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Regulating radical innovations in the EU electricity markets: time for a robust sandbox

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During the last decade, the level of detail and complexity in the EU electricity market legislation has ballooned. Simultaneously, the pace of technological development has been rapid. This is necessary for the clean energy transition but also creates challenges. How do we ensure the legislation is keeping up with the development of the real world? Should innovative solutions be encouraged, even if they do not comply with the current rules? We argue that regulation of the ‘radical innovations’ is inadequate in the EU. As a solution, we discuss an EU framework for regulatory sandboxes and propose design principles for its development.

Keywords: regulatory sandbox; innovation; energy transition; electricity market; energy law; EU law

1. Introduction

Enabling a transition into clean, sustainable and affordable energy systems inevitably requires changes to current structures. In the electricity sector, the key question is how to maintain, at a reasonable cost, a secure and resilient electricity system while cleaning up the electricity production. More flexibility is obviously needed, both inside the electricity market and through the improved connections to other energy systems. These new challenges require novel solutions.

According to the International Energy Agency (IEA)’s report from 2020, the acceleration of clean energy innovations is important to achieve net-zero emissions targets. Energy technologies still in the demonstration or prototype phase are needed to cover over a third of the required cumulative CO₂ emission reductions. While the report handles the whole energy sector, a similar outcome can be expected to apply to the electricity sector where, among other things, the necessary changes in production, the growing demand of electricity and the integration with other sectors bring new challenges.

The need for new solutions is widely acknowledged in the European Union (EU), and promotion of innovations in the energy sector has become a key target during the past few years. Various policy papers state that the innovations in the energy sector
should be accelerated, and funding for the innovative solutions is channelled through the Horizon Europe and Innovation Fund. Most recently in the ‘REPowerEU Plan’, with aim to reduce the EU’s dependency on Russian fossil fuels and to accelerate clean energy transition, the European Commission called again for speeding up innovations. One could say that ‘innovation’ has become a buzzword in the EU energy policy. While innovations are given a central role in the political declarations, their treatment and promotion depend to a large extent on the sectoral legislation.

During the last few decades, the EU electricity markets have developed towards a functioning internal market and the sectoral electricity market legislation has ballooned. Thus, while the efforts to encourage innovations are gathering pace, the level of detail in the electricity market legislation has simultaneously risen. The legislation is, indeed, also intended to guide the development of new solutions, but the legislator cannot always anticipate what kind of solutions can be developed to support the overall target of a sustainable, secure and affordable electricity system. More strict and robust legislation can promote innovations, but it can also lead to situations where regulatory gaps and collisions with norms appear, hampering development. Especially, when innovations do not fit into the current regime, they may end up leading directly into the legal ‘valley of death’. Still, ‘radical innovations’, ie those innovations that do not comply with the current legislation, can also be useful for the energy transition. When the electricity and energy markets are


5 Communication from the Commission ‘REPowerEU Plan’ COM(2022) 230 final, 18 May 2022, 10–12

6 D Zillman and others, ‘Introduction’ in D Zillman and others (eds) Innovation in Energy Law and Technology (OUP 2018), 8–9

7 In the European union primary legislation, the ‘energy trilemma’ is captured in art 194 of the Consolidated Version of the Treaty on the Functioning of the European Union [2008] OJ C 115/13; Bennett Moses argues that forecasting technological development is not even the task of the legislator: ‘[t]he law should not race ahead by anticipating technological trajectories that may never come to pass’. L Bennett Moses, ‘Agents of Change: How the Law Copes with Technological Change’ (2011) 20 Griffith L Rev 763, at 787


9 About the detailed regulation and ‘regulatory disconnection’, see R Brownword and H Somsen, ‘Law, Innovation and Technology: Before We Fast Forward – A Forum for Debate’ (2009) 1 Law, Innovation and Technology 1; in general about ‘challenge of regulatory connection’ see R Brownword, Rights, Regulation and the Technological Revolution (OUP 2008)

10 About the established meaning of the ‘valley of death’, see for example M Granieri and A Renda, Innovation Law and Policy in the European Union (Springer 2012), ch 1.5.1.2

going through a paradigm shift, ensuring adequate room for new solutions that deviate from the existing and anticipated concepts may turn out to be one enabler of change.

The collisions between radical innovations and the applicable law may stem from, for example, technical specifications that practically hinder the use of a particular technological innovation. Equally importantly, and more interestingly from the perspective of this article, the collisions can originate from the electricity market rules. When the electricity market legislation is built on ‘the socio-technical landscape’ of today, or yesterday, and the energy transition challenges even the underlying premises of the electricity markets, these collisions seem likely.

