). The rigidity of tendering as a rule prevents the use of different mechanisms such as net-metering and better sector-coupling instruments locally. There is room for auctions, but not when it comes to citizen-driven small and medium sized projects with good regional embedding.

Regarding the development of policy instruments for renewable energies within the EU, since the midnineties of the last century one could identify two schools, the feed-in school and the certificate school. For a long time a majority of member states followed feed-in mechanisms in their support legislation. Trade and certificate rules, used by a minority of member states, did not have the same success as feed-in tariffs.

7 For instance, see del Río et al. (2012) and del Río (2014). These policy objectives can be mutually supportive (e.g. least-cost energy for industrial development), but they can also create trade-offs. For instance, creating a national industry on the basis of local-content requirements prevents the purchase of equipment from typically lower-cost world markets and thus compromises the objective of least-cost procurement.

Nonetheless, one has to recognise a strong increase in support over the years from parts of the energy department of the European Commission, and especially from the Competition Directorate General for trade and certificates.

In the European Commision's current state aid guidelines for energy and the environment, which recognize the weak output of certificate schemes, the trade approach was replaed by a move towards auctioning and tendering rules as prerequisite for allowing member states to continue to support renewable forms of energy through market premium models. "Pure" feed-in mechanisms were pushed aside for exceptional use for small projects. This move to change member states' support schemes by, in effect, European Commission guidelines created a change of direction in the European Union, despite the secondary legislation leaving the choice of support tools to the discretion of member states (e.g. Directive 2009/28/EC and its predecessor Directive 2001/77/EC).

Establishing one default instrument might make sense from a state-aid and internal market perspective, but it seems more difficult to justify in terms of energy and climate policy. Member states have very different contextual conditions (e.g., in terms of renewable resource or land availability), are at different stages of the energy transition and, partly as a result, have different energy policy preferences.

In view of the climate emergency and the different contextual conditions and policy priorities, member states should be allowed to rethink their approach to supporting citizens and community projects, as well as small and medium-sized projects overall. This would require modifications to the current framework for Small and medium-sized enterprises and energy community projects accessing state aid. This change might take the form of a revision of the current state aid guidelines, allowing member states to deviate from the obligation to issue tenders, which is restricting renewable energy deployment and, as a result, delaying crucial climate protection. Member states should have greater flexibility in applying policy instruments that correspond to their country-specific characteristics (whether geographical or policy-wise) and to the need to support all types of investors, project sizes and technologies simultaneously.
Annex I provides more detail on the reasons why more flexibility is needed in the way the European Commission allows member states to design their policy instruments for citizen energy, renewable cooperatives and more generally renewable energy locally produced by SMEs, as well as outlining the legal possibilities for a new approach.

2.7 Scope and methodology

This report analyses policy instruments for grid-connected renewable energy deployment in the electricity sector, focusing on the shortcomings of auctions and novel ways of combining auctions with feed-in premiums or feed-in tariffs.[8] The report therefore focuses on the most widely used policy instruments for the deployment of renewable energy in the electricity sector, with both instruments being used in more than a hundred jurisdictions world-wide.

The analysis of shortcomings of auctions was based on empirical findings in a large number of countries and regions around the world, including Argentina, Australia, Brazil, Chile, Colombia, Denmark, France, Germany, India, Italy, Jamaica, Japan, Mexico, the Netherlands, Peru, Portugal,

8 Other relevant parts of the policy design, including grid integration, market design and sector coupling, are not discussed in this report. Also, off-grid policies for renewable energy deployment do not form part of the analysis.

Spain, Saudi Arabia, South Africa, Taiwan, the United Kingdom, and the United States.

In order to assess auctions, different sources of information were analysed, including publicly accessible data on individual auction rounds[9], academic literature, reports from international organisations (e.g., IRENA), and case studies carried out by different institutions and as part of EU-funded projects (e.g., AURES).

Based on the shortcomings of auctions and a re-assessment of the disadvantages of feed-in tariffs, we present the case for a broader policy mix. For instance, feed-in tariffs and feed-in premiums could be used for small- and medium sized projects and auctions for large-scale installations. A more detailed analysis is needed of how to combine auctions with administratively fixed remuneration.

A draft of the report was sent out to a selected group of highly knowledgeable policy experts with empirical and legal experience of renewable energy auctions in many parts of the world. We are very grateful for their thorough readings of the draft and their numerous helpful suggestions. While we did not adopt every argument they put forward, our report has gained greatly from this review.

Of course, a broad policy mix to support energy-transition technologies in line with the objectives of the Paris Agreement will need to include a lot more regulations and policies. This includes, among other things, self-consumption policies for small-scale systems, policy frameworks that allow private corporate PPAs, soft loans and R&D programs. In addition, a solid 'policy bedrock' (IEA-RETD, 2016b) is required, including long-term renewable energy targets and a stable regulation shielded against retroactive cuts in remuneration, as well as stringent rules for market access, grid connection, spatial planning, siting and obtaining permissions. However, these additional regulations are not the focus of this report.

9 It should be noted that the information on individual auctions rounds is frequently scarce. Even basic information (e.g. the size of projects submitted by bidders) is often not communicated to the public. Additional transparency would increase the quality of policy research.

3. Main Auction Analysis of the Report: Shortcomings and Empirical Findings

As mentioned above, all policy instruments have their strenghts and weaknesses, and this is also the case with auctions. While the current literature has highlighted the advantages of auctions in terms of cost-efficiencies or minimisation of support costs and has focused on their design, the downside of auctions has not received a similar degree of attention.

The intention of this research paper is to develop a better understanding of renewable energy auctions, in particular with regard to the policy objectives that can be met with auctions and other policy objectives that cannot be met (easily) with auctions. Significant time has passed since auctions were introduced in a large number of countries for conclusions to be drawn on an increasingly broad basis of empirical knowledge. In recent years, renewable energy auctions have frequently been promoted as the silver bullet in the renewable energy policy toolbox, like the frequently over-simplistic promotion of feed-in tariffs in the 2000s. The simplistic argument today frequently goes: "You can replace your feed-in tariff with an auction and achieve the same thing, but cheaper".

However, to calibrate different policies well and to develop the right mix of policies, it is important to understand the advantages and disadvantages of all available policies in the light of different policy goals and priorities. Simply highlighting the advantages of a given policy instrument is not entirely useful for policy-makers. By discussing the shortcomings of auctions in addressing those policy goals, this paper aims to fill this research gap.

By understanding the advantages and disadvantages of all available policy instruments and of the objectives that can be met by certain policies (and which cannot), policymakers can more easily establish the right policy mix. To meet the climate protection objectives of the Paris Agreement, renewable energy procurement needs to be accelerated rapidly in all countries around the world.

The question is no longer about the right choice of one policy instrument in the policy toolbox, but rather about the right combination of a variety of instruments to spur investment in all market segments simultaneously and to balance various policy objectives. This discussion is particularly pertinent in the European context.

In this chapter, we will investigate several hypotheses regarding the shortcomings of renewable energy auctions. This will involve a discussion of the respective shortcoming and a presentation of the empirical findings from various countries around the world.

3.1 Auctions fail to provide fair access to everyone and deter small-scale actors

Auctions have shown a tendency to favour large-scale actors. This is in line with theoretical expectations due to transaction costs, economies of scale favouring larger projects, the need to bear the sunk costs of unsuccessfully bid projects and the costs of capital, all of which create competitive advantages for the larger actors.

The economic and environmental dimensions of the energy transition have received widespread attention. One is the efficiency (or "economic") dimension: the transition is expected to increase overall welfare levels, and the issue is how to calculate the different benefits and achieve the transition at the lowest possible cost. One of these benefits will be lower environmental impacts from consumption and production activities, including a phasing out of greenhouse gases from the energy system.

In contrast to the spotlight on those two dimensions, the distributional (also called "social") dimension has received less attention (see, e.g. IRENA, 2019b). This dimension refers to the afore-mentioned benefits of the transition being widely shared in a fair and just manner among different actors and territories, i.e., not being concentrated on a specific group or region.[10]

Policy instruments regularly provide particularly comfortable opportunities to certain actors, while putting other actors at a disadvantage.[11] Renewable energy auctions are no different in this regard. The experience gained with this instrument during the last decade shows that a tendency to prefer large actors is not only a theoretical possibility but has indeed occurred often, even though it works against the aim of a just and inclusive energy transition. [12]

A number of aspects affect small-scale actors in a different way than larger ones (Grashof, 2019; Amazo et al., 2020; del Río & Linares, 2014; Dobrotkova et al., 2018; Dukan et al., 2019; IEA-RETD, 2016; Mora et al., 2017; REN21, 2017). However, although (Cassetta et al., 2017) suggest that the larger participants have several advantages, a hypothesis they test in their study of Italy, they do not find a statistically significant relationship between size (measured by firm turnover) and bidding behaviour.

Transaction costs

Participating in an auction entails transaction costs for each bidder, for instance, in preparing documents for bid submission, and forecasting both market developments and the bidding behaviour of competitors in order to formulate a bidding strategy for one's own projects. With growing firm size and experience, these fixed costs become less important, to the benefit of the larger actors and those who participate in auctions more frequently or submit various bids within one auction.

Capital for project development

The early development of renewable energy projects at auctions is challenging, since project developers (and lenders) risk the project not being awarded at the auction. Obtaining the finance for early project development is often more difficult for small actors. Larger-scale actors frequently have access to venture capital or can finance early project development based on equity alone. In addition, financially stronger companies that develop many projects in parallel can face this risk more easily by spreading the costs of unsuccessful bid projects over an entire portfolio. In contrast, actors with a small portfolio or pursuing only one project for years and with a low equity base are more risk-averse, as they need to be prepared to write off such expenses. As a result, raising capital for project development becomes more challenging for small actors.

10 Both aspects could be related, since smaller actors are likely to be more attentive to opportunities for localised hiring and sourcing of inputs than players who serve markets worldwide from a limited number of production or service hubs (IRENA, 2019c, p. 66).

11 See the concept of structural benefits provided by policy instruments developed in Voß & Simons (2014).

12 Besides effects caused by the instrument, the maturing sector of renewable energy may experience market concentration for other reasons as well, such as the existence of a dominant design, consolidation due to greater competition or economies of scale, similar to previous developments in other sectors (Peltoniemi, 2011; Utterback & Suárez, 1993).

Capital for financial securities

In most current renewable energy auctions, bidders need to deposit financial securities to guarantee a timely start of project operations or the delivery of set levels of power. However, meeting such obligations also depends on factors outside the control of a careful project developer, and corresponding risks can more easily be spread over larger project portfolios or be borne by corporations with large equity sheets.

Construction costs

Plant construction can also come at a lower cost for larger actors, resulting in a competitive advantage during bidding: large-scale developers may benefit from integrated value chains, rebates with component manufacturers and easier access to low-cost equity and debt compared to smaller actors. As regards the lead times between submitting bids and beginning plant construction, large developers that procure equipment in bulk may benefit from lower costs through forward-pricing on equipment purchase contracts for delivery in, for instance, 18-24 months. In contrast, developers of smaller projects may decide to bet on equipment prices falling and wait to procure components at the time of the plant's construction, a practice that exposes them to the risk of tight markets at the time of purchase. In addition, large developers financing from their balance sheets might include their investment in a strategy to pursue shares in large new markets and therefore accept low returns on investments in individual projects.

Resource availability

Small actors usually deploy locally available energy resources in their regions in possibly smaller project sizes. A professional developer who is active abroad, in contrast, can focus on the regions with the highest resource availabilities and lowest restrictions as regards project sizes.

Land-use rights

In the competition with wealthier, larger actors who are able to pay higher leases or to buy promising land even before an auction is conducted, smaller actors can also have greater difficulties in acquiring land-use rights in regions with attractive energy resources, given that auctions create competition for the best locations.

Irregular schedules and deadlines

In most countries, auctions only take place several times per year and often do not follow pre-determined schedules (Wigan et al., 2016), compared to the situation in, for instance, a FIT that is continuously open for participation. In addition, deadlines between the announcement of an auction round and the closing date for bids are often short, which requires an existing team of experts, streamlined decision-making procedures and financial resources to be able to prepare and submit documents quickly.

Bidder-related participation requirements

Sometimes, bidders are required to demonstrate their ability to realize the awarded projects by providing evidence of previous similar projects or their financial health.

Systematically deterring small actors would be unfortunate, given that a renewable energy market that comprises heterogeneous market actors and not just a homogenous group of large and potentially multinational companies has several advantages (Weiler et al., 2020, see also REN21, 2017; WWEA, 2019). Some of these may come at a cost, such as reduced economies of scale in the case of a market comprising actors of different sizes. Yet, these aspects are often neglected in analyses that focus mainly on economic arguments.

From a competition perspective:
The market segment does not risk being dependent on investment behaviour and the financial well-being of a few companies, and there are greater chances for functioning competition.

From an innovation perspective:
Companies with different specialisations and sizes show different innovation patterns, all of which are needed to support the sustainable transition of the energy system.

With a view to local value creation:
Investments by locally anchored firms bring economic benefits to the regions where plants are located.

From a democratic and political perspective:
Participation of citizens in as many social segments as possible can help balance diverging interests. As regards political economy, there is less risk of rent-seeking or regulatory capture by large influential actors.

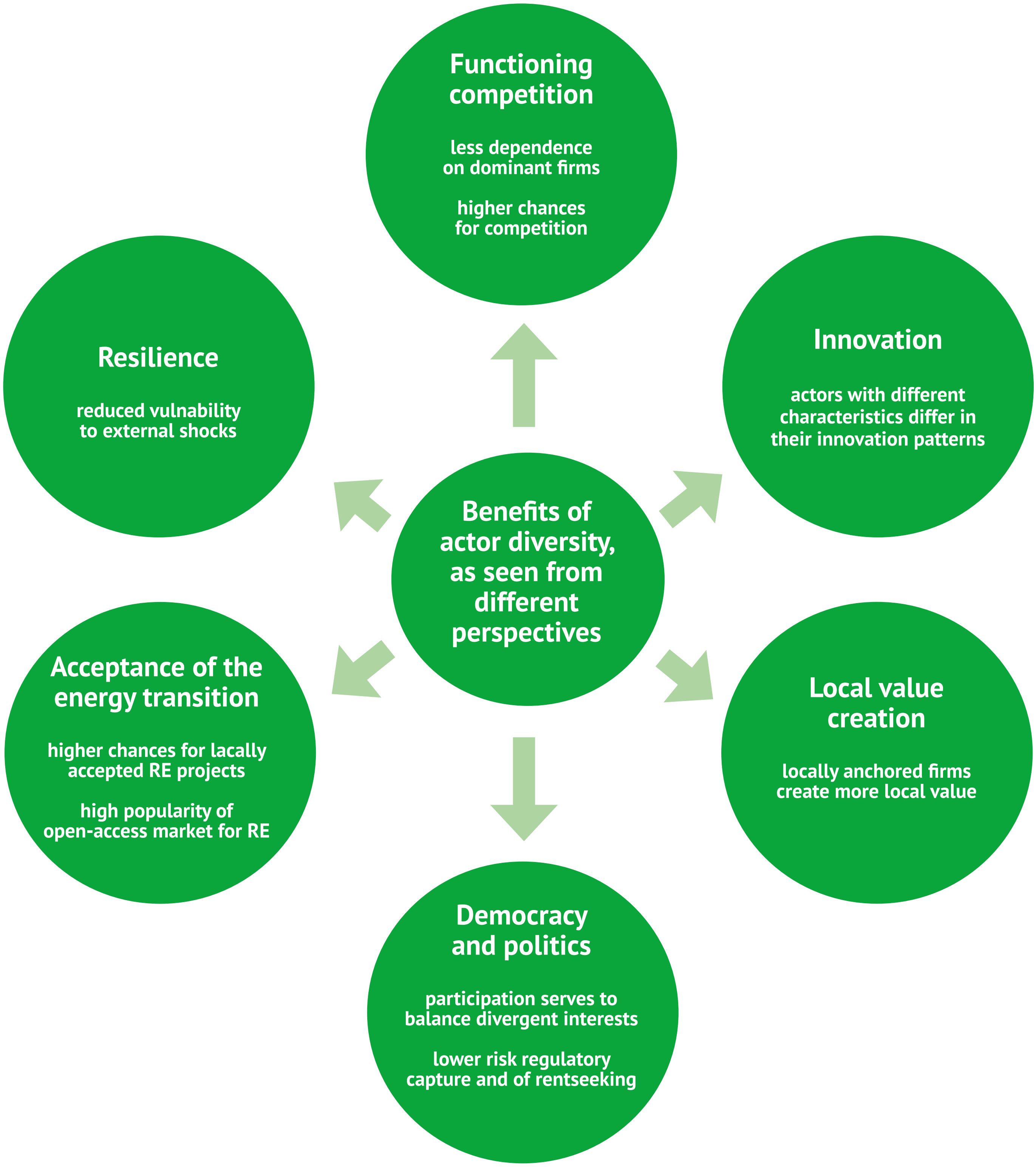
With a view to the public acceptance of the energy transition:
Nationally, citizens often prefer the renewable energy market not to be 'reserved' to large firms and to be open to anyone's participation in principle. Locally, citizens prefer to be able to participate
in planning and operating new renewable energy projects.

From a resilience perspective:
As a complex infrastructure, energy systems are less vulnerable if they are in the hands of heterogeneous actors who are not all affected in the same way by particular external shocks.

Promoting actor diversity in auctions is, indeed, a goal in itself for some governments. According to Schenuit et al. (2018, p.22) and FA Wind (2017, p. 7), auctions in Germany aim to fulfill three main objectives: control and steer expansion volumes, decrease policy support costs by means of competitive price determination, and achieve a high level of participation and diversity of bidders. In Section 2 (3), the German RES Act of 2017 specifically states that in auctions "actor diversity in the generation of electricity from renewable sources [should] be maintained". Actor diversity is a goal of future auctions in Spain, as stated in the National Integrated Energy and Climate Plan (NIECP) (Ministerio de la Transición Ecológica 2019) and the recently passed Royal Decree Law 23/2020, which sets out the main goals and features of the auctions to be conducted before 2030 in order to comply with the NIECP.

Diversity is also a goal in the existing RES Directive (Directive 2001/2018). In Article 17 it is mentioned that "small-scale installations can be of great benefit to increase public acceptance and to ensure the rollout of renewable energy projects, in particular at local level. In order to ensure participation of such small-scale installations, specific conditions, including feed-in tariffs, might therefore still be necessary to ensure a positive cost-benefit ratio, in accordance with Union law relating to the electricity market. The definition of small-scale installations for the purposes of obtaining such support is important to provide legal certainty for investors. State Aid rules contain definitions of small-scale installations". Article 4.4 states that "Member States may exempt small-scale installations and demonstration projects from tendering procedures" and, according to Article 4.8, "By 31 December 2021 and every three years thereafter, the Commission shall report to the European Parliament and to

Figure 2: Benefits of actor diversity.



Source: Weiler et al. (2020).

the Council on the performance of support for electricity from renewable sources granted by means of tendering procedures in the Union, analysing in particular the ability of tendering procedures to: (...) (d) provide non-discriminatory participation of small actors and, where applicable, local authorities."

IRENA has recently stated that in renewable energy auctions, "smaller players (...) are usually not capable of engaging in bidding wars with larger players" (IRENA, 2019c). Also, Sovacool et al. have concluded that the global increase in the conduct of auctions has "created or aggra-vated elite processes" (2019, p. 8).

In Germany, renewable energy auctions have been held since 2015 for ground-mounted PV plants and since 2017 for onshore wind. A research project has measured the actor structures, providing globally unique data on actor diversity on the markets for large-scale PV and onshore wind before and after the policy change to auctions for renewable energies (Weiler et al., 2019; Weiler et al., 2020). In the years before the policy change from administratively fixed feed-in tariffs to auctions, 28% on average of new onshore wind projects were owned by large companies. In the auctions conducted since 2018, this proportion has increased to over 36%.[13] In addition, the market share of commercial project developers has increased from 21% to 35% (Holstenkamp, 2020). In the sector for ground-mounted PV, only 17% of the capacity built before the policy change was put in operation by large companies, while in the auctions conducted since 2017, this share has increased to 55%. Very small and small companies, in contrast, had previously had 46% of the capacity but have won only 25% of the capacity awarded in the auctions since 2017 (Weiler, 2020).

In the **Australian** state of Victoria, despite dedicated measures to support small actors in a round carried out in 2017, none of these actors were successful in the auction due to fierce competition in the technology-neutral auction, and also as a result of the short lead time between the announcement and the holding of the auction (IRENA, 2019c).

The auctions for concentrated solar power in **Dubai and Morocco** were won by international project developers and utility-scale actors (del Río & Mir-Artigues, 2019).

In **Saudi Arabia**, the list of prequalified bidders for a 1.2 GW solar auction mainly consisted of industrial conglomerates, international project developers and electric power utilities (Renewable Energy Project Development Office, n.d.).

In the early renewable energy auctions held in the **United Kingdom**, large actors were also reported to have dominated bidding outcomes (Gross & Heptonstall, 2010; Mitchell, 2000).

Similar findings have been made for renewable energy auctions in **Brazil, India, Spain, South Africa, Mexico and Colombia**, where clear signs of market concentration were found. They are presented in Section 3.2.