Obviously, the promotion of innovations that are incompatible with the applicable legislation sounds counterintuitive. Implementing them would require changes in the legislation or at least deviations from it. In addition to provisions enabling deviations generally, there are also examples of regimes specifically addressing the experimentation of new solutions

One such solution is a regulatory sandbox, which can be defined as ‘a framework that allows innovations to be tested in a real-world environment subject to regulatory safeguards and support’. In the regulatory sandboxes, the projects can be exempted from (certain) legal or regulatory requirements which would normally apply to them. Several Member States have already implemented regulatory sandboxes for energy, but the concept has been lacking from the EU energy legislation. This has created challenges for the Member States that must comply with the EU law. As a consequence, a European regulatory sandbox for energy has been suggested by the Agency for the Cooperation of Energy Regulators (ACER) and the Council of European Energy Regulators (CEER) and in some

12 See Bennett Moses, ‘Agents of Change’ (n 7); For the discussion of 'socio-technical landscape' see L Bennett Moses, 'How to Think about Law, Regulation and Technology: Problems with Technology as a Regulatory Target' (2013) 5(1) Law, Innovation and Technology, 1
13 Heldeweg (n 11)
14 Ibid. In this paper, the term ‘deviation’ is used to cover all kind of derogations, exemptions and waivers from the legislation and regulation in force
16 The Commission definition has been criticised in S Ranchordás, ‘Experimental Regulations and Regulatory Sandboxes – Law without Order?’ [2021] Law and Method doi:10.5553/REM/000064, 7, as narrow and inaccurate, as it juxtaposes sandboxes with (more generally applicable) experimental regulations and dismisses the fact that the sandboxes may not always include deviations but support with compliance. In the context of radical innovations, however, the deviations are the core nature of the regulatory sandboxes. This does not discard the fact that in many cases, the project developers applying to the regulatory sandboxes may not actually need the deviations but the legal counselling and small adjustments to the project – for example in Ofgem, ‘Innovation Link: Enabling Trials through the Regulatory Sandbox’, 23 October 2018 <www.ofgem.gov.uk/publications/innovation-link-enabling-trials-through-regulatory-sandbox> accessed 31 May 2022
17 See International Smart Grid Action Network (ISGAN), ‘Smart Grid Case Studies, Innovative Regulatory Approaches with Focus on Experimental Sandboxes 2.0 Casebook’ (October 2021)
recent studies.\textsuperscript{19} In May 2022, as part of the REPowerEU package,\textsuperscript{20} the European Commission also proposed to include a provision concerning regulatory sandboxes for renewable energy in the Renewable Energy Directive (EU) 2018/2001.\textsuperscript{21}

In this article, the focus is on the regulation of radical innovations in the context of the EU electricity market.\textsuperscript{22} Methodologically, the article builds on legal dogmatics and provides \textit{de lege ferenda} recommendations. The article first gives a wider outlook on how radical innovations are currently addressed in the EU electricity market legislation and explains why the legislation remains inadequate in this regard. Afterwards, the article contributes to the emerging discussion on an EU regulatory sandbox for energy with a practically oriented problem setting. In this context, the limits of the recent Commission proposal on the regulatory sandbox for renewable energy are also briefly discussed. Finally, the concept of an EU regulatory sandbox for energy is elaborated and design principles are suggested for the sandbox.

2. Addressing innovative solutions in the EU electricity market law

In the Clean Energy Package,\textsuperscript{23} the eagerness regarding innovations and innovation language have to some extent also reached the electricity market legislation. While most of this attention is located in the explanatory recitals, the articles too address innovations more directly than before.\textsuperscript{24} Undoubtedly, innovations can also be encouraged ‘indirectly’, for example, by the new rules of Article 32 of the Electricity Directive (EU) 2019/944\textsuperscript{25} regarding the incentives for the use of flexibility in the distribution networks, which are meant to promote the entrance of the new solutions (as an alternative to traditional network investments). However, these effects are out of the scope of this article.

Considering radical innovations, a new principle addressing the treatment of demonstration projects of the revised Electricity Regulation (EU) 2019/943 provides an

\textsuperscript{19} Ibid; ACER, CEER, ‘The Bridge Beyond 2025, Conclusions Paper’, November 2019
\textsuperscript{20} ‘REPowerEU package’ refers here to the Communication from the Commission ‘REPowerEU Plan’ and the several other documents published in the same context
\textsuperscript{22} The scope of the paper is limited to the electricity sector, which is highly important to the energy transition due to electrification. The sectoral electricity market legislation in the EU is already deeply harmonised, providing an interesting subject for research. Similar kind of outcomes regarding the regulation of radical innovations can be expected to occur in the gas sector, too
\textsuperscript{23} The EU energy legislative package from 2018–2019 is often referred to as the Clean Energy Package
\textsuperscript{24} For example, the Electricity Regulation (EU) 2019/943 aims to ‘set the basis for an efficient achievement of the objectives of the Energy Union and in particular the climate and energy framework for 2030 by enabling market signals to be delivered for increased efficiency, higher share of renewable energy sources, security of supply, flexibility, sustainability, decarbonisation and innovation’ (italics added), Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity [2019] OJ L 158/54 (hereafter Electricity Regulation (EU) 2019/943), art 1(a)
interesting object for research. In addition, the possibilities to apply derogations under the revised Electricity Regulation and Electricity Directive (EU) 2019/944 are briefly discussed. Finally, as a reminder of how unreasonable situations can sometimes be avoided and legal flexibility be created through interpretation, a recent decision of the European Court of Justice is briefly examined.

2.1. 'Demonstration principle'

In the Electricity Regulation, a new ‘legislative tool’ in the EU electricity market legislation is launched: Article 3 gathers together core principles regarding the operation of electricity markets. According to Article 3, the Member States, the regulatory authorities, transmission system operators (TSOs), distribution system operators, market operators and delegated market operators shall ensure that the electricity markets are operated in accordance with the given principles. In this study, the main attention is directed to point (I) stating that ‘market rules shall allow for the development of demonstration projects into sustainable, secure and low-carbon energy sources, technologies or systems which are to be realised and used to the benefit of society’.

A demonstration project is defined – and inherently linked to innovations – in Article 2(24) as ‘a project which demonstrates a technology as a first of its kind in the Union and represents a significant innovation that goes well beyond the state of the art’. The types of innovations covered by the definition, and thus by the principle, are limited. The projects should demonstrate a new technology, meaning that purely social or systemic innovations, for example, are out of the scope of the provision. The scope of the feasible projects is further restricted by requiring that they should be developed into sustainable, secure and low-carbon energy sources, technologies or systems, and that they should be realised and used to the benefit of society. In the literature, it is often argued that innovation as such refers to something beneficial for the society or its individuals, and the European legislators have explicitly stated what kind of positive effects the demonstration projects should have.

What are the practical effects of the principle for the demonstration projects and potential radical innovations? The provision itself is quite nebulous and recitals do not provide clarification. The Explanatory Memorandum of the Commission proposal only stated that Article 3 ‘sets out the key principles to be respected by national energy

27 About different kinds of innovations, see for example S Ranchordás, ‘Does Sharing Mean Caring? Regulating Innovation in the Sharing Economy’ (2015) 16 Minn JL Sci & Tech 414; D Zillman and others (n 6), 10–11
28 For example, A Butenko and P Larouche, ‘Regulation for Innovativeness or Regulation of Innovation?’ (2015) 7 Law, Innovation and Technology 52, at 56
29 It can be noted that in the Commission proposal for the revised Electricity Regulation (Proposal for a Regulation of the European Parliament and of the Council on the Internal Market for Electricity (Recast), COM(2016) 861 final, 30 November 2016), the wording in art 3 was ‘market rules shall allow for progress in research and development to be realized and used to the benefit of society’ (italics added). The Council suggested to delete the language, whereas Parliament was in favour of an amended text based on the Commission proposal. The end result is a compromise referring to the development of (separately defined) demonstration projects. It can be seen as logical that this later development phase is addressed, as the market rules may actually affect this stage and not so much to the progress in research.
legislation in order to allow for a functioning internal electricity market’, 30 giving no further guidance on how the market rules shall allow development of the demonstration projects. Does the principle require ‘positive discrimination’ of the demonstration projects or just non-discrimination of them?