3.2 Auctions do not promote a variety of project sizes, as the larger projects are typically successful in outbidding the smaller ones; small and medium-size projects are therefore frequently excluded

Auctions will typically steer investors towards the largest possible projects because these allow project developers to achieve higher economies of scale. Experience from jurisdictions around the world confirms that auctions have been broadly unsuccessful at encouraging different project sizes simultaneously.

13 Note that this occured despite the dedicated measures to preserve actor diversity presented in section 3.4.

Renewable energy projects can differ greatly in size. This includes small-scale solar PV systems on private roof-tops, larger-scale roof-top PV systems for commercial or industrial self-consumption, medium-scale biomass plants next to farmers, medium-scale wind projects developed by local communities consisting of only a few turbines, large-scale concentrated solar power projects on a gigawatt scale and free-standing PV projects. In fact, one of the major advantages of renewable energy technologies like solar PV is that they can be deployed in a modular way, thus allowing faster roll-out.

Previously, feed-in tariffs frequently included size-specific remuneration rates. For instance, in 2006 Portugal introduced different rates for hydro-power plants of between 10 MW and 30 MW capacity (Klein et al., 2010). Germany had four different size categories for biomass, namely projects up to 150 kW, up to 500 kW, up to 5 MW and up to 20 MW (BMU, 2004). The main aim was to reduce windfall profits for larger-scale projects while at the same time not limiting market access for small-scale and medium-sized projects.

There are numerous arguments for incentivizing a wide range of renewable energy project sizes simultaneously, including medium-sized projects:

Grid integration:
Integrating several medium-scale projects in different locations can be easier from a grid-integration point of view than one large-scale project in one location. Grid-integration costs are frequently not taken into account when comparing the costs of small, medium and large-scale renewable energy projects. Medium-scale projects can be more easily adapted to local conditions as regards grid integration and nearby consumers with load-shifting abilities.

Regional diversity and distribution:
The deployment of renewables in regions with ample land availability and more densely populated areas should be equally distributed. This will also move the installed capacity closer to the load centers, thus reducing grid losses and system integration costs. It could also increase the social acceptability of renewable energy deployment compared to the deployment of large-scale projects and their concentration in given locations.

Actor diversity
Different types of actors should be allowed access to the market (see Section 3.1). This could enable community energy projects with strong distributive and procedural fairness, facilitating the acceptance of new projects with local residents. If such projects do not need to compete with utility-scale projects, locally adapted solutions could be developed that make additional land available for new renewable energy projects, which is particularly important in countries that have already reaped the low-hanging fruit, such as the early renewable energy countries (e.g., Germany and Denmark).

Counterbalance market concentration
As outlined in Section 3.3, a focus on large-scale projects via auctions can lead to market concentration in the hands of just a few utility-scale actors and international project developers. A market segment for medium-scale projects could provide a complement to the utility-scale segment, with its inherent tendencies towards national and international market concentration and the emergence of politically powerful incumbent industries.

➤ Access to capital and local value creation:
Whereas access to capital is usually not a constraint in the so-called developed world, it is frequently a bottleneck in emerging markets and developing countries. Often, less experienced project developers active only regionally or nationally have a more limited access to finance and therefore cannot finance the very large-scale projects their larger competitors can. This puts them at a competitive disadvantage with international project developers with access to global capital markets.

➤ Speed of the transition process and effectiveness of policies:
The implicit logic of (usually location-neutral) auctions is to develop the larger scale (lower-cost) projects at the sites with the best resource conditions first and then move into medium and smaller scale projects once spaces attractive to larger-scale projects have been awarded. Policy-makers worldwide will need to increase the deployment targets for renewables many times over to comply with the objectives of the Paris Agreement (see introduction, Section 2.1). Instead of exclusively targeting the least-cost, large-scale projects first, it might be necessary to target different project sizes and different types of actor with specific policy instruments in order to incentivize the required scales of deployment.

Larger scale projects generally require lower remuneration levels due to economies of scale and other reasons (see below). While auctions are in general size-neutral, they frequently include minimum size restrictions and sometimes also maximum size restrictions. However, size-specific support for the different project categories that were previously included in some feed-in tariffs (e.g. project sizes from 1-10 MW; 10-50MW and 50MW and above) is typically not included in auction design since auction rounds with different size categories reduce the level of competition and with it the economic efficiency of this instrument. [14]

In other words, auctions typically do not incentivize different project sizes simultaneously. Size-neutral policy mechanisms like auctions will typically steer investors towards the largest possible projects because they allow project developers to achieve the largest economies of scale.[15] Large-scale projects can procure bulk equipment more cheaply, the installation per unit is usually cheaper, and operation and maintenance costs can also be handled in a more cost-effective way. Therefore, there is a higher probability of large-scale projects winning in competitive bidding.

Second, the auction process can lead to disproportionally high transaction and administrative costs for smaller and medium-scale projects.[16] The costs of fulfilling all financial and material pre-qualifications and preparing all bid documents will increase the share of auction-related costs for smaller-scale projects.

14 Poland, where auctions are organised in line with technology and project size thresholds, represents an exception in this regard (Diallo et al. 2019)

15 Micro-economic theory suggests that long-run average costs fall with increasing output (project size). In addition, after crossing a specific size/output, average costs may increase again (diseconomies of scale). However, renewable energy projects in Dubai (2000 MW) and Saudi Arabia (300 MW) indicate that diseconomies are not an important factor.

16 The analysis by Schenuit et al (2018) of Germany and the United States leads the authors to conclude that auctions "come with rather high transaction cost since they are usually quite complex in their design" (Schenuit et al 2018, p. 43).

Third, in developing countries national project developers have limited access to capital (Donastorg et al., 2017; Jacobs & Spitzley, 2018). Frequently, the only source of debt finance is the national banks, which often require shorter loan terms, higher interest rates and lower overall finance than banks from the so-called developed world that are providing the finance for international project developers. In Vietnam, for instance, national banks that provide finance for national project developers require interest rates of about 11%, whereas international project developers can access capital at rates of about 6.5% (Jacobs et al., 2018).

In short, in developing countries, national project developers could develop medium-size projects in line with their limited and more expensive access to finance. However, in size-neutral auctions they risk being outcompeted by larger-scale pro-jects from international project developers with better access to international finance. The fact that international project developers and utility-scale actors have better access to finance in developing countries – including institutional investors – is positive from a macro-economic perspective (IRENA, 2020b), but it creates a fun-damental imbalance in competitive support frameworks like auctions.

The tendency toward market concentration in the hands of international project developers is becoming apparent in several emerging markets and developing countries that have established auctions, including India (Bose & Sarkar, 2019), South Africa (Matsuo & Schmidt, 2019), Mexico (Matsuo & Schmidt, 2019) and Brazil (Grashof & Dröschel, 2018) (see also Section 3.3). If policy-makers want to establish a niche market for less experienced national project developers with limited access to low-cost sources of capital, a feed-in tariff for medium-scale projects (e.g. up to 50 MW) can be a way forward.

At the same time, small and medium-size projects (e.g. up to 50 MW) are becoming increasingly important for target achievement. This is especially true for countries with increasingly limited availability of land for project developers. This is typically triggered by high population densities, increasing competition for land, high shares of renewables and the increasing scarcity of suitable land.

In countries where larger plots of land for project development are no longer available, developers need to move to small- and medium-size projects. Land availability is already a constraint for project developers in several countries, and this is likely to increase as deployment levels increase over time:

- In **Japan,** developers of solar PV projects indicated that land availability was a major constraint.[17]
- In **Germany**, the last auction rounds for onshore wind energy were undersubscribed, partially because of land-availability constraints (FA Wind, 2019b).
- In **India**, acquiring contiguous land (with high solar or wind potential) is increasingly becoming a bottleneck (Chawla et al., 2018).

The increasing importance of medium-size projects for densely populated countries with high shares of renewables has been apparent for several years. Five years ago, their importance became evident in relation to German feed-in tariff legislation. In the case of onshore wind, 64% of the newly installed capacity was in the project size of 25 MW (i.e. 1-2 turbines) (Bundesnetzagentur, 2015). This is significantly different compared to countries that are just starting to

17 The other constraints were high financial bid deposits and grid access: see IRENA (2020 forth-coming). On renewable energy auctions in Japan, see Context, design and results, International Renewable Energy Agency, Abu Dhabi.

deploy renewables and that have fewer constraints in terms of land availability. In Mexico, the first auction resulted in an average project size of 150 MW for solar PV, and an average size of 78 MW for wind energy (Viscidi, 2018). In Vietnam, the average onshore wind project size is 84 MW (Ha-Duong et al., 2019).

Even though supporting medium-size projects with feed-in tariffs would have many advantages (open market access for smaller actors, ease (distribution) network integration, facilitating a more even geographical distribution of projects, couterbalancing market concentration and creating a niche market for national project developers in developing countries), policy-makers can of course also decide to promote medium-size projects via auctions. Especially in densely populated countries with limited availability of new land, this is already happening. In the 9th German onshore auction, 57% of all winning bids were for projects with an installed wind capacity below 6 MW. Another 31% of winning bids were for projects with an installed capacity of between 6 MW and 12 MW (FA Wind, 2019a). In Japan, the majority of solar PV projects taking part in the fourth auction round were below 2 MW capacity (IRENA, 2020a forthcoming). However, the essential question is whether the (potential) savings in remuneration levels outweigh all the advantages indicated above.

3.3 By favouring financially strong and large actors, auctions foster market concentration

While the participation of small actors in the renewable energy sector is generally acknowledged to be an important ingredient of a just and fair energy transition, small actors have difficulties entering the sector via auctions for a number of reasons. The available evidence shows that auctions lead to higher market concentrations of a few incumbent firms and international project developers, to the detriment of small or new actors.

Actor diversity can bring a number of benefits, but small actors face significant participation hurdles, as discussed in Section 3.1. This section delves further into the economic perspective, in particular with regard to the risk of market concentration processes supported by renewable energy auctions.

The efficiency and competition ("economic") argument for seeing the participation of small new entrants as beneficial to the functioning and outcome of auctions goes as follows: It is generally acknowledged that, compared to the dominance of a single actor, a diversity of different types of actors (i.e., new companies and in-cumbent ones) would increase competition, reduce the likelihood of market power and of collusive and strategic behaviour, and result in lower bid prices. This is a finding of the auction literature (Ausubel & Cramton, 2011; Klemperer, 2002), and it is also stressed in contributions that analyse the functioning of renewable energy auctions (Bayer et al., 2018; Cassetta et al., 2017; Mora et al., 2017).

Although studies of the impact of renewable energy auctions on market concentration are scarce, probably due to the lack of reliable and complete data on project ownership in most countries, the existing empirical literature suggests that auctions can indeed penalise small new bidders and favour market concentration (Schenuit et al., 2018; Bayer et al., 2018; Bose & Sarkar, 2019; Grashof, 2019 and case studies in the EU-funded AURES project, del Río, 2017).

- As reported in Section 3.1, in **Germany** the market shares of large companies and professional project developers have grown since the introduction of auctions for ground-mounted PV and onshore wind. The analysis of Schenuit et al. (2018) on Germany and the United States leads the authors to conclude that auctions "come with rather high transaction cost since they are usually quite complex in their design" (Schenuit et al.

2018, p. 43).

- In **Brazil**, renewable energy auctions have been conducted since 2007. In an analysis of the rounds conducted before 2014, Bayer (2018) did not find any evidence of market concentration. However, the three auction rounds conducted between 2015 and 2017 showed a significantly increased market concentration: nearly 80% of the auctioned onshore wind capacity was awarded to two bidders in 2015; in late 2017, the entire onshore wind capacity was awarded to one international developer based in France; and shortly afterwards three bidders – an international developer based in Italy and the subsidiaries of two incumbent utilities based in Spain and Portugal – won nearly 75% of the awarded onshore wind capacity (Grashof & Dröschel, 2018).

- In **India**, onshore wind auctions conducted since 2017 have been dominated by large companies, whereas the small and medium-sized enterprises which used to build wind farms under the previous feed-in tariff regime are unable to compete at the low price levels reached, partly due to higher costs of capital (Kannan, 2020). Bose and Sarkar (2019) show that 60% of the solar capacity that was auctioned in India between 2017 and 2018 was awarded to just four bidders. According to these authors, although the Indian renewable energy sector witnessed the entry of new actors, these were mostly large investors. "The combined share of international investors like pension funds, sovereign wealth funds and private equity funds went up from 32% in 2016 to 65% in 2019" (Bose & Sarkar, 2019, p. 772).

- in the three auctions organized in **Spain** between 2016 and 2017, large incumbents (utilities) captured a big chunk of the whole volume auctioned (40%, 3438 MW of the 8737 MW auctioned). [18]

- Between 2011 and 2014, four renewable energy auction rounds were conducted in **South Africa.** After an initially more even distribution, market concentration began to increase. Over the four rounds, the four most successful bidders in terms of capacity are all international project developers: ENEL Green Power (Italy), Mainstream Renewables (Ireland), Sun Edison (United States) and Scatec Solar (Norway) (Grashof & Dröschel, 2018; Matsuo & Schmidt, 2019).

- In **Mexico**, the three technology-neutral renewable energy auctions conducted in 2016 and 2017 led to considerable market concentration, dominated by several international developers, including ENEL Green Power (Italy), Sun-power (United States), Engie (France) and X-Elio (Spain) (Matsuo & Schmidt, 2019).

- In an auction in 2019 in **Colombia**, one bidder would have been awarded 88% of the auctioned volume, and a second the remaining 12%. Because of market concentration rules, however, the bids were not awarded and the auction was repeated, though with less strict rules on market concentration (IRENA, 2019c).

- Finally, work carried out in the AURES project focused on the design elements in auctions for renewable electricity in several EU and non-EU countries.[19] An assessment of

18 Public (official) available data on the Spanish auctions: 1st auction (January 2016, two separate auctions, wind and biomass): https://www.boe.es/boe/dias/2016/01/21/pdfs/BOE-A-2016-552.pdf; 2nd auction (May 2017, „technology-neutral", although not really): https://www.lamoncloa.gob.es/serviciosdeprensa/notasprensa/minetur/Paginas/2017/190517-energiarenovable.aspx; 3rd auction (July 2017, mutlitechnology, only PV and wind could participate): https://www.lamoncloa.gob.es/serviciosdeprensa/notasprensa/minetur/Paginas/2017/270717-energia.aspx

19 See Wigan et al. (2016) and the studies included in http://auresproject.eu/topic/wp4-empirical-aspects-of-auctions for further details.

the functioning of these auctions was carried out with reference to several criteria, of which actor diversity was a main one (together with the usual ones of effectiveness and minimization of support costs). The case studies show that small actors are usually discouraged in renewable electricity auctions.

3.4 In deterring small actors, auctions impair important conditions that support the acceptance of new projects

The further expansion of renewables, in particular onshore wind, depends on sufficient acceptance among local stakeholders and the surrounding communities. Small actors like community energy groups frequently cannot spread the risk of potentially unsuccessful bids due to small project portfolios and a weak capital base. Economies of scale are limited because the projects are generally rather small, and such actors mostly limit their search for land to a close regional area. However, well-conducted community energy projects can support local acceptance by emphasizing procedural and distributive fairness (e.g. allowing local citizens to participate in planning decisions and to invest). Such projects also permit an easier integration of local concerns and adaption to local conditions.

As detailed in Section 3.1, renewable energy auctions provide particularly comfortable conditions for large-scale actors, limiting the chances for projects developed by small-scale actors and local communities, which often entail advantages for the acceptance of new renewable energy projects (Grashof, 2019; Walker & Baxter, 2017b). This introduction explains why acceptance is relevant, how it is defined and what conditions support its emergence, after which we turn to the issue of community energy.

This is especially relevant for the sector of onshore wind, which faces increasing challenges regarding local acceptance in a number of countries, in particular when the "low hanging fruit" wind sites close to power demand and transmission lines with good resource conditions, yet far from cities and villages, have already been developed (Stegen & Seel, 2013; US DoE & Wind Vision, 2015). The term local acceptance refers to residents and stakeholders who agree with, or at least do not oppose, the deployment of a specific renewable energy project in their vicinity, in contrast to broader socio-political acceptance of certain technologies and market acceptance by consumers and investors (Wüstenhagen et al., 2007). This applies to densely populated areas, where residents might be able to block further expansion of RE. In addition, the rapid expansion in developing countries has generated numerous complaints regarding human rights, endangering the general acceptance of renewable energy across the globe: "A narrow focus on short term return on investments regardless of the harm to people and the environment has led fossil fuel companies to lose legitimacy and social licence to operate. If the same happens to renewable energy companies, it will only slow our expansion to a net-zero carbon future" (BHRRC, 2020).

Debates on acceptance for new renewable energy projects and on democratizing the energy sector converge on demands for more opportunities for participation of citizens in (renewable) energy projects, as opposed to commercial firms. Szulecki has argued that "the arguments for democratizing energy are thus both normative (increasing legitimacy and democratic meaning) and pragmatic (accountability leads to efficiency, better decisions closer to the optimal solution acceptable to a wider range of stakeholders, and a combination of expert and local knowledge)" (2018, 11). With a view to the goals of the Paris Agreement set out in the introduction and the need to reduce hurdles for (local) acceptance, our approach is here has a pragmatic motivation, without neglecting the broader political benefits of increased opportunities for civic participation. In early studies of the social acceptance of RE, the resistance of neighbours to new plants, in particular wind turbines, has often been explained by the so-called NIMBY effect,[20] that is, on an attitude based on self-interests. Today, we know that this pejorative assessment does not correspond to reality: In fact, emotional reactions are strongest when plants are near-by, both supporting and opposing new projects (Batel, 2020). While distance from wind turbines is therefore not a straightforward predictor of acceptance or opposition, participation has been found to be a crucial factor in an increasing number of studies.[21]

In the current state of research, none of the following aspects are sufficient to guarantee acceptance, but favourable conditions in some cases may outweigh a less favourable situation in others:

- **An ability to affect the outcome of the project development process (C. Walker & Baxter, 2017b) (procedural fairness).**
  Here, local neighbours can participate in decision-making on turbine siting and other important development questions, which is important, given that most of the ongoing negative impacts of wind projects are felt directly in the area around project sites (noise, loss of property value etc.) (Rand & Hoen, 2017)

- **Collective allocation of benefits (distributive fairness).**
  To be perceived as just, (financial) benefits from plant operations need to be shared transparently and locally (Walker & Baxter, 2017a). In contrast, a publicly inaccessible investment of anonymous investors or closed groups of landowners is often perceived as unfair in relation to the negative impacts neighbours cannot escape

- **Local investment.**
  If the spatial extent of the investment (as regards both decision-making and benefits) is quite local, there is a greater chance of neighbours' support than in the case of utility-scale investments (Bauwens, 2016; Baxter et al., 2020)

- **Embedding in the (historical) context.**
  Often, contingent aspects have a supportive effect, such as charismatic leaders, a tradition of locally provided infrastructure or the fact that a community is ripe for economic change. These are not easily replicable, but they help us understand why some projects thrive despite otherwise less favourable conditions (Baxter et al., 2020)

20 "Not In My Back Yard". In this explanation, renewable energy projects are assumed to be supported as long as the projects are not realized in the vicinity.

21 See the review of the global empirical research on the issue in Baxter et al. (2020).

In recent years, research on community renewable energy has proliferated, applying different definitions of the concept. Reviews have been provided by Creamer et al. (2019), Baxter et al. (2020) and an Berka and Creamer (2018). Usually, community energy projects involve citizens or a municipality developing and owning a renewa-ble energy project. The citizens are either the local neighbours of a project or have come together as a 'community of interest' (for instance, members of a national cooperative) (Baxter et al., 2020).

If well conducted, community energy projects can significantly support the local acceptance of renewable energy projects (Walker & Baxter, 2017b).[22] Conversely, an absence of local participation has repeatedly been found to explain why projects are delayed or stalled at the local level (Colvin et al., 2019) and also why acceptance falters more broadly (Lennon & Scott, 2015; Walker et al., 2018). Community energy projects can also help revitalize rural areas suffering from an exodus to more urban regions (Haf & Parkhill, 2017).

Many community energy projects share the characteristics of small actors set out in Section 3.1 that hamper successful participation in renewable energy auctions, making these actors risk-averse (Grashof, 2019; IEA-RETD, 2016a) [23]:

- They often pursue only one project at a time (or even over the lifetime of the organization), which prevents sunk costs being spread over a broader portfolio
- They mostly have a weak capital base
- The projects they realize are rather limited in size, preventing the economies of scale that larger investors enjoy
- hey often develop projects within the geographical vicinity, in contrast to larger actors, who may bid lower in auctions because of lower generation costs in areas with better resource endowments

22 Note that not all approaches labelled "community energy" satisfy the expectations they raise. In some instances, developers merely seek to use the term to gain a "temporary social license," for instance, without giving residents real opportunities to influence important development decisions (Baxter et al., 2020; van Veelen, 2017).

23 Note that community energy projects also face a number of other hurdles in many countries that are not related to renewable energy auctions, including challenges over permitting procedures, a lack of skills or a lack of negotiating power with manufacturers (Walker, 2008).

Particularly in the case of technologies with long development processes, such as onshore wind, this can result in renewable energy auctions having a deterrent effect on community energy projects, given that success in participating in a competitive auction cannot be guaranteed at the start of the project. The strong attachment of community energy groups to their projects – which is part of the explanation for a high local acceptance– explains why they would often rather not start a new project that would need to pass an auction to secure remuneration instead of risking to sell it to an 'outsider' if bidding at an auction is not successful (Grashof, 2019).

As noted in Section 3.1, renewable energy auctions are often won by large actors. A lack of data makes it difficult to determine whether there is evidence of a deterrent effect specifically on community energy projects, but some research indicates that this is indeed the case:

- In the years before the policy change away from administratively fixed feed-in tariffs in **Germany**, at least 8% of new onshore wind projects were held by locally anchored community energy groups that were open to everyone.[24] In contrast, only 3% of the capacity awarded in auctions can be attributed to this actor group (Holstenkamp, 2020). Note that this happened despite an attempt to design specific measures to preserve the variety of actors, which, however, failed and were withdrawn after one year (Weiler et al, 2020). With a view to the introduction of auctions, it has been found that "generally the small, new cooperatives and [community energy enterprises] are no longer participating with new projects, or are not even being founded, since for them the market risks are too high" (Gsänger, Karl 2019, 12).

- The **South African** renewable auction design includes provisions to achieve a contribution to local socio-economic development. In reality, however, it does not provide opportunities for local communities to influence project development decisions. In addition, the communities' influence on the local allocation of benefit funds is rather limited (Barosen, 2018, 89).

- In a case study of a nearshore auction conducted in 2015 in **Denmark**, Krog et al. (2018: 1) show "how the central administration prevents new innovative ownership models from entering the tender [leading to an] elimination of projects based on organizational structures that do not fit the definition of large energy companies".

3.5 Auctions often suffer from undersubscription, project cancellations or delays, hampering the timely achievement of renewable energy expansion targets

Many countries around the world have established targets for renewable energy deployment. The empirical evidence shows that auctions have a poor track record in achieving such de-ployment targets. Ineffectiveness refers to both the auctioned volume being undersubscribed (so-called "ex-ante ineffectiveness") and to delays and underbuilding (so-called "ex-post effectiveness"). In contrast to their image as policy instruments guaranteeing firm political control over expansion levels, auctions set maximum targets which in reality are frequently missed. Theoretically, capped policy instruments could lead to the necessary deployment of renewables if only the deployment targets and schedules were

24 In this case, community energy groups were defined as follows: 51% of the voting rights of the company lie with citizens living close to a renewable energy project, no shareholder may hold more than 25% of voting rights, and equity participation needs to be open to other local citizens at low minimum investment levels; in addition, the company is situated and active only in the region of the project.

in line with the objectives of the Paris Agreement. However, empirical evidence shows that currently deployment targets are far below the necessary deployment in line with the Paris Agreement.

More than 160 jurisdictions around the world have established targets for renewable energy deployment. Ideally, these targets are supported by policies that will allow policymakers to reach those milestones in time (IRENA, 2015). In theory, auctions have been frequently praised for allowing policymakers to meet targets more precisely, since the auctioned volume can be determined by political decision-makers.

However, there is already an abundant literature showing that the performance of auctions in terms of precise target achievement has been rather poor. This lack of effectiveness can be linked to two types of situations (del Río et al. 2015). First, there is "ex-ante" ineffectiveness when the volumes auctioned are not fully contracted. This is also called "undersuscription" (IRENA 2019). Second, there is "ex-post" ineffectiveness when the awarded bidders fail to build their projects ("underbuilding") or there are considerable delays in doing so. These two phenomena are common to auction systems and we will come back to them below.

In addition to ex-ante and ex-post issues that hamper contracting the intended capacities and having them operational in time, another aspect needs mentioning: the often low auctioned volumes. In many political debates, the risks of undersubscription and underbuilding are not acknowledged. In consequence, auction volumes are misunderstood as desired expansion rates and set at compromise levels between more and less ambitious policymakers, often in contentious debates that require much political effort to have them revised (i.e. increased) later on. The fact that the rate of undersubscription and underbuilding cannot be anticipated makes it politically difficult to agree on desired expansion levels first and add a reserve margin for ex-ante and ex-post inefficiencies later, when actual auction demand volumes are set. This is because the resulting higher auction volumes are likely to be interpreted as approval by less ambitious policy-makers for higher levels of expansion than they actually consider acceptable. Yet, with capped instruments, the consequence is a systematic tendency for a slowed expansion of RE.

In the past, a plea for the implementation of capped policy instruments has been made by some authors (Mir-Artigues and del Río 2012). The main argument behind the shift to a capped instrument is that the control of capacity expansion facilitates the control of support costs. It could also facilitate coordination of the support scheme and grid requirements in the short term, at least, provided no ex-ante and ex-post inefficiencies occur. Some countries have used this argument to apply capped policy instruments in the form of auctions or quotas with tradable green certificates or to introduce design elements in their price-based support schemes in order to cap the capacity that is eligible for support (for instance, the feed-in premium for PV in Spain under the new support scheme in 2008).

The plea for capped instruments was mostly a reaction to the strong growth in renewable electricity capacity in some countries. This was mostly related to PV in some cases, such as Italy, Spain and the Czech Republic, among others (del Río and Mir-Artigues 2014). For a more detailed discussion, see also Section 5.2.

Theoretically, capped policy instruments could lead to the necessary deployment of renewables if only the deployment targets and schedules were in line with the objectives of the Paris Agreement. However, empirical evidence shows that currently deployment targets are far below the necessary deployment in line with the Paris Agreement (IRENA 2019d). Various factors may be behind this, such as ignoring possible undersubscription and underbuilding (see above), the political influence of incumbent industries, outdated renewable energy cost data and underestimating the long-term electricity demand. In contrast to their image as policy instruments guaranteeing firm political control over expansion levels, auctions set maximum targets which in reality are likely to be missed. The combination of these two aspects —a significantly reduced need for cost control and the fact that auctions tend to miss targets that are often set too low anyway— calls for a re-examination of the merits of capped instruments.

Several reasons are behind this ineffectiveness: underbidding, a lack of coordination between the administrative, grid-connection and auction procedures, or other unexpected events, including delays in providing the equipment and the awarded winners going bankrupt.

Underbidding occurs because of aggressive bidding and a lack of auction design elements to prevent this behaviour. Some bidders may submit bids with a very small margin above their expected costs. If those costs do not evolve as expected when the project needs to be built (often a few years after the auction was conducted), the awarded bidder suffers the so-called "winners' curse" (Klemperer, 2004): the project costs are above the bid that was submitted, making the project no longer financially viable.

Not meeting renewable energy targets in time is problematic in at least three respects. First, in the case of internationally binding targets, countries may face penalty payments for not complying with decarbonization objectives. Second, delays are detrimental for the energy transition, since they mean that the benefits of renewable energy deployment are being enjoyed later than when this was deemed necessary a priori. Third, non-compliance creates a situation of unfairness, since bidders awarded in the auction who fail to build their projects are effectively blocking others who did not win but might have done so. This puts the focus on actors whose importance is frequently overlooked in energy policy-making: project developers. The term "project developer" encompasses a very heterogeneous group of actors with different motivations (Springer, 2013). In auctions with costly participation (for example, due to prequalification criteria), not all potential project developers will participate (Samuelson, 1985). As already shown in Section 3.1., small-scale and community actors will likely not participate and therefore not win auctions because of relatively high transaction costs, difficult access to finance and other reasons. Bidders with relatively high costs know they have low chances of winning and therefore will not risk losing money by developing their project and participating in the auction (Hanke & Tiedemann, 2020). Therefore, it is likely that entire groups of project developers are not taking part in auctions because they assume that they can-not win against more professional project developers with easier and cheaper access to capital. This in turn can mean that fewer project developers are scanning the land for renewable energy opportunities and therefore that deployment will not happen as quickly as it could.

As mentioned above, there is an abundant literature showing that ineffectiveness (whether ex-ante or ex-post) is a common problem in auctions. There is substantial evidence in this regard, both with respect to past auction schemes and more recent ones. Five documents have assessed auctions in accordance with several criteria, focusing, among others, on ineffectiveness in several countries: IRENA (2019c), del Río & Linares (2014), Viscidi & Yépez-García (2020), Wigan et al. (2016) and Winkler et al. (2017). All of them lead to the conclusion that delays and underbuilding are not an isolated phenomenon in auctions, but rather a widespread one. In addition, several country case studies can be found in the literature that reach the same conclusion.

Ineffectiveness was a frequent phenomenon in the early auctions, i.e., those held before 2013. Ex-ante ineffectiveness occurred in the auctions in Ireland, the **U.K., South Africa** and **Peru** (for some technologies) and ex-post ineffectiveness (underbuilding or delays) in **France, Portugal, China** and **India** (del Río and Linares 2014). Winkler et al. (2017) analysed the effectiveness of several technologies (biomass, PV and wind) in five countries (**Brazil, France, Italy, Netherlands** and **South Africa**) in different time frames in 2005-2014. This study compared the effectiveness of support schemes between countries using auctions and countries not using auctions, as well as over time. The authors concluded that "based on the existing evidence, no general conclusion can be drawn that auctions increase the effectiveness and efficiency of support, although this is the case in some of the analysed countries" (Winkler et al., 2017, p. 40) and that "effectiveness can be high in specific cases, but we did not find a general trend that introducing auctions increases effectiveness" (Winkler et al., 2017, p. 41).

In their analysis of case studies of auctions in twelve countries, carried outwith in the framework of the EU-funded AURES project (**Denmark, France, Germany, Ireland, Italy, Netherlands, Portugal, United Kingdom, Brazil, California (US), China** and **South Africa**), Wigan et al. (2016, p.9) concluded that auctions successfully contracted desired capacities in all countries except the **UK, Netherlands** and **Italy**. The case studies also showed that full project realisation was rarely achieved and that delays were frequent. The auction schemes in **China, Denmark** and **Portugal** had commissioned 100% of contracted capacities, albeit not without delays in some cases. At least 75% of projects whose realisation period had ended in **California** and **South Africa** had been built. In **Brazil, France** and **Italy**, fewer than 50% of projects whose realisation period had ended had been realized, although the authors argued that the ex-post effectiveness of these schemes could not be judged at the time because some projects were still within their realisation period.

More recently, the IRENA analysis (2019c) focuses on delays and underbuilding in several countries (**Brazil, Italy, Mexico, South Africa** and **Germany**). It shows that only 17% of all the projects awarded in the initial ten Brazilian auctions with a completion date in 2017 were built on time. In **Mexico,** "as of September 2019, only 16 of the 42 awarded projects in the first two rounds had started their power purchase agreements (PPAs), although they were all past their commercial operation date" (IRENA, 2019c, p. 42). Higher rates of project completion were observed in **Germany**'s solar PV auctions, with 65% of capacity being built on time and 23% experiencing delays. In **Italy**, IRENA (2019c) estimates that two-thirds of the projects awarded in the 2016 wind auction had already been delayed when the report was published, although 90% of the wind capacity awarded in the first auction in 2012 had already been built. 100% of the projects awarded in the first two rounds (Bid Window 1 and BW2) and 95% of those awarded in the third round (BW3) of auctions in **South Africa** have been completed. Around half of those awarded in the BW3.5 are awaiting financial closure, and all of those awarded in BW4 are under construction. On the other hand, the report provides data on the undersubscription of **Japan**'s PV auctions, which at least in the first round was attributed to "difficulties in securing land, limited system capacity and the associated hard capacity limits and strict compliance rules, specifically related to commitment bonds" (IRENA 2019c, p. 33).

In their analysis of auctions in six Latin American countries (**Brazil, Mexico, Jamaica, Peru, Chile** and **Argentina**), Viscidi & Yépez-García (2020, p. 37) conclude that "the statuses of the projects awarded in the first auctions scheduled to reach completion in each country (starting in 2015) demonstrate high rates of delays. Only a third or less of projects were completed on time in five of the six countries. The exception was **Brazil** which saw high on-time completion rates". The authors provide data on both the capacity and the projects completed on time, with percentages ranging from 0% (Jamaica) to 86% and 78% (Brazil). [25]

Three renewable electricity auctions took place in **Spain** in 2016 and 2017. The first one (January 2016) awarded 700 MW, whereas the auction in May 2017 awarded 3000 MW and 5037 MW were awarded in the last one (July 2017). Therefore, 8737 MW should have been built by December 31st 2019 (the volume awarded in the first auction had three months more to be built, i.e., March 2020). Up to our knowledge, there isn't official data on the number of MW that have experienced delays. However, different sources agree that some projects have not been built on time. According to Ledo (2020), 2800 MW were not built on time (i.e., about 32% of the total volume awarded). Roca (2020a) suggested a similar figure, indicating that the delay concerned 2400 MW (27%). More recently, however, Roca (2020b) estimates that 22 MW from the first auction and 1600 MW from the second and third auctions were delayed (i.e, 19%).

As a final example, the first year of onshore wind auctions in **Germany** (2017) is likely to lead to realization rates of less than 10% (FA Wind, 2020b). The reason were quite loose material prequalifications (i.e. no building permit required) which led to high bidding volumes and very strong competition. When participation requirements were tightened for 2018, competition declined and prices increased substantially, making it economically preferable to bid for a higher remuneration and lose the realization security deposited with the bids in 2017. While rebidding is generally not permitted, bid duplicates 2017 and 2018 could not be identified as those for the former had not necessarily been fixed to a particular location.

3.6 Contrary to received wisdom, auctions do not guarantee low remuneration levels, nor have they caused the recent cost reductions of renewables

Instead, a surge in the global deployment of renewable energy (and the associated experience curves), combined with the unprecedented decline in global interest rates, drove the bulk of the cost declines we experienced during the last decade. It is these declines that were subsequently reflected in auction results around the world.

Auctions have been frequently portrayed as being able to reduce the costs of renewable energy technologies or the support costs for renewables energy better than alternative instruments. For instance, IRENA (2017: 17) stated that "The competition in the market that is created by a properly designed auction can bring down the price of renewable energy projects more efficiently than other support mechanisms" (IRENA, 2017, p. 17).

However, other researchers stress that auctions are not drivers of cost reductions.[26] Instead, auctions mirror (expected) technology cost reductions, which in turn have other drivers (Toke, 2015).

Two factors have proved pivotal in explaining the sharp declines in the cost of renewable energy sources in recent years.[27] First, renewable energy cost reductions can be explained by learning effects, as illustrated by "experience curves". Accordingly, the costs of technologies are reduced by a certain percentage with every

25 The respective percentages of capacity and projects completed on time for the six countries are: Brazil (86% and 78%), Chile (12% and 8%), Mexico (46% and 25%), Argentina (27% and 33%), Peru (51% and 33%) and Jamaica (0% for both).

26 We are grateful to Toby Couture for an intensive and fruitful exchange on the arguments provided in this section.

doubling of globally installed capacity (Schoots et al., 2008; Wene, 2000). With each doubling of installed global solar PV capacity, Rubin et al. (2015) observes a 25% learning rate. In the case of onshore wind, a learning rate of up to 11% annually has been estimated by various studies (IRENA, 2016; Rubin et al., 2015)[28]. Here as well, annual capacity additions began to grow rapidly since the end of the 2000s, triggered by non-auction instruments (mostly, administratively fixed feed-in tariffs or feed-in premiums): New annual global (onshore and offshore) wind capacity ad-di-tions have exceeded 20 GW since 2008 and 45 GW since 2015; new solar (both photovoltaic and solar thermal) capacity has exceeded 30 GW per year since 2011 and reached almost 100 GW per year since 2018.[29] This strong growth expansion helped drive the impressive learning curve that allowed PV and wind installation costs to fall to such a remarkable extent.

A second important factor is that the rapid drop in the cost of renewables is also related to the unprecedented decline in global interest rates that has occurred in recent years. Since the 2008-09 financial crisis, global interest rates have collapsed, mainly due to the extraordinary measures undertaken by policymakers and central banks around the world (Bank of England, 2020; ECB, 2020). This decline in global interest rates has been a powerful factor in accelerating the cost declines observed in renewable energy projects around the world (McCrone, 2016; Schmidt et al., 2019)[30]. The pivotal role of interest rates and the cost of capital in influencing renewable energy costs has been widely documented.[31]

It is noteworthy that this last period of low interest rates and strong capacity expansion coincided with the rise of auctions, leading many to interpret auctions as the primary driver of the observed cost reductions. The full story, however, is more complex, with auctions playing a supporting rather than a leading role.

Many researchers and policymakers have instead focused on the impact of the choice of policy instruments (auctions versus administratively set remuneration) on support costs. In economic theory, the welfare effects of auctions and administratively fixed feed-in tariffs or feed-in premiums are identical, provided that there is perfect competition and that regulators and market participants have perfect knowledge (Weitzman, 1974). However, when marginal costs or benefits cannot be predicted correctly, the shapes of the marginal cost and benefit curves are important. Auctions or other quantity-based instruments would be preferable if these curves were flat (Finon and Perez, 2007; Kitzing et al., 2018; Menanteau et al., 2003). In practice, however, it is difficult to determine the actual shapes of these cost curves, as they depend on many factors (Held, 2011).

27 In addition, the cost of renewables depends on technological and manufacturing advances, the costs of raw materials, labour and finance, and global demand-supply balances, financing conditions and the availability of land (Grashof et al., 2020; Noothout et al., 2016; Taylor, Ralon and Ilas, 2016).

28 These types of cost reductions were observed in many other industries as well. See Grant (2005).

29 Data collected via the Statistics Time Series dashboard provided by IRENA (2020).

30 According to Schmidt et al. (2019), analysis of 133 photovoltaic and onshore wind projects in Germany over the last eighteen years shows that, in the case of wind power, lower financing costs have accounted for about 25% of the savings in electricity production costs. They show that financing costs account for about one-third of the total levelized cost of electricity.

31 For wind and solar PV, capital costs are of particular importance and strongly impacted by market risks as studied in detail, for instance, in a comparison of European member states (Roth and Brückmann, 2020).

There have been numerous empirical efforts to compare the effect of renewables' policy instruments on support costs, and in particular to compare auctions and feed-in tariffs and feed-in premiums in this regard. In a systematic review, Grashof et al. (2020) investigated the methods applied in 23 analyses of auction price outcomes provided by 17 studies. Four approaches were found, each of which has a tendency to overestimate the cost-reducing effect of auctions (the corresponding sources are referenced in the review paper; Grashof et al., 2020):

Five studies compared auction results with administratively set feed-in tariff or feed-in premium levels that applied previously in the same jurisdiction. Mostly, auction results were found to be lower, this being attributed to the competitive pressure exerted by auctions. However, administratively determined levels have also been found to decrease over time (Kreycik, Couture and Cory, 2011), demonstrating that it is too simplistic to attribute the cost reductions seen around the world simply to a shift to auctions.

Four studies compared auction results with feed-in tariff levels applying simultaneously in other jurisdictions, only one of which discussed the possibility that the outcomes may also have been influenced by differences in resource endowments, the availability of land or financing conditions. A further limitation is that feed-in tariff levels usually apply to plants realized in that particular year, whereas auction results in the same year translate into remuneration for plants that will be realized in eighteen to sixty months after the auction. In other words, auction results capture anticipated future renewable energy generation costs, not current costs.

Three studies compared auction outcomes with the ceiling prices that were fixed in these auction rounds, also coming up with the 'result' that auction outcomes are lower. From a policy formulation perspective, this is the most likely outcome, given that policymakers have a strong incentive to set ceiling prices high enough to enable substantial bid volumes, and thus, competition.

Finally, ten studies compare the results of auctions conducted at different moments in time, finding that auction outcomes decline over time. Only six of these discuss the multitude of factors that can explain this finding —including technology cost reductions, the 2008-09 financial crisis, changes in interest rates, uncertainty as regards future rounds etc.— while others interpret it as a demonstration of the cost-reducing effects of auctions.

In an endeavour to overcome these methodological shortcomings, Grashof et al. (2020) have analysed the first two years of onshore wind auctions in Germany, taking into account site-specific wind conditions, realization deadlines and a transitional feed-in tariff, which applied at the same time in the same jurisdiction.[32] Prices were found to decline first, but then to increase again over initial levels, due to a strong fall in competition after a tightening of participation requirements. With this increase, prices also exceeded the level of the transitional eed-in tariff,. In the last analysed round in 2018, the auction results were 13% higher than the parallel feed-in tariff remuneration level.

In contrast, only 9% of the capacity awarded in the first year, which had shown low price levels, has so far been put into operation (FA Wind, 2020b). Although the realization deadlines have not yet been reached, the remaining capacity is likely to be realized with awards from subsequent auction rounds where the prices were ca. 2 ct/MWh higher.[33] Accordingly, over 90 % of the capacity awarded in the first year of the auctions will most likely be lost.

The previous reflections show that, so far, neither theoretically nor empirically have auctions shown a general superiority to decrease the costs of renewables. Nonetheless, this image of auctions is widespread among policymakers and experts, as the quote in the introduction of this section illustrates. This may be due to simplified assumptions, for instance, when high competition levels are taken for granted. Another reason may be that unexpectedly low auction results often make it into the headlines of industry media (see, for instance, Borgmann, 2015; Roselund, 2014; Spatuzza, 2015; EWEC, 2020; BNEF, 2017), whereas those same media do often not report as visibly on auctions that have less spectacular results (see Grashof, forthcoming). In some instances, renewable energy auctions that did not deliver the intended low-cost results were cancelled. In India, for instance, several solar PV auctions were cancelled due to high cost outcomes (Saurabh, 2017).