In the EU law, the Regulations are directly applicable in the Member States; thus, they do not need to be separately transposed into the national law. 32 Even though Article 3 consists of principles, the provision is formulated in a binding way (shall ensure/shall allow). As the list of the addressees of Article 3 is wide, containing Member States, legislators and the regulatory authorities as well as network and market operators, the effects of the principle could extend to different levels of ‘market rules’. If the provision were interpreted literally, this could in theory lead to an idea that Article 3 point (I) would allow bypassing the generally applicable market rules hindering the development of demonstration projects. While being a tempting idea when considering the development of radical innovations, this kind of interpretation would contradict the basic idea of the harmonisation of the EU electricity market law and enable arbitrary results.

In earlier literature, innovation-oriented rules have been classified using a dichotomous categorisation of ‘regulation for innovation’ and ‘regulation of innovation’. 33 The first refers to rules seeking to promote innovations, whereas the second addresses the rules regulating the new innovative solutions. 34 When applying this dichotomy, the demonstration principle seems to fall somewhere in between: it does not clearly promote or enable innovations, but seeks to guarantee that the other rules do not hamper development of the projects. Simultaneously, the principle does not actively regulate the innovations or their treatment. This difficulty to categorise the rule also reflects the challenges in capturing the legal nature of the principle.

It is notable that most of the principles of Article 3 are ‘strengthened’ by other (more substantive) provisions of the Regulation and/or the Electricity Directive. 35 Regarding point (I), the treatment of demonstration projects is referred to in two other provisions. Article 5 allows Member States to enable exemptions for these projects from the responsibility for the imbalances they cause, in which case the derogation should be approved by the national regulatory authority. Moreover, Article 12 stipulates that the Member State shall ensure in some cases that priority in dispatching is provided for a limited time and extent to the demonstration projects. While there is a clear link between the demonstration principle and these articles, the latter are also stand-alone provisions. They embody the demonstration principle but do not necessarily cover the whole content of it.

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30 COM(2016) 861 final, 19
31 In the energy context, the principle applied, for example, in cases C-454/18 Baltic Cable AB v Energinmarknadsinspektionen [2020] ECLI:EU:C:2020:189, C-17/03 FEMW and Others [2005], ECLI:EU:C:2005:362
32 Art 288 of the Consolidated Version of the Treaty on the Functioning of the European Union [2012] OJ C 326/47. In the cases of direct applicability, the Member States’ competence to explain or clarify directly applicable provisions is also limited; see, for example, case C-278/02 Herbert Handlbauer GmbH [2004] ECLI:EU:C:2004:388, case C-316/10 Danske Stineproducenter v Justitsministeriet [2010] ECLI:EU:2011:863
33 Butenko and Larouche (n 28)
34 Ibid
35 Webster (n 26)
Rather, the demonstration principle also has an indirect effect. The principle is to guide the interpretation of other provisions, as the European Commission stated in its derogation decision regarding Kriegers Flak Combined Grid Solution: ‘Article 3 point (l) does not set out any specific requirements as to how regulatory frameworks shall deal with demonstration projects’ but it shows the ‘will of the legislator’.\(^{36}\) The demonstration principle reflects an objective of the Regulation and the Clean Energy Package, and its teleological interpretation effect is probably the most relevant content of the principle. It seems very unlikely that a national regulatory authority would base a deviation decision solely on Article 3 point (l) but when approving, for example, conditions and terms for network access, the principle should be considered. Despite the binding language, the independent effect of the demonstration principle in the case of radical innovations is thus likely to remain vague.

2.2. Derogations

Testing radical innovations could be enabled by granting deviations from the applicable law. An exemption regime in the EU energy law and the Member States’ leeway for regulatory sandboxes have been briefly discussed in some recent papers,\(^{37}\) but the general derogation regime in the EU electricity law has gained less attention from this point of view. Nevertheless, the Commission’s recent derogation decision regarding Kriegers Flak Combined Grid Solution\(^{38}\) shows that the regime can be applied in the case of innovative solutions. The derogation provision and its applicability to radical innovations will therefore be briefly discussed.