In addition, auction outcomes refer to average levels of awarded bids, which translates into average remuneration levels in the case of realization rates of 100%. However, in many countries, realization rates have been found to be (sub-stantially) below 100% (see previous section). According to auction theory, lower-priced bids are more susceptible to the so-called winner's curse (Klemperer, 2004). This results in plausible underestimates of the remuneration levels that result from an auction whenever the average price outcomes are not corrected for unrealized projects at the end of the corresponding realization deadline (Grashof et al., 2020). Such a correction is generally not possible for researchers, given that the bid levels of individual projects are usually not published. At least, this situation should encourage researchers not to confuse the average price announcements of successful bids with the actual average remuneration levels awarded to realized projects.

To ensure future cost reductions of renewable energy technology, policymakers should focus on ambitious deployment targets, as is necessary for climate protection anyway. The choice of deployment mechanism is less relevant as long as this mechanism is sufficiently effective. As shown in Section 3.5, the effectiveness of renewable energy auctions in terms of timely target achievement is limited. In addition, small

32 Before the first auction round, project developers had to chose whether to stick with the transitional feed-in tariffor participate in the auctions for projects which already had a construction permit. This decision was not revisable, and accordingly the auction results were not influenced by developers still considering whether to apply for the administratively fixed feed-in tariff.

33 As one of the subsequently altered participation requirements for the 2017 onshore wind auc-tions, projects could be submitted without construction permitsonshore wind. They can therefore not be clearly identified, and new bids could be submitted for such projects in later rounds at higher price levels once the construction permits for these projects had been granted.

scale actors (see Section 3.1) and small and medium-size projects are frequently not included in or promoted via auctions. In fact, a combination of policy instruments for different market segments and actors is likely to ensure a faster up-take of renewables (see Section 4).

Alongside the focus on demand-side policies (targets), policymakers can also bring about price reductions by establishing additional supply-side support. For less mature technologies at an early stage in their commercialization, it is equally important to provide public R&D funding to drive technologies further down the cost curve (IEA-RETD, 2016b). This is shown by two-factor-learning curves, which explicitly show the impact of R&D on technology cost reductions (Kouvaritakis et al., 2000; Wiesenthal et al., 2012).

4. Potential Additional Shortcomings: Anecdotal Evidence and Need for Further Research

There are several additional shortcomings that require further research. For some of them there is only anecdotal evidence available, based on interviews. For others, the data needed to investigate these aspects further have so far been too limited.

The following hypotheses are relevant here:

- In favouring large (international) actors, auctions may hamper the creation of local value
- Auctions encourage the concentration of plants in locations with very good resources, thus potentially threatening local acceptance
- Auctions may be inefficient in promoting less mature technologies

4.1. In favouring large (international) actors, auctions may hamper the creation of local value

National or local value creation by localizing parts of the renewable energy value chain is an increasingly important objective of energy policy-making (IRENA, 2020e). While components such as solar panels or wind turbines are often manufactured abroad, plant construction and operation can create a regional market for engineering firms, specialists in environmental licensing or operations and maintenance firms. Such economic benefits may be particularly important in regions facing distress due to the phasing out of fossil fuels or other industrial changes. Research has emphasized the benefits of solar energy for local economies affected by the Fukushima accident in Japan (Ohira, 2017).

In several emerging markets, it has been observed that international project developers usually bring in their own expertise and sub-contractors. It is frequently too time and resource consuming to establish the necessary contacts with new employees and sub-contractors first and then execute projects with local experts. Even when local teams are created for particular projects, "the technical and managerial expertise remain in the home country" (Matsuo & Schmidt, 2019). Under the umbrella term 'local content', several countries have combined the introduction of renewable energy auctions with an obligation to use a minimum of locally produced components or services, as local value is broadly understood as not being created by auctions focusing on low costs only (Hansen et al., 2020). According to IRENA (2019c), this is the second most common objective when conducting renewable energy auctions, after low remuneration.

The added economic value that comes from plant construction has greater chances to remain in a project's region if locally based developers are involved. In addition, such companies may also be more inclined and better able to adapt projects to local circumstances. Given the long operating times of many renewable energy technologies, the greatest employment potential is usually in operations and maintenance, followed by procurement and manufacturing for solar PV, and by construction and installation for onshore wind (IRENA, 2019c).

- Despite official goals to create domestic renewable energy value chains, the highly competitive auctions held in **Mexico** in 2016 and 2017 did not lead to significant localization of project development, finance or component manufacturing (Matsuo & Schmidt, 2019). Instead, international developers using their own finance, and sub-contractors dominated the auctions.

- Also, the examples presented in Section 3.1 show that internationally active developers based in Western industrialised countries have won significant shares of renewable energy auction volumes in countries like **Brazil or South Africa**.

- In **South Africa**, a complex policy framework for local value creation was established under the Renewable Energy IPP Procurement Program (REIPPPP). Even though local content requirements were usually exceeded, research indicates that many independent power producers focused on the "low-hanging fruit" in the early rounds, avoiding more advanced localization approaches (SAWEA 2019, 6). Concerning employment, it appears that the majority of locally residing workers are hired temporarily, usually for low-skilled jobs, and usually only during the construction phase (WWF-SA, 2015).

4.2. Auctions encourage the concentration of plants in locations with very good resources, thus potentially threatening local acceptance

Policy instruments for renewables, as for other power-generating technologies, can be either location-neutral or location-specific. This applies to all types of policy mechanisms, including auctions, feed-in tariffs and quota-based mechanisms.

Location-neutral support frameworks provide the same incentives for power plants within a given country or jurisdiction. They provide implicit incentives to set up renewable energy plants in regions with the best resource conditions, thus increasing the overall economic efficiency of the renewable energy policy. Renewables are deployed where direct electricity-generating costs (e.g., based on LCOE) are the lowest and therefore the cost to society is reduced (IRENA & CEM, 2015).[34]

In contrast, location-specific policy frameworks provide different levels of remuneration for different regions to incentivize investment in a given region or simply to distribute new power-generating capacity more evenly. There are several reasons why policymakers might opt for locational incentives, even though this would reduce the allocative efficiency of the policy:

Public acceptance.

Although public acceptance is a multi-faceted issue, location-specific policies can help reduce public opposition, which might result from too many power projects being deployed in one region

Distribution of socio-economic benefits.

Location-specific policies can direct socio-economic benefits related to renewable energy deployment (e.g. job creation, local value chain creation, etc.) to specific regions, or simply distribute these benefits more evenly in the country

System integration.

Location-specific policies can ease the system integration of renewables because existing (or future) grid bottlenecks can be considered, and deployment can be steered into regions with remaining grid capacity, thus reducing curtailment costs

Avoid excessive remuneration in the best locations.

If the same remuneration level is provided to projects in different locations, those in the best places will receive an excessive remuneration level with respect to the costs of generation

Location-specific policy frameworks are usually implemented in countries with relatively high shares of variable renewables (to reduce public opposition or distribute economic benefits more evenly) or in countries with a relatively weak electricity-network infrastructure (to avoid grid congestion and align renewable energy de-ployment with grid-network infrastructure). For instance, France adopted location-specific feed-in tariffs for solar PV to reduce the competition for land (and resulting public opposition) in the south of the country (Jacobs, 2012). Vietnam adopted location-specific remuneration levels for solar PV to make use of the available grid

34 IRENA and CEM (2015). Renewable Energy Auctions: A Guide to Design. U.A.E, International Renewable Energy Agency.

capacity in the north of the country (Jacobs et al., 2018).

In most cases, renewable energy auctions are location-neutral. Even though it is technically feasible to include locational incentives in auctions, and there is an increasing trend to do so (see, e.g., IRENA 2019c), most auctions do not include them, yet.[35] For auctions to be successful, a high level of competition between the different bidders is required. Auctions need to be over-subscribed to deliver low prices. By introducing location-specific auctions (for different regions within a country), the level of competition will be reduced, and thus the allocative efficiency of the auction will likely be reduced. As a competition-based instrument, auctions are typically location-neutral and thus encourage the siting of plants in the locations with the best renewable energy resources, favouring concentration in given regions.

This is especially the case for wind energy because wind speeds can vary sharply within a given jurisdiction.

- In **Germany**, the top three of all sixteen provinces, Brandenburg, Lower Saxony and Nord Rhine-Westphalia, accumulated more than 50% of the newly installed wind capacity in all auction rounds between 2018 and 2020. More than 75% of the new onshore wind wind installations were in the windier north of the country, and only 25% located in the south (FA Wind, 2020a).

- Similarly, in the fourth French onshore wind auction, more than 85% of the newly installed capacity was located in only two of eighteen **French** regions (Haute-de-France and Grand-Est) (MTE, 2017).

- In **India**, a similar concentration of new onshore wind projects in resource-rich areas can be observed. Prior to the implementation of auctions in 2017, the national feed-in tariff triggered investments in seven states. In past auction rounds, new deployments only took place in two states, namely Gujarat and Tamil Nadu (Kannan, 2020).

- In **Australia**, 309 MW of the total 599.9 MW of auctioned wind capacity in the Australian capital territory was granted to three different sites of the same wind farm, the Hornsdale Wind Farm located in South Australia, leading to significant locational concentration (Buckman et al., 2019).

While the correlation between location-agnostic neutral auctions and the concentration of wind and solar PV projects in resource-rich areas is clear, the causal relationship between the density of renewable energy projects and local public acceptance is less evident. There is only anecdotal evidence for this, and research projects analysing the acceptance of renewable energy projects have not yet focused in particular on the effect of project clustering in certain regions.

Some research projects have indicated a negative correlation between the concentration of wind turbines in a given region and local acceptance of this technology. Social scientists analysing the acceptance of onshore wind in southern Germany used expert interviews to gather authentic information that can be retraced intersubjectively. Some of the statements collected from local citizens, local policymakers and project developers describe a negative correlation between the concentration of onshore wind turbines and public acceptance:

> *"In principle we believe that acceptance is correlated negatively with the number of wind turbines. This means the bigger, the more impressive and the more pressing a single wind turbine seems, the stronger are the reservations."*

35 Locational signals were included in Mexico's auctions, leading to the deployment of projects in places lacking the best wind/solar resources (1st auction). This was corrected in the second auction.

"The amount of wind turbines certainly plays a role when it comes to the loss of acceptance."
"The further away the wind turbines are, the higher the acceptance level will be." (Langer et al., 2016, p. 254)

Similarly, Wolskin argues that the visual impact of wind power on landscape values "is by far the dominant factor in explaining why some are opposed to wind power and others are supporting it" (Wolsink, 2007, p.1188). In addition, a study of Germany and France showed that acceptance of wind energy decreases with increasing visual impact (Jobert et al., 2007). A Danish study showed that "attitudes to increasing the wind capacity are significantly influenced by how many turbines people see on a daily basis": i.e. more visible turbines in daily life reduces the acceptance of new wind installations (Ladenburg et al., 2013).

However, living in proximity to wind turbines can also create a positive emotional response towards renewables, as several research projects have shown (Braunholtz, 2003; Devine-Wright, 2007; Warren et al., 2005). As indicated in Sec-tion 3.3, local acceptance of renewable energy projects is a multi-faceted phenomenon, depending on perceptions of procedural and distributive fairness. Therefore, the causal relationship between high concentrations of renewable energy projects and a decrease in public acceptance is less evident.

There is also anecdotal evidence of a negative correlation between the de facto exclusion of small-scale actors in auctions and the local availability of land for new project development. This research hypothesis is based on the following assumed interdependencies between local project-developers, local policy-makers responsible for spatial planning, and the availability of land included in local or national spatial-planning regimes:

If community projects can take part in renewable deployment through feed-in tariffs or other support frameworks that allow market access to these actor types, they can increase the pressure on local policymakers who are responsible for spatial planning to assign more land for new projects. Accordingly, the amount of land for project development as part of the local spatial-planning regime will increase.

Conversely, if projects are not developed by local communities but instead by "foreign" project developers, public acceptance will decrease decline, and there will be pressure on local policy-makers involved in spatial planning to provide as little land as possible for new project development.

A 2019 analysis in **Germany** pointed out additional factors that negatively influence the availability of new land for project development (FA Wind, 2019b):

- Many plots of land cannot be developed because of potential conflicts with aviation (4.800 MW)
- Many plots of land cannot be developed because of potential conflicts with military activities (3.600 MW)
- Many plots of land cannot be developed because of legal conflicts with opponents of wind energy (1000 MW).

4.3. Auctions may be inapt at promoting less mature technologies

The availability of a wide range of renewable energy technologies is crucial for a successful energy transition. Both mature and emerging technologies need to be supported and deployed simultaneously. A mixture of dispatchable and variable renewable energy technologies will facilitate system integration. A mixture of renewable energy technologies will enable faster scaling-up and decarbonisation of the existing energy system.

Renewable energy technologies vary in their level of maturity. The likelihood of their adoption is at least partly influenced by such maturity. This also affects the instrument or combination of instruments that could be implemented in order to support them. If they are allowed to do so, technologies generally improve over time, from least mature to most mature. [36]

Renewable energy technologies move through different stages of maturity at different moments in time. However, there might be disagreements on exactly what those stages are and in what stage a given technology currently is.

A priori, whatever classification of the level of maturity of different technologies is used, an instrument which prioritises low LCOEs can be expected to lead to less mature technologies being excluded from remuneration, which also discourages the building of a local supply chain around them, since profits are squeezed to the maximum, and the lowest cost suppliers at each stage are likely to be outside the country. The theoretical analyses carried out by Finon and Menanteau (2008), del Río and Bleda (2012) and Groba and Breitschopf (2013) support this conclusion.

Empirical analysis of this issue is nevertheless difficult. Ideally, one would like to have a large database of auctions and, for instance, a parallel database of administratively fixed remuneration schemes with feed-in tariffs to show how well less mature technologies are deployed under each alternative instrument, in order to test whether auctions perform poorly in this regard, as suggested by the theory.

Unfortunately this is not so simple, and the two databases required are not available. There is currently no empirical evidence suggesting that auctions perform worse than administratively fixed feed-in tariffs in promoting the less mature technologies. There are only some indications that auctions are probably worse than administratively fixed feed-in tariffs to promote the less mature technologies and their value chains. However, more systematic research on this topic is certainly needed.

The fact that countries do not organise auctions for less mature technologies suggests that they do not rely on this instrument to promote them due to beliefs about their ineffectiveness in this context. The least mature and/or more expensive renewable energy options, namely tidal and wave, have not been promoted in any of the technology-neutral auctions, and no auctions for these two technologies have been organized (technology-specific auctions). The least mature technologies face sev-eral barriers, which should be removed or reduced before considering their inclusion in an auction, or else they could be

36 There are many analyses showing that technologies pass through different stages over their life-times. For example, IRENA (2017) distinguishes between the research, development, demonstration, market development and commercial diffusion stages. IEA (2020a) distinguishes "Mature" (commercial technology types that have reached sizeable deployment and for which only incre-mental innovations are expected), "Early adoption" (technology types for which some designs have reached markets and policy support is required for scaling up, though competing designs are validated at demonstration and prototype phase), "Demonstration" (technology types for which designs are at the demonstration stage or below), "Large prototype" (technology types for which designs are at the prototype stage of a certain scale), "Small prototype" (technology types for which designs are at the early prototype stage) and "Concept" (applications that have just been formulated but that need to be validated) (IEA, 2020a, p. 69).

promoted using a different instrument. For example, demonstration projects can be excluded from the new renewable energy auction scheme in Spain (art. 3 of the Royal Decree 960/2020).

IRENA (2019) argues that, although most renewable energy auctions still focus on mature and cost-competitive power-generating technologies, less mature technologies have also been successfully promoted in auctions. They mention the examples of offshore wind, concentrated solar power and biomass. Similarly, IRENA (2017) claims that auctions of less mature renewable technologies have attracted interest from policy-makers and investors. Examples of this are the offshore wind auctions in Denmark, Germany and the Netherlands, bioenergy capacity auctions in Argentina and Peru, and the announcement of an auction for solar thermal power in Dubai.

However, of the 110 GW auctioned and awarded in auctions from around the world in 2017-2018, almost 90% was awarded to mature technologies: PV (57.4GW), onshore wind (39.9 GW) and small hydro (0.5GW). The volumes awarded to offshore wind were not negligible (9.7GW), but those for concentrated solar power (2.1GW), biomass (1GW) and biogas (0.07 GW) were comparatively very small. Nevertheless, it should be realized that the uptake of these technologies will not be massive anytime soon, unlike with highly mature ones, given their current relatively high costs. These technologies are very different from each other, and including them in the same "less mature technologies" category is obviously a simplification. Offshore wind cannot be deemed an immature technology (except maybe its floating type), with substantial knowledge being transferred to it from its onshore version, and very low costs being reached in some countries. Concentrated solar power is a non-standardised technology with a considerable implicit knowledge component (Kiefer & del Río, 2018; Lilliestam, 2018). In biomass, a major issue or barrier is obtaining feedstock of the appropriate quality and economic conditions, making this technology generally unsuccessful in auctions (see below). In general, auctions for those renewable energy technologies for which projects are easier to develop and standardize, such as wind and especially solar photovoltaic projects, but that may be less suited for technologies such as biomass and that require more resources to be invested and risked in the project development phase to prepare the bids, have been more successful (del Río, 2019).

There have been mixed results with respect to the effectiveness in concentrated solar power auctions, with delays and even a failure to build awarded projects in India, some delays in the last two rounds in South Africa, and good performance by Morocco. In particular, the experience in India, which was one of the first countries to use auctions to support concentrated solar power deployment, has not been good, with general delays being the norm (Stadelmann 2014). It is still too early to conclude on the effectiveness of the auctions in Dubai and South Australia (del Río & Mir-Artigues, 2019). [37]

A main distinction in this context is that between technology-neutral and technology-specific auctions, since they can be expected to provide different incentives respectively for the participation and award of less mature technologies.

There are several examples of technology-neutral auctions showing that technological diversity and less mature technologies have not been promoted.

- In **Chile**'s three technology-neutral auctions, less mature technologies were not awarded.

37 The Dubai concentrated solar power auction, which was in the spotlight for the low prices it achieved, has several specific features in terms of design elements (lenient prequalification requirements, long deadlines, no local content requirements, and long PPA duration) and local context conditions (competitive local subcontractor market, low cost of finance, and land being provid-ed at nominal costs) (del Río & Mir-Artigues, 2019).

These auctions were technology-neutral not only for renewable energy technologies, but for all electricity-generating technologies (i.e., here conventional, fossil fuel-fired technologies are competing directly with renewable energy technologies). Only solar and onshore wind were awarded (with the exception of geothermal, which in the last auction was awarded 33 MW, out of a total volume of 1533 MW).

- In **Mexico**'s technology-neutral auctions, the less mature technologies were not awarded. Technological diversity in both auctions has been low, especially in the first, when only wind and solar were awarded. In the second auction, wind and solar dominated, but there was a small share of geothermal and hydro.[38] Less mature technologies, such as offshore wind and concentrated solar power, did not participate in the auction. In the third auction, only wind and PV were awarded electricity, green certificates and capacity. CCGTs were awarded the most capacity (although not generation or CELs): 500MW out of 593 MW awarded in total.

- In the largest auction in **Spain** (May 2017), which was defined as "technology-neutral", 5 GW were awarded. The share of less mature technologies was nill. Virtually all the volume awarded went to onshore wind.

However, have less mature technologies been awarded in technology-specific auctions? These technologies could be expected to have been more successful in this type of auction. However, auctions with technology bands have shown a limited ability to promote technologies with different maturity levels, both in the past and more recently. The more expensive technologies were not promoted in the U.K. NFFO (Lipp, 2007), where waste-to-energy and on-shore wind dominated (Mitchell & Connor, 2004). No biomass-anaerobic digestion or offshore wind projects were commissioned in the Irish Alternative Energy Requirement (AER) programme (Finucane, 2005). Auctions have proved particularly ineffective in encouraging biomass. In Peru, the biomass auction was undersubscribed (low awarded volumes with respect to offered volumes). Apart from Peru, IRENA (2017) reports several biomass-specific auctions which were undersubscribed (Italy, South Africa and Brazil, although not in Spain), indicating that the auctions were unable to attract enough bidders to meet the desired demand, despite the small capacities offered in most bioelectricity auctions. This raises the question of whether biomass technologies should be rather promoted with another instrument. This is probably related to the non-standardized features of this set of technologies and their reliance on local conditions (feed-stocks), which differ across countries.

However, it is also true that, globally, offshore wind has mostly been awarded (Denmark, U.K. and Germany) in technology-specific auctions. Compared to biomass, however, this is a more standardized product that benefits, to some extent, from spillovers from its onshore counterpart and that is deployed in utility-scale project sizes by large actors. This suggests that auctions may be less suitable not only for less mature technologies, but also for less standardized, complex ones.

On the other hand, it is also clear that value chains for technologies that have become mature after obviously being much less mature decades ago have flourished under administratively fixed feed-in tariffs. This was the case for wind

38 In the Mexican auctions, three products are simultaneously awarded (electricity, green certifi-cates and capacity). In the second auctions, geothermal was awarded 1.98 TWh of electricity (for a total volume awarded of 8.9 TWh of electricity awarded). Geothermal and hydro were awarded 198,764 and 314,631 green certificates, respectively (out of a total of 9275534 green certificates).

energy in Germany, Denmark and Spain, and to some extent also for PV in Germany and Spain. Therefore, not only have administratively fixed feed-in tariffs been more effective in promoting less mature technologies, so have their value chains, as suggested by the fact that at that time wind equipment manufacturers were companies from those three countries, which all had vibrant domestic markets (Haas et al., 2004; Lauber & Mez, 2004; Lipp, 2007; Meyer, 2007). In contrast, this was not the case for the U.K. NFFO auction scheme (Butler & Neuhoff 2008).[39]

An analysis of the findings of the country case studies in the AURES project suggests that auctions have not led to the development of strong local renewable energy supply chains anywhere in the world.[40] Given the strong pressure to reduce costs, they probably lead to weak domestic industries, with countries importing a significant share of their renewable energy-related products. It may be rather the other way around: auctions are favoured by the existence of a mature market and mature value chain in a given country, which has probably been developed under an administratively fixed feed-in tariff, which work better in such contexts. This, for example, was the case for auctions of onshore wind and PV in Spain, which were implemented in sectors which had been developed under administratively fixed feed-in tariffs in the 2000s (del Río & Mir-Artigues, 2014).