In the Clean Energy Package, both the revised Electricity Regulation and the Electricity Directive contain an article enabling derogations. Compared to the earlier regime, the scope of the derogations is widened.\(^{39}\) Derogations from certain provisions under both the Directive and the Regulation can be applied for by the Member State, and the Commission decides whether the derogation is granted.\(^{40}\) The Member State should demonstrate that there are substantial problems for the operation of small isolated systems or small connected systems.\(^{41}\) Derogations under the Directive can concern the rules relating to, for example, distribution system operation, transmission system operation or well as unbundling of TSOs. In the Regulation, the list covers, for

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37 See Schittekatte and others (n 18); Veseli and others (n 18)
38 Commission Decision (EU) 2020/2123
39 The second and third Electricity Market Directives also included a derogation provision, but the general derogations could earlier be applied to only small (and micro) isolated systems. In the Electricity Regulation (EC) No 714/2009, there was no article containing rules on general derogations
40 See art 66 of the Electricity Directive (EU) 2019/944 and art 64 of the Electricity Regulation (EU) 2019/943
41 ‘Small isolated system’ means any system that had a consumption of less than 3,000 GWh in the year 1996, where less than 5% of annual consumption is obtained through interconnection with other systems; and ‘small connected system’ means any system that had a consumption of less than 3,000 GWh in the year 1996, where more than 5% of annual consumption is obtained through interconnection with other systems. Electricity Directive (EU) 2019/944, art 2(42) and (43)
example, the new principles in Article 3, balancing market rules, capacity allocation and congestion income rules.

The first derogation regarding a ‘small connected system’ under the Electricity Regulation was granted to Kriegers Flak Combined Grid Solution (KF CGS) project where a hybrid offshore transmission line connects two offshore wind farms to Germany and Denmark, simultaneously serving as an interconnector between the two countries.\(^{42}\) The application was submitted by the Danish and German authorities. KF CGS can be considered an example of an innovative solution that does not entirely fit into the current legal framework.\(^{43}\) The problem arises from the dual function of the transmission lines, and according to the applicants, there would be substantial problems in operating the KF CGS if it was to be treated as an interconnector with general capacity allocation rules.\(^{44}\) The application also provided the first example where the demonstration principle was used to support the argumentation.

The European Commission stated that the project fulfils the set criteria for derogations and granted the derogation for the project regarding the capacity allocation rule. In its reasoning, the Commission stated the project is first of its kind and a demonstration project in the meaning of the Electricity Regulation. As noted above, the Commission supported its argumentation with the ‘demonstration principle’ of the Electricity Regulation.

While this encourages the idea that the current derogation regime is in fact applicable to radical innovations in general, there are several limiting factors. The scope of the eligible projects is limited: the generally applicable rules should lead to substantial problems for the operation of small isolated or small connected systems. First, the ‘smallness’ of the system\(^{45}\) limits the scope of application.\(^{46}\) Second, even though the Commission stated that the ‘operation’ of the system is not to be understood narrowly\(^{47}\) and ‘all the potential problems related to the particular situation of small systems’ can be taken into account,\(^{48}\) the starting point of the derogation provision is that the current rules cause substantial problems which cannot be otherwise avoided. In the case of innovative solutions which, for example, seek ‘only’ to make system operation more efficient, this is not necessarily the case.

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\(^{43}\) Commission Decision (EU) 2020/2123, section 5.2.2

\(^{44}\) According to art 16(8) of the Electricity Regulation (EU) 2019/943, the TSOs are to provide at least 70% of the interconnection capacity to the market actors, taking into account the operational security limits. For more detailed analysis regarding the effects on hybrid offshore infrastructures, see CT Nieuwenhout, ‘Dividing the Sea into Small Bidding Zones? The Legal Challenges of Connecting Offshore Wind Farms to Multiple Countries’ [2022] Journal of Energy & Natural Resources Law, doi:10.1080/02646811.2021.2011034

\(^{45}\) The definition of a ‘system’ is lacking from the EU legislation, but according to the Commission it is ‘something which can include consumption points and can be linked to other systems’. In addition, a system should be separable from another system. See Commission Decision (EU) 2020/2123, para 28

\(^{46}\) The commission interpreted the smallness rather widely, and Nieuwenhout (n 44), 5, 11 aptly raises the question whether ‘small isolated system’ was meant to cover 400 MW interconnectors

\(^{47}\) Commission Decision (EU) 2020/2123, para 37

\(^{48}\) Commission Decision (EU) 2020/2123, para 36
Third, in the case of KF CGS, the project was already planned in the era of the second and third energy packages. At the time, the Renewable Energy Directive (2009/28/EC) included a provision on priority access of renewable electricity which the project developers had apparently interpreted to apply to interconnectors, too. This interpretation had not been contested by the national authorities or the Commission. According to the Commission, ‘it is plausible that the project parties could have misunderstood the legal situation’. Even though the Commission understated the legitimate expectations of the project developers, in practice these expectations seem to be taken into account. Thus, in this specific case, the revision of the legislation just before the system was commissioned was relevant.

Fourth, in procedural terms, the application for derogations is burdensome for smaller innovative projects. The process is Member State driven and the Commission takes the decision on the derogation with large discretionary power. KF CGS is a good example of a large-scale project for which this kind of process itself is not an insurmountable hindrance, but in the case of a small distribution system testing a new practice, the derogation procedure does not function as an agile tool. Thus, while the derogation regime could in principle also benefit new radical innovations, the scope of the regime is practically limited.

2.3. Creating flexibility by interpretation

In some cases, the collisions – or the situations where there seems to be a breach of the law – can be solved by interpretation. A recent example of this kind of ‘flexible’, or simply teleological and systemic, interpretation was demonstrated in Baltic Cable AB v Energimarknadsinspektionen (C-454/18). To briefly summarise, the case was about whether Baltic Cable AB qualifies as a TSO even though it operates only one interconnector instead of a full-fledged transmission system, and, if this is the case, how the provisions of Electricity Regulation (EC) No 714/2009 regarding the use of congestion income should be applied.

The court stated that Baltic Cable is a TSO in the meaning of the third Electricity Directive (2009/72/EC). The application of Article 16 of the Electricity Regulation

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49 The second energy package refers to the legislative instruments in the energy sector adopted in 2003, and the third refers to those adopted in 2009
50 Commission Decision (EU) 2020/2123, para. 73. The Commission also stated that ‘the mere fact that national authorities and the Commission have over a number of years not raised legal concerns as regards a project cannot in any way be seen as a justification for granting a derogation to the project’ (para 70)
53 For detailed analysis of the case, see J Rumpf and I Hansen, ‘Baltic Cable AB v Energimarknadsinspektionen (C-454/18): The CJEU Decides on Congestion Income Regulation of Single Electricity Interconnector Companies and Applies Classic Remedies for Modern Issues’, (2021) 46 E.L. Rev., 242
(EC) No 714/2009 (the congestion income rule) was then discussed. Interpreting the article literally would have meant that Baltic Cable is not allowed to use the congestion incomes collected by the company (and, which according to the decision, formed most of its income) because the Article limits the use of these revenues to certain purposes that were out of the reach of Baltic Cable.

The Regulation did not contain a derogation provision; thus, the congestion income rule was applicable. However, the court rejected the literal interpretation of the rule. The court’s main argument was that in the light of the non-discrimination principle and to ensure that the TSO is able to carry out its (regulated) tasks, Baltic Cable should be allowed to use the congestion revenues differently in its specific situation. The court stated that

it is for that authority [referring to the national regulatory authority] to authorise that TSO to use part of its congestion revenues to make a return as well as for the operation and maintenance of the interconnector, in order to prevent it being discriminated against by comparison with the other TSOs concerned and to ensure that it is in a position in which it is able to carry out its activity in financially acceptable conditions, which includes making an appropriate profit.

One could argue that the court in practice adopted a contra legem approach to Article 16(6), in order to guarantee that other obligations of the TSO could be fulfilled and that the non-discrimination principle is not breached.\(^{55}\)

While the court decision does not necessarily provide grounds for analogical interpretation for the situations where new innovative solutions do not fit into the current legal framework – the Baltic Cable AB has been operational since the 1990s and during the last couple of decades its business environment has changed greatly – it does provide a reminder of how the court can avoid deadlocks by teleological and systemic interpretation and can sometimes even bring this flexibility by adopting interpretation (nearly) contra legem to a specific provision. In particular, when there are uncertainties regarding the applicable rules or regulatory gaps, the ‘will of the legislator’ and the context of the specific rule play an important role.\(^{56}\) Still, the court decision is ultima ratio to solve uncertainties relating to the applicable rules. And in the case of radical innovations, where novel projects do not comply with the applicable regime, the teleological or systemic interpretation will in most cases not save them from the legal valley of death.

2.4. Inadequate regulation for radical innovators

Despite the purported eagerness regarding innovations at the level of EU energy policy, the revised Electricity Directive and Regulation remain inadequate when it comes to the promotion of radical innovations. Evidently, there are uncertainties surrounding how the demonstration principle is applied, but its effects are likely to remain vague in this respect. The application for derogations could be useful in some

\(^{55}\) Rumpf and Hancher (n 53) consider instead that the court narrowly avoided interpretation contra legem as the court interpreted art 16(6) in its context and in the light of Recital 21 of the Electricity Regulation (EC) No 714/2009

\(^{56}\) For example, in C-17/03 VEMW and Others [2005] EU:C:2005:362, para 41 and references therein
situations but the scope is limited and, in the case of smaller projects, the process is too burdensome. In addition, the derogations are currently not planned as a forward-looking instrument. After the derogation period ends, the generally applicable rules will apply to the project or system.\(^\text{57}\) Of course, during the long derogation periods the applicable legislation may be revised, even several times, in theory enabling ‘learning’ from these individual projects, but this is not the *ratio* of the regime.