Therefore, the increased maturity and cost reductions that technologies have experienced in recent decades as a result of advances along their learning curves have not been the consequence of the very limited number of auctions, but of many other factors, in which administratively fixed feed-in tariffs have likely played a very relevant role.

39 Butler & Neuhoff (2008) compared two schemes in the U.K. (auctions under the NFFO and TGCs) with administratively fixed feed-in tariffs in Germany for wind energy over the 1990-2006 period. They reached the conclusion that the German feed-in tariff achieved cheaper prices per wind energy delivered, greater competition and more deployment.

40 These case studies cover many countries from around the world, both European (Denmark, France, Germany, Ireland, Italy, Netherlands and Portugal) and non-European (Peru, Mexico, Zambia, China, South Africa, Chile, California (U.S.) and Brazil). See https://auresproject.eu/topic/wp4-empirical-aspects-of-auctions for details on each of those countries.

5. Outlook: Elements of a New Policy Mix for an Unprecedented Scale Up of Renewables

The aim of this research project is not to label auctions "bad" or "insufficient". Auctions have become an important component in the renewable energy toolbox and will certainly make an important contribution to the global energy transition in the coming decades. Nonetheless, a better understanding of the shortcomings of auctions should enable policymakers to calibrate the mixture of renewable energy policy instruments at their disposal more effectively, identify the comparative advantages of auctions and use them in particular contexts, such as supporting primarily large-scale projects. This will al low policymakers to support all types of investor, all project sizes and all renewable energy technologies simultaneously.

5.1 Shortcomings of auctions cannot simply be overcome by policy modifications

Many countries have implemented auctions and replaced feed-in tariffs wholly or partially as a result, assuming that auctions can achieve the same goals as feed-in tariffs, but in a more efficient manner. However, the assessment in sub-sections 3.1 to 3.6 shows that auctions have certain shortcomings and, therefore, limitations in reaching all policy objectives simultaneously and by themselves. While we accept that all policy instruments have their strengths and weaknesses, in this report, we focus on the shortcomings of renewable energy auctions in order to counter widespread over-estimates of their capacity to achieve their goals.

Several studies have focused on overcoming the particular shortcomings of auctions by changing and optimizing their design (GIZ, 2015; IRENA & CEM, 2015; Mora et al., 2017; World Bank, 2013). However, the empirical evidence set out in this report suggests that such failings cannot be overcome by auction design alone. Design modifications always entail trade-offs, and an attempt to overcome one deficiency will usually come at the expense of increasing another. In other cases, design modifications have simply failed to achieve their goals.

➤ Actor diversity

Policymakers in Germany have tried to preserve actor diversity by reducing the material pre-qualifiactions for community-owned wind projects. However, these design modifications were mainly used by commercial project developers, causing the government to withdraw most of them. As a result, the share of locally anchored community wind groups open to participation by everyone has more than halved since the introduction of auctions, and the larger companies have gained higher market shares than previously (Weiler et al., 2020). In Australia too, dedicated measures to support small actors in an auction round carried out in 2017 have failed (IRENA, 2019c). Part of the challenge in designing such measures lies in adequately addressing the intended market actors and not the others. In addition, the hurdles for small actors in auctions are numerous (including transaction costs, access to and the cost of capital, limited economies of scale and resource availability – see Section 3.1), increasing the difficulties in designing respective remedies.

➤ Variety in project sizes

One theoretically conceivable design modification is to distinguish between project sizes. However, such measures are typically not implemented, given that auction rounds with different size categories reduce the level of competition in the individual rounds, and with it the intended pressure on prices. In addition, economies of scale may be reduced with the inclusion of small and medium-scale projects, which increases the levelized costs of energy (LCOE) and, potentially, bid prices.

Public acceptance

With locally anchored community projects losing market shares to larger commercial developers, there is a risk that local acceptance of new projects (in particular onshore wind) will decline (Grashof, 2019). So far, to the authors' knowledge, no approach designed to maintain citizen participation has proved to work sustainably. As noted above, dedicated auction design modifications tried out in Germany have failed and were mostly withdrawn again. Similarly, South Africa's auction design requires bidders to dedicate a certain share of turn-over to finance activities related to local socio-economic development. In reality, however, it does not provide opportunities for local communities to influence project development decisions, an important factor for local plant acceptance (Barosen, 2018).

Market concentration

Seller concentration rules can be implemented to mitigate the risks of market concentration. For example, an awarded winner may be prevented from capturing more than a given percentage of the total volume being awarded. However, this may have the disadvantage that fewer economies of scale result, leading to higher LCOEs and thus higher bid prices and support costs.

Target achievement

Target achievement in auctions could be improved by implementing stricter participation requirements. In this case, projects need to be further advanced in their development before bids can be submitted (material prequalifications). Such provisions lower realization risks after the auction but also entail higher bid-preparation costs for bidders, usually reducing the number of participants and, as a result, the level of competition.[41] As a second option, financial guarantees (or prequalifications) to ensure plant realization can be set high in order to deter speculative behaviour. However, plant realization is not entirely controllable by plant developers, as a degree of risk remains even with meticulous planning. Accordingly, high financial guarantees translate into higher risk premiums, which bidders need to add to their bids, thereby undermining the aim of minimizing price levels.[42] Finally, some renewable energy auction design elements, adopted in order to set incentives against delays to and cancellations of projects that have been successful in the auction, are also likely to present additional hurdles for the entry of small-scale actors. Examples include requirements to reach a certain level of project maturity before bid submission, to provide evidence of the developer's experience and financial capacities, and to submit financial guarantees for project completion.

41 How strong this relationship is can be seen in the example of German wind energy auctions, where a tightening of material prequalifiations turned a large oversubscription into a situation where bid capacities fell below auctioned capacities within only one year, entailing a substantial increase in price outcomes (Grashof et al., 2020).

42 Other relevant design elements in this context include adopting appropriate (sufficiently long) lead times between the auction being announced and held, which allows closing the financing; implementing a schedule of auctions with a minimum number of rounds each year and setting neither too long nor too short realisation periods; including minimum prices in the auction (bids below this minimum price would not be considered); including provisions so that the cheapest non-awarded bidder can replace the non-compliance of a successful bidder with favourable conditions; and setting auction volumes above the initially considered amount under the expectation that part of the auctioned volume will not be built.

Accordingly, we argue that the shortcomings of auctions analysed in this report cannot simply be eliminated by changes in auction design. Instead, they demonstrate the need to implement a combination of policy measures (see Couture et al., 2015; IEA RETD 2016b, del Río 2014).

5.2 Shortcomings of feed-in tariffs re-visited

Administratively set remuneration schemes, such as feed-in tariffs and premium feed-in tariffs, also have their shortcomings. Feed-in tariffs and premiums were the most widely used policy instrument in supporting renewable electricity in the 1990s and 2000s. During this period, relatively few countries turned to other instruments, such as quotas with tradable green certificates or auctions.[43]

The main criticism of administratively set remuneration approaches were (Cointe & Nadaï, 2018):

1. The difficulty of setting the right tariff levels, given the well-known problem of asymmetric information
2. … leading to a difficulty in managing market growth in schemes without capacity caps
3. … leading to a difficulty in controlling the overall policy costs

These shortcomings of feed-in tariffs and premiums led policymakers around the world to re-consider policy choices and switch to auctions. However, in the past decade, several factors have changed that eliminate the shortcomings of feed-in tariffs to a considerable extent. This development re-opens the door for re-assessing their potential merits, for instance, for small- and medium-scale renewable energy projects. This is accordingly the subject of the subsequent sections.

Managing market growth in the 2000s: Strong growth of PV in some countries

In several instances, feed-in tariffs created strong booms in investments in renewable energy, leading to deployment levels that exceeded previously fixed political targets. Sudden and rapid expansions of renewable energy deployment were primarily limited to solar PV, due to the technology's modularity, consequent short lead times and rapidly decreasing technology costs during that period.

In particular, sharp increases in the deployment of solar PV were observed in several European countries lacking annual capacity caps, including Italy, Spain and the Czech Republic, among others (del Río and Mir-Artigues 2014; Cointe & Nadaï, 2018). For example, between September 2007 and September 2008 installed solar PV capacity in Spain increased almost ten-fold. The main drivers were relatively generous administratively set remuneration levels and a short-term prediction that a new regulation would provide much less favourable conditions (i.e., capacity caps and lower remuneration levels), motivating developers to realize new capacities before the policy change.

Cost control in the 2000s: The impact of high-cost PV

The strongly rising total costs of remunerating electricity from renewables in the above-mentioned countries attracted the attention of energy policy experts across the globe. What was not noted consistently, however, was the fact that the cost overruns of renewable energy programmes were primarily triggered by the deployment of solar PV, not by renewables in general. The ability to install new solar PV projects relatively quickly in combination with sharp cost reductions in

43 This was mostly due to their alleged advantages in kick-starting renewable energy markets. Alternative schemes failed in the past in terms of effectiveness, whether auctions in the late 1990s (U.K.) and early 2000s (Ireland, France) or quotas with tradable green certificates in Europe in the 2000s (Belgium, Poland, Italy, Romania, U.K. and Sweden. Mostly, administratively fixed feed-in tariffs were the instrument of choice because they provided security for investors in terms of the constant and foreseeable revenue flows they deemed necessary. This allowed such projects to be financed, with relatively low costs (de Jager et al. 2011).

short time-frames led to high increases in the total costs of remunerating PV in the countries mentioned above, costs that were then passed on to final electricity consumer. Policymakers frequently did not react in a timely manner to reduce remuneration levels in line with technology cost reductions. In many countries, this coincided with the economic and financial crisis of 2008 to 2013. In turn, this raised concerns among policymakers, who reacted by reducing feed-in tariff levels, sometimes even retroactively, as in Spain or the Czech Republic (Cointe & Nadaï, 2018; Noothout et al., 2016). This led some actors to associate feed-in tariffs with risks to general investment security (Grashof, forthcoming).

Setting tariffs appropriately in the 2000s: Limited data availability

The reason for the challenge to dynamically adapting remuneration levels to decreasing technology costs is related to the well-known problem of 'information asymmetry'. This describes the fact that information about the real deployment costs of a project is in the hands of the project developers and is not publicly available. In the 2000s, many feed-in tariffs were set on the basis of insufficient data, and even with the aim of offering higher remuneration than competing countries in order to attract more investment (Jacobs 2012). At the same time, project developers and industry associations may have exploited the incentive to use existing information asymmetries strategically in order to increase their margins. This 'information asymmetry' problem is always present with administrative remuneration setting, but it was even more problematic for a technology that was experiencing substantial cost reductions in a limited period, as was the case with solar PV in the late 2000s.

Cost control in the 2020s: Low costs of rapidly deployable PV

With key renewable energy technologies having become the least-cost options for new deployments in the last decade (BNEF, 2020, IRENA 2020c), the risk of cost overruns with renewable energy procurement programmes has been significantly reduced. Remuneration levels for individual technologies and the total resulting costs are much lower today.

In particular, the costs of solar PV have plummeted since the 2000s, limiting the potential risks of the very high total renewable deployment costs which could be caused by unexpectedly strong expansion rates. In addition, the pace of solar PV cost reductions was very rapid between 2010 and 2014, but has since slowed considerably (IRENA 2020). Other renewable energy technologies that face still higher installation costs (e.g., offshore wind energy, concentrated solar power or geothermal) have much longer lead times, meaning that unexpectedly strong market growth can be detected and controlled more easily than in the case of solar PV.

Managing market growth in the 2020s: The need for rapid growth and policies for steering (and not just limiting) renewable energy deployment

To reach the objectives of the Paris Agreement, a six-fold increase in renewable energy deployment is required. In this situation, the tendency of auctions to deliver insufficient deployment levels, described in section 3.5, might be as problematic as the above-mentioned propensity of fixed feed-in tariffs or premiums to suffer cost overruns whenever quickly deployable technologies experience rapid cost reductions.

Today, market growth in schemes with administratively set remuneration levels can be managed by applying design options like tariff degression formulae or growth corridors. These were developed by countries such as Germany, but without taking the time to evaluate their effects before deciding to switch to auctions (Grau, 2014; Leiren & Reimer, 2018). In addition, information from auctions conducted for proximate technology segments is now available to regulators (see below).

44 https://www.irena.org/costs

Table 1. Shortcomings of feed-in tariffs re-visited

	Perceived shortcomings of feed-in tariffs in the 2000s	Re-visiting shortcomings of feed-in tariffs in the 2020s
Managing market growth	• Rapidly growing shares of renewable energy capacity in countries without annual capacity caps, exceeding conservatively formulated political goals in some instances • Sharp increases in installed capacity, especially in the case of solar PV, due to short lead times, modularity and large potential for cost reductions along the learning curve which was perceived as problematic due to policy costs	• Higher market growth required due to Paris Agreement objectives • Availability of design options like tariff degression, growth corridors, etc.
Cost control	• High costs of solar PV, leading to high policy costs • The financial crisis of 2008 increased policymakers' concerns as regards the cost burdens on rate-payers • Policymakers pulled back, looking for options that allowed for stricter control of costs and market growth	• The cost of rapidly deployable technologies (solar PV) has fallen rapidly, but the pace of the cost reductions has slowed down • Solar PV and other renewable energy technologies are now least-cost technologies • Therefore, exceeding deployment targets will no longer lead to ex-cessive costs for rate-payers
Setting tariffs appropriately	• Challenges resulting from infor-mation asymmetries between project developers and policyma-kers, especially for technologies (PV) with rapidly declining costs • Difficulties to adjust tariff levels fast enough • Limited data for tariff calculation because of rather small markets	• Improved data availability due to larger national and international markets • Data collection effort by IRENA and research institutes • Availability of auction results to inform tariff-setting • Improved implementation of auto-matic tariff reduction elements

Source: authors

The high levels of investor security associated with feed-in tariffs can help contribute to the necessary scaling-up of renewables. What was seen as a disadvantage of feed-in tariffs and premiums at the end of the 2000s, due to the risk of rapidly increasing costs for rate-payers, can now become a major advantage of this policy instrument at a time when renewables are the least-cost option for new deployment.

Setting tariffs appropriately in the 2020s: Benefiting from improved data availability and information from auctions

Data availability regarding the cost of renewable energy projects (including specific cost components) has increased widely over the past decade. Today, international organizations like IRENA and research institutes like the Berkeley Lab collect and publish world-wide cost data for various renewable energy technologies, thus improving the basis for administratively fixed remuneration levels. The IRENA Renewable Cost Database, for instance, contains around 18 000 utility-scale renewable power-generation projects and 11 000 PPA and tender results.

At the same time, a parallel use of auctions and feed-in remuneration for different market segments can mutually enhance the policy design of both instruments. On the one hand, auction results can provide the additional data required to determine feed-in remuneration administratively. On the other hand, administratively set feed-in tariff levels can be used in auction design, e.g. as a ceiling price for future auction rounds.

5.3 Overcoming the old dichotomies: Combining auctions with feed-in tariffs in more innovative ways

Overcoming the old dichotomies of auctions versus feed-in tariffs is crucial. Understanding the shortcomings of auctions should enable policymakers to use both support instruments in parallel for different market segments. This can allow policymakers to support all investor types, all project sizes and all renewable energy technologies simultaneously.

Creating an additional market segment based on medium-sized projects (remunerated via feed-in premiums or feed-in tariffs) can have a number of potential benefits (as discussed in section 2.3):

- Easing grid integration
- Fostering regional diversity and distribution of projects
- Enhancing actor diversity and public acceptance
- Counterbalancing market concentration
- Easing access to capital for regional actors and increasing local value creation
- Increasing the speed of renewable energy deployment

Therefore, we propose to use different instruments for different market segments:

- Continued use of auctions for large-scale projects
- Use of feed-in tariffs or feed-in premiums for small- and medium sized projects
- Use of self-consumption policies for very small-scale projects

This is only a starting point for a debate we deem necessary. Other criteria may also be appropriate in determining the relative suitability of feed-in schemes or auctions, such as the intended degree of local participation, the level of transaction costs for particular projects, instances where the application of renewables is mandatory (for instance, on the rooftops of new buildings) or other aspects.

It should be realized that combining different instruments for clearly differentiated market segments may produce problems in terms of strategic sizing or categorisation and therefore require an appropriate calibration of participation requirements. For example, the coexistence of auctions and feed-in tariffs was problematic in France for auctions organized before 2009. Power producers could either receive a feed-in tariff or participate in the auction. According to Lairila (2016, p. 34), "the feed-in tariff level appeared to set the minimum price for the bidders, as no one wanted to bid for a worse price as what they could receive. This resulted in too high bidding prices and the auction round was cancelled". Another example is Japan, where solar project developers decided to benefit from the relatively high feed-in tariff for projects under 2MW, instead of bidding in the auctions for projects above 2MW (Arias, n.d., p. 60). However, the advantages of running feed-in tariffs (for small- and medium-scale projects) and auctions (for large-scale projects in parallel) will likely outweigh these challenges.

5.4 Meeting multiple policy objectives simultaneously by combining auctions and feed-in tariffs

Governments around the world usually have several energy policy goals to which renewable energy deployment can substantially contribute. These policy goals include effectiveness (meeting renewable energy deployment and climate targets), efficiency (minimisation of support costs/least-cost procurement or minimisation of system electricity costs), dynamic efficiency (technological development, long-term cost reductions), actor diversity (including favouring energy communities), local socioeconomic impacts, and development of a national value chain[45] (del Río et al. 2012).

5.4.1 Increasing effectiveness: Meeting ambitious deployment targets on time

One of the main reasons for implementing auctions in several countries was to provide better 'control' of market growth (see Section 5.2). Despite this neutral term, an important aspiration of many policymakers had been to set a firm upper limit for annual capacity expansions (Grashof, forthcoming). The evidence discussed in this paper, however, shows that reaching even these upper limits is frequently not guaranteed. Auctions have had problems in the past in ensuring the timely deployment of renewables because of insufficient bid volumes, delays in the realization of projects and project cancellations (see Section 3.5).

Accordingly, we can question whether a capped policy instrument, like auctions, can trigger the required scaling up of renewables. A critical element for renewable energy auctions to create price competition and deliver low-cost projects is that the supply of potential projects (bids) exceeds the auctioned (demand) volume in each auction round (Klemperer, 2002). To achieve this objective, the supply of pre-developed renewable energy projects needs to be sufficiently high (Hanke and Tiedemann, 2020). In the future, this might not be the case in countries with high

45 Furthermore, the fact that renewable energy technologies face several barriers in addition to differential costs with respect to their competitors, including risks for investors and problems of access to financing, should be taken into account (de Jager, 2011). Auctions, like other demand-pull instruments, cannot mitigate all the barriers to renewable energy technologies by themselves.

competition for land, high population densities and increasing acceptance challenges, such as in Germany with onshore wind since 2018 (Grashof et al., 2020).

Therefore, a combination of capped auctions with uncapped or flexibly capped feed-in tariffs can be a solution to balancing the advantages and disadvantages of the two approaches.[46] Feed-in tariffs that include 'breathing caps' with annual deployment corridors or the option to transfer surpluses or deficits of capacity installed in a given year to another year (borrowing/banking) merit a closer look in this regard, as renewable energy markets typically do not grow linearly.

5.4.2 Increasing project size diversity: Supporting small, medium, and large-scale projects simultaneously

In the past, renewable energy policies have frequently addressed either small-scale (roof-top) projects or large-scale, utility-sized projects (Couture et al., 2015). Using different policy instruments for different renewable energy project sizes is not a revolutionary approach. More recently, small-scale projects have often been targeted by feed-in tariffs or net metering, and large ones by auctions. Larger scale projects usually require lower remuneration levels due to economies of scale, and therefore auctions generally tend to incentivize the largest types of project possible within the band of project sizes that can be submitted to them. Accordingly, the implicit logic of auctions is to develop the larger scale (lower cost) projects at the sites with the best resource conditions first, and only move into smaller scale projects once attractive locations for larger scale projects have been taken.

As a result, renewable energy auctions usually do not reach an increasingly important project category: Medium-size projects. This size category can provide important benefits, in addition to deploying both small and large projects:

- Access to additional land for new projects, for instance, in the case of smaller areas of land, and scattered ownership or a general scarcity of land because of already high installed capacities of renewables
- Easier adaptation of projects to non-standard local conditions
- Broader geographical dispersal of grid connections, compared to connecting fewer large-scale projects, potentially resulting in lower medium-term costs for grid integration
- If such projects are realized by a broad variety of actors, the risks associated with market concentration are reduced; such risks are becoming apparent, for instance, in the case of certain renewables markets in developing countries (see section 3.3)
- Higher market shares for domestic or regional actors (as opposed to large developer companies working in many regions) can produce benefits for local value-creation and regional development

46 Fully uncapped frameworks can lead to boom-and-bust cycles (e.g., PV in Spain between 2007 and 2009) (del Río & Mir-Artigues, 2014), while a boom in a given year may reduce the social acceptability and political feasibility of the whole policy instrument for renewable energies.