Overall, the radical innovations have not specifically been a priority of the legislators, which is logical considering the objective to further harmonise the electricity market legislation in the EU. One could argue that leaving or creating intentional ‘loopholes’ for these types of projects does not fit into this thinking. While this is evidently to some extent always the case, ie all the specific cases cannot be anticipated,\(^\text{58}\) creating a suitable framework could provide a tool to promote these innovations in a controlled way.

3. Towards a regulatory sandbox for energy in the EU

3.1. Regulatory sandboxes and innovative solutions

As noted above, one potential solution to promote radical innovations is to establish regulatory sandboxes, and they have been adopted by several EU Member States and other countries during the last years. Although national regulatory sandboxes are not banned in the EU, they must be designed to comply with the EU law. The Member States’ room for manoeuvre is limited to the extent the EU legal instruments leave discretion for the implementation, or remain silent on a specific matter.\(^\text{59}\) Currently, these sandboxes can only enable the testing of new solutions that are ‘radical’ in the national context but not in the EU context. While the lack of a European regulatory sandbox has not impeded Member States from establishing regulatory sandboxes, this limited leeway has raised criticism, and the need for an EU framework addressing sandboxes has been identified.\(^\text{60}\)

Today, the question of limits has become more topical than ever. In the era of the Clean Energy Package, the secondary EU law stipulates more detailed questions than ever before. In addition, the network codes and guidelines are in force and the harmonisation work is ongoing in different areas.\(^\text{61}\) While this has positive effects when it comes to the completion of the Energy Union, the possibilities for legal national experimentation have simultaneously contracted. As the energy policies of the Member States still have their own particularities, the ‘laboratories of innovation’, or regulatory

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\(^\text{57}\) According to art 64 of the Electricity Regulation (EU) 2019/943, the derogation can be granted for a limited time; also see Schittekatte and others (n 18) more generally about ‘waivers’

\(^\text{58}\) P Popelier, ‘Five Paradoxes on Legal Certainty and the Lawmaker’ (2008) 2 Legisprudence 47, at 54

\(^\text{59}\) Also Veseli and others (n 18); Schittekatte and others (n 18). In accordance with the principle of shared competence, the Member States shall exercise their competence to the extent that the Union has not exercised its competence. In the case of conflicts, the EU law prevails over the national law

\(^\text{60}\) Veseli and others (n 18); Schittekatte and others (n 18). See also K Tews, ‘Europeanization of Energy and Climate Policy: The Struggle Between Competing Ideas of Coordinating Energy Transitions’, (2015) 24(3) Journal of Environment and Development, 267, where the author discusses ‘laboratories of innovation’

sandboxes, can be important for integration of national preferences with new, innovative solutions. In addition, regulatory competition between policy or legal innovations could be useful for the whole Union. In the best case, the results of the sandbox – what works and what does not – can be scaled up, which is also the core idea of regulatory sandboxes: new solutions are tested and the ‘results’ are evaluated, after which the tested solution/regime is possibly ‘normalised’ into the legal framework, or rejected. Step by step, the energy law paradigm changes.

Needless to say, a regulatory sandbox is not a perfect solution and also has weaknesses. The temporary approval of the solutions does not in all cases encourage the development or testing of new innovations – the element of legal uncertainty regarding the time-after-sandbox remains. In other words, the regulatory sandbox cannot guarantee the adoption of a specific kind of legal framework in future. That would obviously contradict the core idea of the sandbox as well as the principle of rule of law. In addition, to avoid issues with, for example, legality and non-discrimination, or clashes with the precautionary principle, the careful design of the sandbox including safeguards to prevent hazardous outcomes for other equally important objectives is crucial.