5.4.3 Increasing actor diversity: Activating investment from all potential stakeholders

We have not found any evidence that auctions have been able to sustainably promote a diversity of actors or the inclusion of community actors in at least one country or market segment thus far. Some changes in auction design have been proposed to encourage actor diversity, particularly participation by small actors.[47] However, even with modifications to auction design, the empirical evidence presented in sections 3.1 and 3.3 suggests that auctions have tended to award bidders in certain actor categories, such as utility incumbents and project developers that are active nationally or even internationally. In many instances, this has lead to market concentration processes.

There is widespread evidence that feed-in tariffs have been able to promote actor diversity and the participation of community projects in a number of countries, although not necessarily everywhere (Grashof, 2019). Establishing a feed-in tariff for small and medium-sized projects can enable market access for small-scale actors. This in turn could also increase acceptance locally by increasing procedural and distributive fairness, thus enabling a local investment scale and/or the adaptation of projects to local contexts.

5.4.4 Increasing static efficiency: Keeping short-term prices low

Auctions are usually adopted due to their expected cost-efficiencies. Auction theory has emphasized the efficiency benefits of procurement auctions, such as those conducted to promote renewable energy installations. Indeed, in many markets, auctions have resulted in low remuneration levels for large-scale projects (Mora et al., 2017).

However, it would be short-sighted to assume that the selection of a certain policy instrument will by definition lead to cheaper procurement. Other aspects in the policy framework, e.g. de-risking policies and cheap access to capital, are also very important drivers, as shown by several analyses carried out for different types of technology (e.g., Frisari and Stadelmann, 2015; Labordena et al., 2017; Schinko and Komendantova, 2016 for concentrated solar power). In addition, and despite the expectations of governments, our research presented in section 3.6 shows that auctions have not always led to remuneration being minimized with respect to alternative instruments, including feed-in tariffs.

Combinations of auctions and feed-in tariffs or feed-in premiums can help increase the efficiency of remunerating renewable energy projects. This can be done, for instance, by running auctions and feed-in tariffs in parallel for different technologies (mature vs. less mature) or market segments (large vs. medium/small).

Feed-in tariffs have frequently been criticised for setting tariffs that are too high or too low because of prevailing information asymmetries between project developers and the regulators who calculate the tariff and because of rapid technological learning. Yet, as explained in section 5.2, a number of options are available today to mitigate the associated risks. Thus, the price outcomes of auctions in some market segments can be used as an input factor to determine the remuneration for administratively set feed-in tariffs or feed-in premiums in other segments, provided that the two segments are sufficiently comparable. Remuneration levels can also be linked to past installation levels (as in systems using 'breathing caps') or other important factors such as global price indices and interest

47 As suggested by Steinhilber & Soysal (2016, pp. 9–13), these include focusing bidding requirements more on projects (e.g., requiring a building permit) than on bidders' previous experience or financial capabilities; taking into account other criteria in addition to price in awarding contracts in the auction; pre-determining award contingents for small actors; adopting more favourable pricing rules for smaller actors paying remuneration according to the uniform pricing rule instead of pay-as-bid; setting maximum project sizes; limiting the economies of scale which mostly large actors can reap; lowering minimum project sizes to include those usually pursued by smaller actors; and setting market concentration rules that limit the capacity or number of successful bids per bidder.

or exchange rates. If not done well, combining feed-in tariffs or feed-in premiums and auctions can fail, in particular when access to feed-in tariffs and the obligation to secure remuneration in auctions are not clearly separated. This does not exclude such approaches, but they should rather be the object of careful policy formulation.

5.4.5 Increasing dynamic efficiency: Keeping an eye on the long-term costs of the energy transformation

Empirical studies have shown that private RD&D investments are an important side-effect of deployment policies (Rogge et al. 2011, Watanabe et al. 2000, Johnstone et al 2010). However, deployment support is no substitute for public RD&D support. Rather, they complement each other and should therefore be coordinated (Popp, 2010).

Deployment feeds back into RD&D for two interrelated reasons: the existence of a stable market outlook for renewable energy technologies (Watanabe et al. 2000), and the existence of an income surplus for renewable energy generators that they can share with RES-E manufacturers, thus allowing the latter to invest in RD&D (Finon and Menanteau 2004). The existence of such an influence has been suggested by Menanteau et al. (2003) on theoretical grounds and empirically demonstrated by Butler and Neuhoff (2008) for the UK and Germany.

There is a common presumption that auctions lead to innovation (Haufe and Ehrhart, 2015; Bode and Groscurth, 2013). It is argued that the competition between project developers encourages (short-term) cost reductions, which in turn will have a positive effect on innovation. However, this is only part of the story. If auctions fail to be as effective as other instruments—and our research shows that they have deficiencies here – then they may be less successful than alternative instruments in activating the afore-mentioned market-creation effect. The impressive cost reductions of renewable energy technologies experienced in the 2000s and later can hardly be attributed to quantity-based instruments such as auctions and quotas with tradable green certificates. They are probably much more closely related instead to advances along their learning curves facilitated by administratively set feed-in tariffs and feed-in premiums (see section 3.6). In addition, the competitive pressures exerted by auctions are likely to reduce profit margins compared to administratively set feed-in tariffs or feed-in premiums and, as a result, reduce private R&D investments as well (Finon and Menanteau 2004). Both effects suggest that auctions will induce less innovation than administratively set remuneration schemes, except for finding ways to reduce short-term costs.

5.4.6 Increasing local and national value creation: Domestic industry development and local value creation

Creating a national industry and localizing parts of the renewable energy value chain has become an important objective of many policymakers, especially in the so-called developing world. In emerging markets, which did not have the time to establish a national industry in recent decades, while renewable energy value chains were maturing elsewhere, the implementation of auctions can lead to a situation in which new national actors cannot beat the low bids of experienced and potent international project developers. Policymakers can establish an additional market segment by focusing on medium-scale projects with remuneration based on feed-in tariffs or feed-in premiums, to be realized by local domestic actors.

48 A recent example of this combination of instruments has been suggested for Spain. The recently published Royal Decree 960/2020 on the economic regime for renewable energy projects in Spain leaves open the possibility of exempting small-scale and demonstration projects from an auction but using the results of auctions conducted until 2030 to set the remuneration for such projects (art. 3).

Beyond the objective of reducing remuneration in the short term through auctions, this approach can help establish regional or national industries by localizing parts of the value chain. The fact that strong supply chains for renewable energy technologies were created in the past in countries using administratively set feed-in tariffs is a relevant argument here.

5.5 The EU perspective: Allowing more flexibility in the choice of policy instruments

The current legal framework, and especially the European Commission's state aid guidelines for environment and energy, places unnecessary barriers on the choice of support schemes, with potentially detrimental impacts on the deployment of renewable energies. Establishing one default policy instrument – in this case auctions – might make sense from a state-aid and internal-market perspective. However, it makes less sense from an energy and climate policy perspective, as member states operate in very different contexts and are at different stages of the energy transition.

The 'dogma' of prevailing auction support schemes no longer fits with the EU's need to change energy systems because of the climate emergency. For example, some countries have ample space for new projects, whereas in other countries land availability is becoming an increasingly important barrier. Some member states have a tradition of community-based renewable energy deployment, whereas other countries do not. Member states also differ in population densities (a higher population density increases the competition for land) and already installed capacity (high shares of existing renewable energy capacity increase the difficulties in identifying appropriate plots of land for new development).

Partly reflecting these national circumstances, policymakers also have different energy policy preferences. For countries with high population densities, increasing competition for land and increasing public acceptance issues, it will be crucial to implement policies that allow for the deployment of medium and smallscale projects combined with community ownership. In countries with ample land availability, cost-effective deployment based on very large-scale projects might be the way forward.

In order to remain aligned with the objectives of the new Green Deal, the climate law, REDII and all the other legislative and policy changes that have been introduced in recent years, these support schemes must adapt and evolve. It has been made clear that, in times of crisis, EU institutions, and particularly the European Commission, have found novel and flexible solutions, such as with the COVID-19 crisis. However, it is the climate emergency that is the greatest crisis facing humanity, making it crucial to adopt the established solutions as quickly as possible. This, of course, includes renewable energy deployment throughout the EU.

In view of this urgency, member states should rethink their support approach and try to choose the Public Service Obligation approach, stressing in particular that citizens, community projects and small and medium-size projects generally are delivering public services by rapidly rolling out types of renewable energy. Using such an approach, the whole support mechanism could fall outside the state-aid regime. Legal clarity in the EU framework would also help to avoid member states pre-emptively treating their programmes as state aid even when they do not qualify for it, as was the case in Germany. Such clarity would not only help the public sector, it is also necessary to attract private investments aimed at long-term projects.

As outlined further in the Annex (6, below), numerous possible measures exist to improve the current framework for state aid ensuring access by small and medium-size enterprises and community energy projects that are politically realistic and quick to implement. This change can take the form of a revision to the current state aid guidelines, allowing member states to deviate from the obligation to use auctions, which is restricting renewable energy development and as a result delaying crucial climate protection. Member states should have greater flexibility in implementing support schemes that correspond to their country-specific characteristics (geographically or policy-wise) when identifying which renewable development pathway is the most promising. The public service or general economic approach under the EU treaties, which enables models without state aid elements, might be one way forward.

6. Annex: A New Support Policy for Renewable Energy and Related Energy Transition Policies for EU 27 in View of the Climate Emergency: A Legal Reflection by Dr. Dörte Fouquet

6.1 Introduction

The following analysis argues for the re-introduction of greater flexibility in the way the European Commission (EC) allows EU member states to design support mechanisms for citizens' energy projects, renewable cooperatives and small and medium size projects, as well as renewable energy projects more generally.[49] It briefly discusses the increasing environmental imperative under the climate emergency and the environmental imperative under the EU treaties, drawing on lessons regarding the emergency support response instruments of EU institutions. It also outlines the legal possibilities for a new approach, leaving aside the rigidity of the current scrutiny of state aid, that is, the existing but just extended guidelines on State Aid for Energy and Environment, first issued in 2014 (EEAG 2014-2020). [50]

In the European Union (EU), and in light of the climate crisis, some policies and programmes are moving ahead with the overall goal of achieving next to no greenhouse-gas emissions (GHGs) in the EU by 2050. Under the heading of the 'New Green Deal', the current EU Commission, led by President Ursula von der Leyen, has come up with a set of ambitious draft legislation and financing mechanisms. Several climate action initiatives were put forward as first initiatives, which will be followed by further legislative proposals in 2021. The first action items of the European Commission focused especially on the legislative proposal for the first European Climate Law. Encouragingly, after the publication of its first proposal for a Regulation of the European Parliament and of the Council establishing a framework for achieving climate neutrality and amending (Governance-) Regulation EU 2018/1999, first issued in early March 2020, in September 2020 the EC amended its proposal in order to ensure a coherent path towards climate neutrality by 2050. [51]

In September 2020, the EU agreed a new financing mechanism to support renewable energy projects, following the options under Art. 33 of the current so-called Governance Regulation.[52] Member states can collectively benefit from renewables projects funded in a different EU country through tenders using this new EU-wide

49 In this chapter, small and medium sized renewable Energy projects are defined as projects up to a limit of 10 MW for most renewable technologies and for wind energy for up to 10 turbines with a capacity which will be the standard within the period of the next 5 years. As all bigger turbine suppliers have this design already today in their portfolio, this standard size per turbine is seen at 6 MW. These project sizes are also within the possible limit that medium sized companies can realise. In the past, (including in the EEAG 2014-2020) capacity of up to 1 MW for most renewable technologies with the exemption of wind power, where 6 turbines of an average capacity (at that time 3 MW) were considered an appropriate limit by EC/DG COMP for small projects, where MS had no obligation to use tendering systems only. Due to climate urgency and technology development, these thresholds should be raised.

50 A Communication from the Commission, 08.07.2020, COM 2020/C 224/02 provides direction by enshrining the EU 2050 climate-neutrality objective in legislation, thus increasing certainty and confidence in the EU's commitment, as well as transparency and accountability.

51 The original proposal stated that by September 2020 the Commission would present an impact assessed plan to increase the EU's greenhouse gas emission reduction target for 2030 to at least 50% and towards 55% compared with 1990 levels in a responsible way, and that the Commission would propose to amend the proposal accordingly. This was reflected in Article 2(3) and Recital 17 of the initial Commission proposal. The 2030 Climate Target Plan demonstrates that increasing the EU's emission reduction target for 2030 to at least 55% is both feasible and beneficial. With a view to achieving climate neutrality in the EU by 2050, it is therefore proposed that the EU's greenhouse gas emission reduction target for 2030 be increased from 40% to at least 55% compared with 1990 levels, including emissions and removals. This proposal modifies the initial Commission proposal (COM(2020) 80 final) to include the revised target in the European Climate Law."; see Amended Proposal for a Regulation of the European Parliament and of the Council on establishing a framework for achieving climate neutrality and amending Regulation (EU) 2018/19999 (European Climate Law), COM (2020) 563 final pf 17.09.2020, p. 1.

52 Regulation (EU) 2018/1999 of the European Parliament and the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No. 663/2009 and (EC) No. 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council. See Art. 33: 'Union renewable energy financing mechanism: 1. …

financing mechanism[53], a new set of rules for which will be in place by 2021. This mechanism will act as an autonomous financing tool to speed up the penetration of renewables in the total EU energy mix, rather than merely filling gaps in the achievement of EU or national RES targets. This new instrument will again need a rapidly working application framework, including modernised state aid guidelines that allow speedy reaction and support to these new mechanisms. Otherwise the member states should choose an approach under the common interest rules of the TFEU, which will be outlined below. It is acknowledged throughout the EU that the renewable energy sector will play a crucial role in reaching the decarbonisation goal. The urgent calls for a more rapid switch to renewables, energy efficiency measures and the phasing out of coal and fossil fuels are increasingly being supported by civil society, politicians and scientists alike.[54] The conclusion of the scientists is clear: 'In other words, warming must be limited to 1.5 °C. This requires an emergency response.'[55]

In November 2019, by a strong majority the European Parliament (EP) passed a resolution declaring a global Climate and Environmental Emergency in the European Union.[56] Many, including members of the EP, understand this Resolution as constituting an appeal alone and not being able to trigger any legal or policy consequences at the EU or member state level. This view would appear to be formally correct if it were regarded as a single, independent event with no direct legislative follow-up from the Resolution and no direct constitutional obligation for the European Commission to translate this Resolution into specific actions. However, recognition of the urgency of our climate crisis, as outlined so clearly by EU institutions, such as the European Commission with its Green Deal programme, needs to be translated into ana comprehensive fast-track procedure. All possible obstacles at the national and EU level need to be reviewed.

Since 2014, the roll-out of independent small and medium size projects locally and regionally has been hindered particularly by the conditions laid down under the current State Aid Guidelines for Energy and Environment. Unfortunately, these guidelines are preventing fast-track renewable energy programmes for independent renewable power projects, despite the fact that the EU treaties stress the importance of environmental protection as a fundamental right. Therefore, it is necessary to review the guidelines so as to correct a certain conditional tendering request to re-implement a clear and positive enabling framework for renewable energy projects in

… By 1 January 2021, the Commission shall establish the Union renewable energy financing mechanism referred to in point (d) of Article 32(3) to tender support for new renewable energy projects in the Union with the aim of covering a gap in the indicative Union trajectory. Support may be provided, inter alia, in the form of a premium additional to market prices, and shall be allocated to projects bidding at the lowest cost or premium. 2. Without prejudice to paragraph 1 of this Article, the financing mechanism shall contribute to the enabling framework pursuant to Article 3(4) of Directive (EU) 2018/2001 with the aim of supporting renewable energy deployment across the Union irrespectively of a gap to the indicative Union trajectory. To that end: (a) payments from Member States referred to in Article 32 may be complemented by additional sources, such as Union funds, private sector contributions or additional payments by Member States in order to contribute to the achievement of the Union target; (b) the financing mechanism may, inter alia, provide support in the form of low-interest loans, grants, or a mix of both and may support, inter alia, joint projects between Member States in accordance with Article 9 of Directive (EU) 2018/2001 and Member States' participation in joint projects with third countries referred to in Article 11 of that Directive. 3. Member States shall retain the right to decide whether, and if so, under which conditions, they allow installations located on their territory to receive support from the financing mechanism.'

53 For the details of the new finance programme, see: https://ec.europa.eu/energy/topics/renewable-energy/eu-renewable-energy-financing-mechanism_en .

54 A comprehensive comment by scientists, just one of many examples of such a warning, is included in Nature, November 27, 2019 (with a correction of April 9 2020: Timothy Lenton, Johan Rockström, Stefan Rahmstorf, Katherine Richardson, Will Steffen and Hans Joachim Schellnhuber, 'Climate tipping points – too risky to bet against'; https://www.nature.com/articles/d41586-019-03595-0 .

55 See previous footnote.

56 The resolution was passed by a vote of 429 to 225, with 19 abstentions.

general, and especially citizen projects, co-operatives and other small and medium size local projects. The following analysis will also consider interim solutions until new European Commission guidelines are in place, and more importantly to call on member states to develop mechanisms relevant to the climate emergency outside the EU's state-aid rules. The EU treaties will act as the legal backbone in achieving the targets set out by the climate crisis.

6.1.1 The environmental imperative under the EU Treaties

During the last decade, the environmental protection objective and sustainable programming of EU policies have increasingly been accepted into all European Treaties, with the exception of the Treaty establishing the European Nuclear Economic Community (EURATOM).

The **European Charter of Fundamental Rights**[57] gives environmental protection a clear footing on the fundamental rights agenda. Article 37 of the EU Charter states: *'A high level of environmental protection and the improvement of the quality of the environment must be integrated into the policies of the Union and ensured in accordance with the principle of sustainable development.*

The **Treaty on European Union**[58] (EU Treaty) repeats this exact wording in its preamble. Article 3 of the EU Treaty further stipulates:

'1. The Union's aim is to promote peace, its values and the well-being of its peoples.

2. The Union shall offer its citizens an area of freedom, security and justice without internal frontiers, in which the free movement of persons is ensured in conjunction with appropriate measures with respect to external border controls, asylum, immigration and the prevention and combating of crime.

3. The Union shall establish an internal market. It shall work for the sustainable development of Europe based on balanced economic growth and price stability, a highly competitive social market economy, aiming at full employment and social progress, and a high level of protection and improvement of the quality of the environment. It shall promote scientific and technological advance.'

Environmental policy is now listed as an element in the completion of the internal market under Article 114(3) of the Treaty on the Functioning of the European Union (TFEU). Article 194 TFEU, the legal basis for the adoption of measures in the field of energy, requires EU policy to be exercised with respect to preserving and improving the environment, as well as promoting energy efficiency and energy saving, especially underlining the development of new and renewable forms of energy. Moreover, under Title XX, the TFEU contains a specific chapter on environmental policy. Its Article 191(1) calls the European Union to contribute to:

- preserving, protecting and improving the quality of the environment;
- protecting human health;
- prudent and rational utilisation of natural resources; and
- promoting measures at an international level to deal with regional or worldwide environmental problems, in particular combating climate change.

57 Abl. EU, C 202/393 of 7. 6. 2016.

58 O.J. C 202/15, 07.06.2016.

To attain these objectives, the following principles apply. Measures should be adopted on the basis of:

- the highest level of protection, taking into account the diversity of situations in the various regions of the European Union;
- the precautionary principle;
- preventative action;
- environmental damage should as a priority be rectified at source; and
- the polluter pays principle is to be observed.

6.1.2 The international climate obligation

During the UN COP 21 in Paris in December 2015, EU member states committed themselves to limiting global warming to well below 2°C above pre-industrial levels and to pursue efforts to limit the increase in average temperatures to 1.5°C.[59] In its Communication in the run-up to the UN climate summit in Katowice (COP24), in November 2018 the European Commission re-stated that the EU must achieve carbon neutrality by 2050 and presented a long-term strategic vision for reducing greenhouse gas (GHG) emissions, showing how Europe can lead the way to climate neutrality by evolving an economy with net-zero GHG emissions framework.[60] The Commission further states: 'Only by limiting global temperature increase to 1.5 °C could the world avoid some of the worst climate impacts and reduce the likelihood of extreme weather events. Immediate and decisive action on climate change is therefore necessary.'[61] Recently, the European Commission has presented a comprehensive plan to increase the EU's GHG

The European Commission's vision outlines seven main strategic priorities in its strategy, including to:

• maximise the benefits of energy efficiency, including zero-emission buildings;

• maximise the deployment of renewables and the use of electricity to fully decarbonise Europe's energy supply;

• embrace clean, safe and connected mobility

If we take this 1.5°C window seriously, strong public policies, huge investments and major changes must take place in the whole economic framework of the EU and its member states. The Commission, in the above-mentioned report, on the one hand stresses the potential employment gains of the green economy, while on the other hand underlining the losses for certain industries, especially coal and other fossil-fuel industries in the EU.[62]

59 For text of agreement, see https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf .

60 EU Commission, 'Going climate neutral by 2050, a strategic long-term vision for a prosperous, modern, competitive and climate-neutral EU Economy'.

61 See previous footnote, p. 5.

62 See inter alia in the above communication the following outline by the EC (p. 17): 'Green jobs represent around four million EU jobs. Policies implementing the EU's 2020 energy goals have already added 1-1.5 % to the EU's labour force and moving to a climate-neutral economy will further spur job growth. The EU's Energy Union policies, including the new 2030 targets, are expected to create more new and high quality jobs, given the investment needs that have been highlighted for industrial modernisation, energy transformation, the circular economy, clean mobility, green and blue Infrastructure. While there will be an increase in job opportunities for some sectors, for example construction or renewable energy, some regions could be affected if they depend on activities that will decline or transform, such as coal mining, oil and/ or gas exploration. Other jobs will need to be transformed and adapted to this new economy. The transition will also be shaped by a shrinking and ageing labour force, as well as increasing substitution of labour due to technological changes.'

6.1.3 The neglect of low-hanging fruit in climate action planning in the EU

Unfortunately a major backbone of the energy transition, the local projects and established small and medium size projects of independent producers, which were the backbone of all progress with renewable energy in the EU, often secured by sound feed-in support mechanisms, are no longer being encouraged within the EC's current scrutiny of state aid. On the other hand, even bigger projects are being endangered or delayed due to the uncertainties caused by tendering systems, especially in the case of different bidding conditions for citizen projects submitted without advanced planning and authorisation status versus traditional renewable energy projects.

This is fairly well-documented for the German market, for example.[63] There, the auctioning system created a distortion which ultimately did not help citizen projects or other local and regional projects and therefore halted the rapid roll-out of renewable energies. The auctioning system did not and could not help overcome the local and regional planning and authorisation barriers, including for citizen projects.

In order to achieve the decarbonisation goal by 2050, there must be a serious and rapid increase in renewable energy uptake. This cannot be achieved without stronger re-instatement of investment security for independent renewable energy producers, renewable energy communities (RECs) and citizen energy communities (CECs) in developing citizen and community projects. These three groups, which are often intertwined, will play a vital role in the energy transition, allowing communities and local governments to become involved in energy projects. This in turn is having several positive effects, such as increasing the popularity of and support for the energy transition. REDII has recognised the importance of the RECs for the first time in European legislation, a clear indication that in achieving the targets for 2030, 2040 and 2050, RECs will be an important part of the transition. Therefore, it is crucial that Articles 21 and 22 RED II are transposed and that an enabling legal framework removes any obstacles for energy communities, as well as any unjustified barriers in general when enforcing the new RED II Directive in member states' legislation. In part, this includes allowing member states to provide support for renewable-energy projects in the manner they believe to be most appropriate and and most capable of being designed outside current applications of state-aid rules, or at least under general group-exemption rules. The European Commission must allow member states to make nationally appropriate decisions on which sectors, territories and technologies they choose to support and whether they want to use auctioning systems or rather rely on other mechanisms such as feed-in tariffs, feed-in premium mechanisms and clear rules regarding access to the grid. Without such flexibility for the member states, the objectives of the climate package and the EU targets will not be reached in time.

6.2 The current legal framework: A short overview

6.2.1 The Renewable Energy Directive: Recast

The Renewable Energies Directive 2009/28/EU (RED I) and its recast, which entered into force in December 2018, Directive 2018/2001/EU, (RED II), set the framework for the promotion of energy from renewable energy sources (RES) in the EU.

63 See above, previous chapters. See also Hans-Josef Fell, 'The shift from Feed-In-tariffs is hindering the transformation of the Global Energy Supply to Renewable Energies', Energy Watch Group, Policy Paper No.1, March 2019. An initial scientific analysis can be found in Vasilios Anatolitis, Marijke Welisch, 'Putting renewable energy auctions into :action an agent-based model of onshore wind power auctions in Germany', Energy Policy 110, (2017), 394-402.

While the RED I committed the EU to reach a 20% share of renewable energy in its gross final energy consumption by 2020 and a share of 10% of renewable energy in consumption by the transport sector, it also set different levels of binding renewable energy targets for each member state. RED II calls on the EU to commit to reaching an overall target of 32% by 2030. Member states must impose on fuel suppliers a minimum of 14% of the energy in road and rail transport from renewable sources by 2030. RED II no longer imposes binding national targets. Subsequently, and to ensure there are instruments and mechanisms in place that enable the EU to reach its overall binding target by 2030, despite missing national binding targets, a ten-year integrated National Energy and Climate Plan (NECPs) was introduced under the new Governance Regulation. This tries to overcome possible shortcomings due to the lack of obligations by introducing various enabling instruments, including the stringent reporting and planning of climate policies by EU 28 (27) member states.[64]

Both Renewable Energy Directives apply the principle that it is up to the member states to adopt adequate measures, fix their National Renewable Energy Plans (RED I) and National Energy and Climate Plans (RED II), and reduce the obstacles to their development.

6.2.2 Energy Policy as a shared responsibility and the subsidiarity principle under the EU - EU treaty

The subsidiarity principle, as laid down in the Treaty on European Union (Art. 5(3)), explicitly contains local and regional dimensions and thus underlines the necessity to respect the competences of local and regional authorities within the EU.

In the EU, energy policy is a shared responsibility of the EU and its member states, as laid down in Article 194 of the TFEU, which in its Para. c) e.g. the sole authority of member states on their general structure of their energy supply, an area where the principle of subsidiarity applies. Following the entry into force of the Lisbon Treaty, the competences conferred on the Union have been more precisely defined and established: Part One, Title I, of the TFEU divides the competences of the Union into three categories (exclusive, shared and supporting) and lists the areas they cover, with energy coming under shared competence.

Article 5(3) of the Treaty on European Union (TEU) and Protocol (No 2) on the application of the principles of subsidiarity and proportionality ensure that the rules of subsidiarity and proportionality are respected in the execution of the EU's competences. In areas in which the EU does not have exclusive competence, such as in the field of energy, the principle of subsidiarity seeks to safeguard the ability of the member states to take decisions and actions and authorises intervention by the Union when the objectives of an action cannot be sufficiently achieved by the member states, but can be better achieved at Union level 'by reason of the scale and effects of the proposed action'. The principles of subsidiarity and proportionality govern the exercise of the EU's competences. The purpose of including a reference to the principle in the EU Treaties is also to ensure that powers are exercised as close to the citizen as possible, in accordance with the proximity principle referred to in Article 10(3) of the TEU.

Reviewing the support mechanism rules at the EU level must re-establish the safeguard of the subsidiarity principle by improving flexibility

64 Under the regulation, member states are asked to develop and notify the European Commission of all integrated national energy and climate plans, which must tackle all dimensions of the Energy Union based on a common template. The Commission will monitor progress in the EU as a whole, in particular as part of the annual State of the Energy Union report. By 2023 member states need to deliver reporting on progress of the plans, in line with the five-yearly ambition cycle in the Paris climate agreement

and ensuring that renewable-energy projects both in general and especially locally, involving small and medium size projects, find adequate support without the EU imposing inflexible auctioning mechanisms. The climate emergency and the need for rapid deployment programmes for renewables in all member states must be protected from the undue dominant influence of EU guidelines under the subsidiarity principle. The following section reflects further on the shortcomings of the current EU mechanisms.

6.2.3 Support mechanism and state aid principles

Starting point

Most mechanisms in member states that support renewable energy in their activities are EC-authorised state-aid mechanisms, with the exception of Germany's legislation regarding feed-in mechanisms. The latter, in its various legislative stages, has repeatedly come under the scrutiny of the EC's DG for Competition over the past twenty years. The European Court of Justice has found on two occasions that the respective system did not contain state aid. [65]

Art. 107 Para. 1 TFEU states that member states' financial support to businesses that meets the criteria under this article are incompatible with the common market, regardless of what form the aid is given in, if it could distort competition and affect trade by favouring certain undertakings or the production of certain goods. Art. 107 Para. 1 introduces a general prohibition on state aid. Exemptions to this prohibition are regulated under Art. 107 Para. 2 and 3 TFEU. To be classified as state aid under Art. 107 Para. 1, four conditions must be met simultaneously under a specific support scheme:

1. It is necessary to identify a financial intervention by the state or from state resources (e.g. grants, interest and tax reliefs, the provision of goods and services on preferential terms, etc.),
2. the actual intervention must create an advantage for its recipient,
3. this intervention must distort or threaten to distort competition, and
4. the intervention must be able to affect trade between member states.

The definition of state aid is interpreted broadly in EU law. As a general rule, aid is illegal in EU law. However, there are situations in which aid can be considered compatible with the internal market under certain conditions and is therefore approved by the Commission. These conditions are regulated under Art. 107 Para. 3 (a) to (d) TFEU and are specified in further regulations and guidelines. Since 2001, the EU has issued several promotional directives for the uptake of renewable energies in the internal EU energy market. However, any member state support mechanism under these EU directives that fulfils the state aid conditions needs to be authorised by the EC's DG for Competition of before the mechanism can be introduced in the respective member state. RED II aims at flexible markets suitable for high shares of renewable energies, introduces and clearly supports renewable energy consumers self-consumption, and incentivises decentralised and community power. There is nearly no echo of this in the state aid guidelines. Since the guidelines were issued years before RED II this is not surprising, as many of the relevant objectives of European energy policy were fundamentally reformulated in 2018. This has

65 See ECJ C-379/98 preliminary ruling of 13 March 2001, PreussenElektraAG; Case C 405/16 P, Appeal Germany v Commission, ruling of 17 March 2019.

led to major inconsistencies between different policy objectives.

Until 2015/2016, the European Union had a variety of different support mechanisms, with a strong priority for support in the renewable energy electricity sector. Feed-in tariffs (FIT) and feed-in remiums (FIP) in the form of grants, bonuses and premiums to be added on top of the energy market price are still the main factors and tools in the vast majority of member states, often using the levelized costs of energy (LCOE) approach.[66] After 2015, and as a result of conditions set out under the current state aid guidelines, auctioning systems were increasingly introduced in member states, thus replacing the administrative setting of tariffs and premiums.[67] Chapter 3.3.2. of the guidelines marked a complete change to the European Commission's compatibility assessments and balancing criteria when considering operating aid for renewable energy, in comparison to the previous Community Guidelines on State Aid for Environmental Protection (2008/C 82/01) of 1.4.2008[68] (previous Guidelines).

Rather than continuing with the application of a certain balancing test to assess the compatibility of state aid measures entailing operating aid to renewable energy, the new guidelines established a new set of well-defined cumulative conditions and set out in detail by when such conditions should be met. This set of rules starts with Chapter 3.3.2.1., Para. 124, according to which, from January 2016 onwards, aid is granted as a premium in addition to the market price (market premium) whereby the renewable electricity generators have to sell their electricity directly in the market. The guidelines set out a further condition that beneficiaries are subject to standard balancing responsibilities, unless no liquid intra-day market exists and unless measures are put in place to ensure that generators have no incentive to generate electricity for negative prices. From January 2017 on, para. 126 of the guidelines requires that aid is granted in a competitive bidding process on the basis of clear, transparent and non-discriminatory criteria open to all generators producing electricity from renewable energy sources on a non-discriminatory basis.

Although the guidelines foresee various exemptions from the new rules as opt-out options, they treat them only as general principles for assessment purposes. Only through a reasoned exception can member states deviate from the broad bidding approach of a technology specific tendering mechanism, as outlined under Para. (110) of the Guidelines. It must also be noted that the Guidelines provide exceptions from the tendering rules for installations with an installed capacity of less than 500 kW or demonstration projects, except for electricity from wind energy, where an installed electricity capacity of 3 MW or 3 generation units applies (see Para. 111). The Guidelines specify that these projects do not need to follow the market integration rules as laid down under Para. (124), according to which the aid can only be granted as a premium to the market price, not as a feed-in mechanism, and imposing the necessity to be subject to standard balancing responsibilities. Even though the Guidelines do not assume that a bidding process would be "appropriate" for such installations, they leave it optional for member states to include smaller projects under the tendering rules. The Guidelines do not encourage specific

66 See with intensive details JRC Science for Policy Report, (Banja M., Jégard M., Monforti-Ferrario F., Dallemand J.-F., Taylor N., Motels V., Sikkema R.) Renewables in the EU: an overview of support schemes and measures (2017).

67 See Communication from the Commission, O.J. C 200/1 of 28.6.2014.

68 Official Journal of the European Union (O.J.), C 82/1 of 1.4. 2008.

positive support programmes outside tendering for local projects. As a result, member states can just ignore positive rollout methodologies for local projects.

The controversy: Long shadows

There was fierce controversy at the time of the introduction of these new guidelines from industry, associations and various member states. In the course of the drafting process, on 18 December 2013 the EU opened a public consultation procedure concerning its "Draft Guidelines on Environmental and Energy State Aid for 2014-2020".[69]

The Commission documented all the responses to the consultation, including those submitted by the member states. For example, the Austrian government insisted that the national freedom to design national support mechanisms needed to be safeguarded. Technology neutral tendering mechanisms in the whole European Economic Area (EEA) sphere were also rejected by Austria on the grounds that it is the right of each member state to choose an adequate support system.[70]

In its submission, the German government, and more specifically the Ministry of Economic Affairs and Energy, argued that the principle of technology-neutral competitive bidding introduced by the European Commission violated the sovereign right of choice of the member states in relation to their respective energy policies and limited the competence of the member states under Art. 194(2) sub. 2 TFEU. In the same written comment, it stressed that the obligation to open national support mechanisms to third parties from other member states goes against the Renewable Energy Directive allowing member states to choose the most effective way and method of support and to restrict their support systems to projects within their respective national boundaries. Furthermore the German government argued that the prioritization of specific support mechanisms in its design, as an exemption to the rule, would have subsequent negative reversal of evidence effects for the member state concerned if it needed to argue for an exemption.[71]

69 Document on the EU Commission's web page under http://ec.europa.eu/competition/consultations/2013_state_aid_environment/index_en.html (last accessed 26th of October 2020).

70 Bundesministerium für Wirtschaft, Familie und Jugend Abt. C1/8, Koordination „EU-Beihilfenrecht" 26.2.2014; "HT 359 – Consultation on Community Guidelines for environmental and energy State Aid for 2014-2020, Stellungnahme der Österreichischen Behörden zur Überarbeitung der EU-Beihilferechtlichen Grundlagen für Umwelt- und Energie-Beihilfen; documented by the EU Commission in a specific folder under „Replies to the Consultation" – „Member States,"; „....Der innerstaatliche Gestaltungsspielraum für die Festlegung eines Energiemix innerhalb der EE sollte grundsätzlich erhalten bleiben. Daher werden die verpflichtenden Ausschreibungen, die vorsehen, dass grundsätzlich Erzeugungsanlagen aus dem gesamten EWR-Raum zu berücksichtigen sind und die technologieneutral (innerhalb der EE) auszugestalten sind, grundsätzlich abgelehnt. Überdies wird hervorgehoben, dass es grundsätzlich Angelegenheit der MS bleiben muss, welches Fördermodell unter Beachtung der Kosteneffizienz gewählt wird....".

71 Comment submitted to the Commission by Bundesministerium für Wirtschaft und Energie, Berlin, 7. February 2014,"HT 359 – Consultation on Community Guidelines for environmental and energy State Aid for 2014-2020 documented in the specific folder under „Replies to the Consultation" – „Member States,"; http://ec.europa.eu/competition/consultations/2013_state_aid_environment/index_en.html ; latest accessed 26th of October 2020.

The main arguments of the stakeholders can be summarised as follows:

The draft guidelines would constitute:

a.) an unjustifiable excess of power by the European Commission;

b.) a restriction of the sovereign rights of member states under the Treaties and their rights and obligations under the Renewable Energy Directive;

c.) a lack of reflection or analysis on the current EU energy system and on the system change quality of the proposed renewable energy promotion mechanisms. Renewable support is increasingly becoming part of a broader approach to system change. Therefore a singled out or standalone support mechanism for renewables without consideration of the local regional grid and storage needs is bound to fail the overall task of system change;

d.) the lack of a proven record of use and success of the methodologies used over a longer period, such as the introduction of a very restricted choice of state-aid mechanisms. This would prevent use of the guidelines in a 'one-fits-all' approach;

e.) a lack of experience or established decision making practice on the part of the EC concerning reserve capacity and balancing markets.[72]

Annulment proceedings in 2014: Main arguments

The author defended the interests of some renewable energy companies and the EREF, the European Renewable Energies Federation, in an annulment plea to the European Court filed against the Commission and the Guidelines. The case was dismissed as inadmissible, as the plaintiffs were not directly concerned by the issuance of the Guidelines.[73]

Despite not being examined by the Court, the grounds of the plearemain pertinent: the Commission lacked the competence to adopt the Guidelines, as the European legislator has limited competence in the field of energy. Under Art. 194 TFEU, technology-neutral renewable energy support schemes cannot be imposed on the member states, as they affect their sovereign energy rights. The European Commission is not the EU legislator and cannot use guidelines to adopt 'quasi-legislation' to go against the provisions of EU secondary law, such as the Renewable Energy Directive. Neither in the guidelines themselves nor in the impact assessment was there sufficient justification for the policy choice to require all member states to adopt in principle a technology-neutral competitive bidding system to support renewable energy. One could argue that the Commission, in invoking these guidelines, harmed the principle of proportionality, as the guidelines propose instruments which are not suitable for the declared objectives of promoting the EU's renewable energy objectives while reducing distorting effects. These instruments are not proportionate, but create excessive burdens both on member states by forcing them to

72 See e.g. Comment submitted by EREF to the European Commission, under HT 359 – Consultation on Community Guidelines for Environmental and Energy State Aid for 2014-2020 documented in the specific folder 'Registered organisations Part I' under 'Replies to the Consultation'. http://ec.europa.eu/competition/consultations/2013_state_aid_environment/index_en.html; (last accessed 26th of October 2020).

73 Case T-694/14, European Renewable Energies Federation (EREF) v European Commission.

change their support mechanisms, as well as on individuals, who will have to take on the additional administrative burden of participating in competitive bidding.

In various judgements[74] the ECJ has held that the Renewable Energy Directive does not entail the full harmonization of renewable energy support schemes, but leaves it to the discretion of the member states to design their own support schemes. The EU legislator has thus in fact exercised its competence so as to ensure that the EU's objectives in the field of renewable energy are pursued, while also explicitly leaving room for the member states to legislate on the design of their own national support schemes, .e. to a certain extent how the EU objectives are being pursued. This competence to decide how to support renewables and thus how to reach the nationally binding renewable energy targets is explicitly left to the member states.[75]

The guidelines seem to present a different picture and impose a system that not only opposes the member states' right to choose, but also hinders the smooth and rapid uptake of renewable-energy projects. Under the gguidelines, the Commission sets certain rules for how the member states must support renewable energy: in general, they prescribe that this should be done by introducing a technology-neutral competitive bidding system, and the support may only be paid out in the form of market premiums. Here the guidelines exceed the competence of the EU legislator, which the latter has itself restricted by adopting the Renewable Energy Directive and leaving this competence explicitly to the member states. It should be noted that during the procedure for drafting the guidelines, even the Legal Service of the EU Commission had some doubts about the limited competences of the EU under Art. 194 TFEU. Technology-neutral mechanisms in particular would conflict with the right of the member states to determine their own energy mix, as recognized by Art. 194 TFEU.

The prominent role of bidding in the guidelines

Since January 2017, the following conditions for the design of aid-support mechanisms have been imposed by the EC (Para. 126 cons. of the Guidelines):

> *'(126) From 1 January 2017, the following requirements apply:*
>
> *Aid is granted in a competitive bidding process on the basis of clear, transparent and non-discriminatory criteria, unless:*
>
> *(a) Member States demonstrate that only one or a very limited number of projects or sites could be eligible; or*
>
> *(b) Member States demonstrate that a competitive bidding process would lead to higher support levels (for example, to avoid strategic bidding); or*
>
> *(c) Member States demonstrate that a competitive bidding process would result in low project-realisation rates (avoid underbidding).*

If such competitive bidding processes are open to all generators producing electricity from renewable energy sources on a non-discriminatory basis, the Commission will presume that the aid is proportionate and does not distort competition to an extent contrary to the internal market.

74 See e.g. firstly ECJ, Case C-379/98 PreussenElektra AG v. Schleswag AG (Request for preliminary ruling; and joined Cases C-204/12 to C-208/12- Essent Belgium NV v. Vlaamse Reguleringsinstantie voor de Elektriciteits- en Gasmark (requests for a preliminary ruling) and Rn 98: '..it must be acknowledged that since, inter alia, EU law has not harmonised the national support schemes for green electricity, such a territorial limitation may in itself be regarded as necessary in order to attain the legitimate objective pursued in the circumstances, which is to promote increased use of renewable energy sources in the production of electricity (see, to that effect, Ålands Vindkraft, EU:C:2014:2037, paragraphs 92 to 94).'

75 See Judgment of the Court C-Case 573/12, Ålands Vindkraft, Para. 59f.

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:

(a) the longer-term potential of a given new and innovative technology; or (b) the need to achieve diversification; or

(c) network constraints and grid stability; or

(d) system (integration) costs; or

(e) the need to avoid distortions on the raw material markets from biomass support.

(127) Aid may be granted without a competitive bidding process, as described in paragraph (126), to installations with an installed electricity capacity of less than 1 MW, or demonstration projects, except for electricity from wind energy, for installations with an installed electricity capacity of up to 6 MW or 6 generation units.

(128) In the absence of a competitive bidding process, the conditions of paragraphs (124) and (125) and the conditions for operating aid to energy from renewable energy sources other than electricity as set out in paragraph (131) are applicable.

(129) The aid is only granted until the plant has been fully depreciated according to normal accounting rules and any investment aid previously received must be deducted from the operating aid.

(130) These conditions are without prejudice to the possibility for Member States to take account of spatial planning considerations, for example by requiring building permissions prior to the participation in the bidding process or requiring investment decisions within a certain period.'

Member states introducing or modifying renewable energy support laws in the period from 2017 onwards need to design them taking into account these conditions. Deviations from the technology neutral tendering rule need to be notified to the EC. As a rule, the European Commission should take decisions on notifications of state aid within two months of complete notification. 'In practice the timetable is longer. Allow at least 6-9 months for approval for any cases that must be notified.[76] Only for very small projects do the Guidelines allow for non-tendering mechanisms: see Para. (111) of the Guidelines.

Overall, the EC, with the DG for Competition as the responsible Directorate, has introduced a dogmatic shift in the state-aid authorisation procedure, which reduced the freedom and flexibility of member states and increased the administrative burden. As a result, these guidelines have often created unfavourable renewable support mechanisms for member states. The tendering priority in the guidelines has unfortunately resulted in ineffectually designed mechanisms for tendering, including for citizen projects, and it could be used as a blueprint for obstacles at the member-state level, especially for citizens, cooperatives and small and medium-size independent projects. The whole renewable-energy sector, and in particular the former strong dynamic of citizens or independent small and medium-size projects in many EU member states, are often negatively restricted by the new auctioning world.

In the main part of this study, intensive analysis of tendering mechanisms showed that there is a real risk of slowing down the development

76 See BIS Department for Business, Innovation and Skills (UK, State Aid: frequently asked questions, May 2012), page 7.

of the renewable sector by applying tendering mechanisms. This analysis also reflects on the inefficiencies of the current system and shows that citizen and community projects are losing out, even in countries with traditional support policies and broad public support for decentralised and local renewable-energy projects, such as Germany.

During its notification process and debate with the EC concerning whether its renewable energy support legislation, the EEG law, contains state aid, Germany, almost as a precaution, applied the State Aid Guidelines and introduced a tendering scheme under its EEG 2017. Despite the fact that the ECJ had decided that the EEG 2012 does not contain state aid,[77] and thus that the State Aid Guidelines would no longer apply, Germany had continued with the tendering mechanism.

Germany had introduced preferential auctioning rules under Art. 3 Para. 15 of the EEG 2017 for citizen wind projects. However, since it is highly complicated to design a proper auctioning system, these exemptions for small and locally owned project systems, mentioned above, caused severe problems for the whole system. The design limits stemmed from a mismatch between project applications that already had authorisation and those that did not. More inventive yet unauthorised projects without clear and realistic prices always came out ahead of the planned and authorised projects. As consequence, the German authorities stopped this mixed approach. This in turn led to further hesitation in the market. It was feared that a considerable share of successful projects would still take years to be realised, thus endangering the targeted increase of renewable energies. The previous chapters have analysed this situation in more detail. In the current context, it helps to draw a line between the loss of flexibility in promotional mechanisms for member states due to the auctioning priority and the need to urgently increase the uptake of renewable energy. [78]

77 See e.g. Hans-Josef Fell, 'The shift from Fee-In-tariffs is hindering the transformation of the Global Energy Supply to Renewable Energies', Energy Watch Group, Policy Paper No.1, March 2019.

78 See Case C 405/16 P, Appeal Germany Commission.

Criticisms of the tendering mechanisms have been summarised as follows:

- Tenders often suffer from undersubscription and project cancellation (see Section 3.5), thus curbing renewable energy expansion rates and in consequence endangering success with climate protection
- Auction volumes are frequently too low (see Section 3.5), as tender design is determined largely by the authorities, often conflicting with a liberal multi-player market and being vulnerable to influence by incumbent players
- Tenders fail to prevent fair market access for small-scale actors (see Section 3.1), thus reducing the diversity of actors, especially equipment producers, private investors, energy cooperatives, and SMEs, given the high application requirements
- Tenders impair important conditions for local acceptance (see Section 3.4)
- Calls for tenders do not promote advanced decentralised solutions, particularly for grid integration and sector coupling[79]

Adjustment needs for renewable energy projects

The following section outlines why this inflexible approach to determining auctions as the default instrument needs to be adjusted in order to enable member states to strive for efficient and rapid mechanisms for responding to the climate emergency. The EU is supporting the phasing out of the coal and fossil fuel industry in the member states and foresees a major EU Just Transition fund, especially for coal regions in the EU.[80] However, there have been far fewer concrete changes concerning the realisation of increased renewable energy deployment.

This creates a legal and a political problem: comparing the speed with which, fortunately, the EU and the Commission reacted with emergency aid measures to member states, their industry, and their employment and health sectors in order to cope with the coronavirus pandemic,[81] the same flexibility and pragmatism is missing when it comes to speeding up the roll-out of renewable energies and allowing sound enabling instruments for renewable energy projects. Much more ambition, strength and political commitment will be required in the EU and its member states over a very short timeframe, more so than any 'man on the moon/US Apollo mission', with which the European Commission President, Ms. von der Leyen, compared the decision of the European Union in December 2019 to make itself fully GHG-free by 2050.[82]

79 See e.g. Hans-Josef Fell, 'The shift from Fee-In-tariffs is hindering the transformation of the Global Energy Supply to Renewable Energies', Energy Watch Group, Policy Paper No.1, March 2019.

80 Even in this sector, the phasing out of EU coal regions call for more flexibility for their structural change needs under the State Aid regime in the EU; see Michele Alessandrini, Pietro Celotti, Giacomo Nespeca (t33 Srl), Silke Haarich, Christian Lüer, Sabine Zillmer (Spatial Foresight GmbH), Erich Dallhammer, Martyna Derszniak-Noirjean, Markéta Prasilova (OIR GmbH), and Salvatore Tarantino, 'Assessing the need for a modification of the state aid rules for the phasing-out of coal', European Committee of the Regions 2020.

81 See European Council Conclusions of July 2020, even allowing, for the first time ever, the EU Commission to borrow funds on the capital markets: '--The exceptional nature of the economic and social situation due to the COVID-19 crisis requires exceptional measures to support the recovery and resilience of the economies of the Member States. ...The plan for European recovery will need massive public and private investment at European level to set the Union firmly on the path to a sustainable and resilient recovery, creating jobs and repairing the immediate damage caused by the COVID-19 pandemic whilst supporting the Union's green and digital priorities.': https://www.consilium.europa.eu/media/45109/210720-euco-final-conclusions-en.pdf.

82 It is estimatedthat the total cost of the Apollo moon programme came to around $25bn, equivalent to $175bn (roughly Euros 150 bn) today. In 1965, NASA funding peaked at some 5% of government spending, today being just a tenth of that. 'Those billions paid for the rockets, spacecraft, computers, ground control and the 400,000 or so people needed to land just 12 men on the Moon' (https://www.bbc.com/future/article/20190712-apollo-in-50-numbers-the-cost).

6.3 Lessons from the COVID-19 pandemic help and recovery programmes

During the current COVID-19 virus pandemic, the EU has acted quickly and effectively by fast-tracking financial and other support to the whole economy throughout the EU.

One tool used to support the economy during the crisis was the European Commission extending several guidelines that were due for revision in 2020, including the Guidelines for Environment and Energy, which have now been extended until December 2021. Under this extension, the European Commission is helping energy-intensive industries to benefit from the exemption of the balancing mechanisms due to their competitive situation on the world market and has allowed the continuous use of exemptions, saving them from paying full charges as long as they had not been in economic difficulties at end of 2019 and are now considered to be in difficulties.

On the other hand, the European Commission has maintained its liberal market approach in considering renewable energy deployment, emphaising that, in the '*period between 2020 and 2030 established renewable energy sources will become grid-competitive, implying that subsidies and exemptions from balancing responsibilities should be phased out in a digressive way*'[83] Unfortunately, the communication does not allow greater flexibility for member states to define support mechanisms that deviate from the tendering obligation, although this is necessary to trigger faster climate protection. This in turn is preventing the accesleration of the job creation that is desperately needed to overcome the economic crisis.

It is certainly a positive and remarkable step that the European Commission allowed Italy, because of COVID-19, to use Art. 107 (3) (b) TFEU as a state aid mechanism to support the Italian economy due to a 'serious disturbance in the economy of a Member State'. The European Commission is also at present considering broadening the circle of eligible member states that fall under this TFEU article.

Art. 107 (3) (b) reads as follows:
'...3. The following may be considered to be compatible with the internal market:
[...].
(b) aid to promote the execution of an important project of common European interest or to remedy a serious disturbance in the economy of a Member State;
[...]'

Sadly, the European Commission does not at present apply the same flexibility by providing a fast-track support mechanism for member states to speed up renewable energy projects, especially local and regional renewable development using state aid.

Interim Conclusion. The EU is missing a crucial opportunity during the COVID-19 pandemic to recognise that the climate crisis is aligned with the economic crisis, and to introduce pragmatic and rapid enabling instruments and opportunities for renewable energy projects from both the climate and social perspectives. At the very least, the European Commission could issue a

83 See Communication from the Commission concerning the prolongation and the amendments of the Guidelines on Regional State Aid for 2014-2020, Guidelines on State Aid to Promote Risk Finance Investments, Guidelines on State Aid for Environmental Protection and Energy 2014-2020, Guidelines on State aid for rescuing and restructuring non-financial undertakings in difficulty, Communication on the Criteria for the Analysis of the Compatibility with the Internal Market of State Aid to Promote the Execution of Important Projects of Common European Interest, Communication from the Commission – Framework for State aid for research and development and innovation and Communication from the Commission to the Member States on the application of Articles 107 and 108 of the Treaty on the Functioning of the European Union to short-term export credit insurance- (2020/C 224/02), O.J. C 224/2 of 8.7.2020, Rn 11.

temporary waiver of the principle of tendering priority in the guidelines for renewable-energy projects. We are already facing serious disturbances in the economy of member states due to increased climate events such as flooding, forest fires and the like. **Combined with the necessity for a rapid energy system change the same approach under Art. 107 (3) (b) TFEU could be envisaged as has been the case for the authorization to Italy under COVID-19 rules, for many member states as a combination of both considerations under Art. 107 (3) (b): important project of common interest in any case and maybe in some member states even leading to a serious disturbance in the economy.**

6.4 Pathway for reform: A mechanism outside state aid rules

In view of the current turbulence, there are additional risks for the continuous development of the renewable energy sector and latent barriers under tendering rules, in particular for citizen-run renewable energy projects and small and medium size projects, as well as because of the climate crisis described above and the principles laid down in Article 191 TFEU. It is therefore necessary for the European Commission and member states to review the rules governing the uptake of renewable energy and accelerate sustainable changes to the energy system within the national renewable energy development portfolio. A first step to consider is to clearly acknowledge that the climate crisis and the environmental obligations under the EU treaties call for the recognition of renewable energy roll-outs as a public service, especially when undertaken in line with local and regional climate planning.

6.5 Public service models without state aid elements

On 24 July 2003, the ECJ issued its judgment in the Altmark Trans GmbH and Regierungspräsidium Magdeburg versus Nahverkehrsgesellschaft Altmark GmbH (Altmark) case,[84] ending the controversy surrounding the application of the state aid control regime to compensation granted to undertakings for public service obligations executed by them.

84 ECJ Case C-280/00 Altmark; In this case, a local bus company benefited from 18 licences to operate bus passenger services in a German district, for which it received a subsidy from the public authorities. A competitor contested the licence grant, arguing among others that the beneficiary could not survive without the subsidy. The referring German Federal Administrative Court queried whether the subsidy constituted State Aid and put a question to this effect to the Court of Justice.

The Court held that such compensation does not confer an advantage on the undertakings concerned, and hence does not constitute state aid within the meaning of the European Commission Treaty, provided that four cumulative conditions are satisfied:

- First, the recipient undertaking must actually have public service obligations to discharge, and the obligations must be clearly defined.
- Second, the parameters on the basis of which the compensation is calculated must be established in advance in an objective and transparent manner.
- Third, the compensation cannot exceed what is necessary to cover all or part of the costs incurred in discharging the public service obligations, taking into account the relevant receipts and a reasonable profit.
- Fourth, the Court had ruled that, where the undertaking that is to discharge public service obligations in a specific case is not chosen pursuant to a public procurement procedure which would allow for the selection of the bidder capable of providing those services at the lowest cost to the community, the level of compensation needed must be determined on the basis of an analysis of the costs which a typical undertaking, if well run and adequately equipped, would have incurred.

This last condition would necessarily need to be used if renewable energy roll-out is ultimately recognized as a public service in the respective member states. Fortunately, it is not difficult to establish a clear cost analysis for a typical renewable energy project and to 'administer' a fair feed-in / feed-in premium price in view of the long experience with administrative tariff settings in many member states. The established provisions for services of public interest could replace any previous state aid design of national support mechanisms for specific types of independent renewable energy projects. This could be used in the design of renewable energy programmes and operational support in the member states by re-installing non-tendering support systems to benefit from those feed-in mechanism contracts. A registry of eligible installations could also be established and defined for each technology.

The climate crisis and the urgency to improve security of supply with sustainable energy within the EU is leading to a situation in which the environmental objective of the above-mentioned EU treaties becomes a priority. At least, experience with the negative and obstructive effects of the current tendering mechanisms and other obstacles, such as caps on the numbers or the power of new RES installations, should prompt a renaissance of clear support programmes.There are examples where public service elements are used, such as in the balancing mechanism for the payment of the renewable surcharge under the French legal renewable support system. The current draft legal text for the amendment of the German EEG establishes a new Para. 5 in Article 1, which clearly provides that the use of renewable energy for electricity production is in the public interest and serves the ends of public security. [85]

85 Art. 1 Para. 5 draft bill EEG,‚Die Nutzung erneuerbarer Energien zur Stromerzeugung liegt im öffentlichen Interesse und dient der öffentlichen Sicherheit.', https://www.bmwi.de/Redaktion/DE/Downloads/Gesetz/referentenentwurf-aenderung-eeg-und-weiterer-energierechtlicher-vorschriften.pdf?__blob=publicationFile&v=4

This could be an excellent opportunity to link renewable energy support with public service obligations outside state aid rules. As long as Germany can maintain the non-state aid character of its EEG, it can modify its system and allow greater flexibility outside tendering mechanisms. However, the logic established in this new Para 5 for the new EEG could be useful as an introduction and template for Public Service Obligation (PSO) arrangements in other member states' legislation.

6.6 Options for addressing the current barriers

Whereas the above pathway provides an alternative whereby member states can define climate service obligations under the renewable energy development and draft state aid-free mechanisms, the following approach would remain within the state aid framework but increase its flexibility. There are different options available for addressing the afore-mentioned barriers. The Commission could improve the flexibility for SMEs and citizen community projects with the following measures: amend the communication on the current state aid guidelines, or enhance new guidelines with the introduction of climate flexibility measures. Alternatively, the Council could pass a Council Regulation amending or replacing the current state aid guidelines in view of a faster RES deployment.

A Council Decision for more climate support flexibility

A renewable energy roll-out plan based on the 1.5° celsius target could also be introduced at Council level in the form of a Decision or Council regulation. The anchor for such a decision would be Art. 107 Para. 3 (e) TFEU. According to this article, the Council can, by its own decision on a proposal from the Commission, supplement the catalogue of approvable aid and rule that a particular aid package is considered compatible with the internal market. On the basis of this act, member states may establish their own schemes for implementing such aid. Aid based on such a regulation must nevertheless be approved by the EC, but if it follows the principles laid down in the Act, the European Commission will give its approval.

In order to promote a more rapid uptake of renewables, taking into account the arguments set out above, the Council could develop a renewable roll-out plan under the combined principles of the RED II Directive, the upcoming climate law and the main principles enabling member states to support renewable energy more rapidly than at present, thus avoiding tendering procedures where member states find it does not assist them in reaching the renewable energy and climate targets.

During the coming months, the European Commission will be preparinga review of the current RED II Directive in order to bring its provisions more in line with the climate targets and the upcoming climate law. This would be an excellent opportunity to draw up a specific Council Regulation supporting a fast-track procedure for the above RES projects and defining support authorising conditions. The objectives of such a regulation should be linked to the climate goals under the 1.5° Celsius target. The member states should be enabled to develop programmes and publish them in their National Energy and Climate Plans, which would not need to impose technology-neutral tendering or any tendering schemes at all, as long as clear conditions are met. There are prior examples of such an approach. The Council has already used its power under Article 107(3) (e) TFEU, namely for the shipbuilding and coal sectors. The Council took a decision on the 10th of December 2010 on State Aid to facilitate the closure of uncompetitive coal mines (2010/787/EU) using Article 107(3) (e) TFEU. The decision had as its objective a smooth transition from measures under Council Regulation (EC) No 1407/2002 of 23 July 2002 on State Aid to the Coal Industry, as amended by Council Regulation (EC) No. 1791/2006 of 20 November 2006. These regulations were based on the preceding regulation of Art. 107 (3) (e) TFEU, namely Art. 87 (3) (e) EC Treaty.

Following a proposal by the EC, the Council should adopt the regulation. This requires a qualified majority, i.e. a majority of at least 55 % of the members of the Council, comprising at least 15 members, provided that the member states represented cover at least 65 % of the EU population (Article 16 (3) and (4) TEU). If the Council departs from the Commission's proposal, a unanimous decision of the Council is required (Art. 293 (1) TFEU).

Re-flexibility: An European Commission-amended Communication on the current State Aid Guidelines.

As outlined above, within the Coronavirus pandemic assistance measures, the European Commission has prolonged the validity of the current guidelines until the end of 2021 and eased the position for energy intensive industry. In the same way, and following the goals of the Green Deal process, it would be logical for the European Commission at least to amend the state aid guidelines, introducing more flexibility and thus enable member states to abstain from tendering rules and re-introduce support options without the obligation to participate in tendering mechanisms.

The RED II Directive clearly underlines such a pathway:

Recital 19 states: 'Market-based mechanisms, such as tendering procedures, have been demonstrated to reduce support cost effectively in competitive markets in many circumstances. However, in specific circumstances, tendering procedures may not necessarily lead to efficient price discovery. Balanced exemptions may therefore need to be considered to ensure cost-effectiveness and minimise overall support cost. In particular, Member States should be allowed to grant exemptions from tendering procedures and direct marketing to small-scale installations and demonstration projects in order to take into account their more limited capabilities.' RED II is referring to the current state aid guidelines and their thresholds, set out for projects that can be supported without direct marketing and tendering: […]'While Member States develop their support schemes, they may limit tendering procedures to specific technologies where this is needed to avoid sub-optimal results with regard to network constraints and grid stability, system integration costs, the need to achieve diversification of the energy mix, and the long-term potential of technologies.' Given such amended guidelines, member states could introduce even higher thresholds than stated in the current guidelines as an exemption from tendering rules.

In light of the climate crisis, the European Commission should re-introduce more flexibility in the new guidelines for the period after 2021 so that member states can choose which support system is the most effective way of reaching their targets and not limit themselves to the tendering process for renewable energy projects alone.

6.7 Summary

There is an urgent need to improve the current framework of support for renewable energy projects. In order to achieve the energy transition outlined in the European Green Deal to achieve climate neutrality by 2050, an immediate and rapid uptake of renewable energy is necessary.

In view of the urgency, member states should rethink their approach to support and try to choose the Public Service Obligation method more often, stressing that citizen and community projects, small and medium size projects especially, but also larger projects deliver a public service in rapidly rolling out renewable

energy. With such an approach, the whole support mechanism could fall outside the state aid regime. Legal clarity in the EU framework would also help prevent member states from pre-emptively treating their programmes as state aid even though they do not qualify as such, as was the case in Germany. Legal clarity in this regard would not only help the public sector, it is also necessary to attract private investments aimed at long-term projects.
The role of renewable energy deployment has to be seen in the light and under the principles of a service of public interest.

In the case of the future support models of member states, where state aid regulations need to be observed, the current State Aid Guidelines for Environment and Energy of the European Commission need to be reformed drastically, as in their current form they place unnecessary barriers on the development of renewable energies. The dogma of prevailing tendering support schemes no longer fits with the required changes to the EU's energy system under the climate emergency. In order to remain aligned with the objectives of the new Green Deal, the climate law, REDII and all the other recent legislative and policy changes that have been made in recent years, these support schemes must adapt and evolve.

It has been made clear that in times of crisis EU institutions, in particular the European Commission, have found novel and flexible responses, as with the COVID-19 crisis. However, it is the climate emergency that is the greatest crisis faced by humanity, therefore it is crucial to adopt the agreed solutions as quickly as possible. This, of course, includes renewable energy deployment throughout the EU.

There are a multitude of possible measures to improve the current framework for accessing state aid, especially for SMEs and community energy projects, but also renewable energy projects in general that are politically realistic and quick to implement. The new guidelines for state aid must allow member states to introduce feed-in premium mechanisms, for example, without any tendering obligation. Member states should have greater flexibility in applying support schemes that correspond to their country specific characteristics (geographical or policy-wise) when identifying which renewable development pathway is the most promising. Whatever decision is taken over the coming years, one thing is certain: a major overhaul of the current support scheme mechanisms must take place if we are to have any hope of avoiding the worst of the climate crisis.

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