Despite these challenges, a regulatory sandbox can open up a new channel for ‘dialogue’ between legislator, innovators and other stakeholders and provide important information for the legislator and regulator on the new solutions and their regulation. While technical, social or systemic innovations can be tested in this way, the sandboxes provide also, and equally importantly, opportunity for legal innovations by allowing testing of regulation, too. They enable testing of the solutions without changing immediately the general legal regime decreasing the risks potentially related to the new framework and the innovation itself. When duly designed, the regulatory sandbox can both proactively guide the innovations with applicable principles/rules and enable the adoption of new fit-for-purpose legislation. In the best case, the

62 Tews (n 60)
63 Ibid; see also n 90
64 See for example S Ranchordás, ‘Experimental Regulations and Regulatory Sandboxes’ (n 16) and references therein, 3, 8
66 This should also be clearly communicated to the project developers to avoid ungrounded expectations (ibid)
67 S Ranchordás, The Constitutional Sunsets and Experimental Legislation: A Comparative Perspective (Edward Elgar 2014); Heldeweg (n 11); Philipson, Stamhuis and de Jong (n 65). About the precautionary principle and criticism towards the innovation principle, see K Gamett, G Van Calster, and L Reins, ‘Towards an Innovation Principle: An Industry Trump or Shortening the Odds on Environmental Protection?’ (2018) 10 Law, Innovation and Technology, 1
68 Schittekatte and others (n 18); Heldeweg (n 11) where the author sees experimental regimes as a solution to avoid regulatory disconnect. A regulatory sandbox could also be considered a solution to the ‘Collingridge dilemma’ – D Collingridge, The Social Control of Technology (Francis Pinter 1980) – according to which first there is too little information for regulating new technology and then, as the technology matures, regulating becomes costly. However, this applies better to unregulated sectors than highly regulated ones like electricity
69 Ranchordás, ‘Experimental Regulations and Regulatory Sandboxes’ (n 16), 11–12 and references therein
70 For example Ranchordás, ‘Experimental Regulations and Regulatory Sandboxes’ (n 16); Schittekatte and others (n 18)
regulatory sandbox could simultaneously lead to innovation-driven and legislation-driven solutions. In other words, the regulatory sandbox may provide a peephole to the future legal and socio-technical landscapes.

3.2. *The proposed regulatory sandbox regimes in the EU*

Against this background, it is not surprising that ACER and CEER have suggested the creation of an EU umbrella regulatory sandbox for energy. The concept of an EU-level regulatory sandbox, or experimentation clause, is not new; it was presented already, for example, in Directive 2007/46/EC establishing a framework for the approval of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles, and in Directive 2010/75/EU on industrial emissions. Recent and more comprehensive examples of regulatory sandboxes can be found in the European Commission proposal for Artificial Intelligence Regulation and in the Distributed Ledger Technology Regulation.

In May 2022, the first regulatory sandbox for energy was proposed by the European Commission as part of the REPowerEU package. The Commission proposal for amending the Renewable Energy Directive (EU) 2018/2001 more specifically, Article 15 of the Directive – includes a rather short provision following the definition introduced in the Better Regulation Toolbox:

> Member States shall promote the testing of new renewable energy technologies in pilot projects in a real-world environment, for a limited period of time, in accordance with the applicable EU legislation and accompanied by appropriate safeguards to ensure the secure operation of the electricity system and avoid disproportionate impacts on the functioning of the internal market, under the supervision of a competent authority.

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71 About the relation of energy law and energy innovations, see Zillman and others (n 6)
72 For the discussion of ‘landscape’, see Bennet Moses (n 7, n 12)
73 ACER, CEER (n 19), 17
74 Ranchordas, ‘Experimental Regulations and Regulatory Sandboxes’ (n 16) considers experimental legal regimes as a wider concept and regulatory sandboxes as a subset. The examples used here are legal regimes that allowed new technical solutions but did not include, for example, the element of limited time for deviations, which is typical of sandboxes
77 Proposal for a Regulation of the European Parliament and of the Council Laying Down Harmonised Rules on Artificial Intelligence (Artificial Intelligence Act) and Amending Certain Union Legislative Acts, COM(2021) 206 final, 21 April 2021
78 The Regulation has yet not been published but the text adopted by the Parliament on 24 March 2022 and by the Council on 12 April 2022 can be found at <www.europarl.europa.eu/RegData/semplinaire/textes_adoptes/definitif/2022/03-24/0088/P9_TA(2022)0088_EN.pdf>
80 European Commission, ‘Better Regulation Tool #21’ (n 15)
81 Art 1(3) of the Commission Proposal (COM(2022) 222 final)
The proposed provision is a concrete step towards a European regulatory sandbox regime and contains interesting elements. While a thorough analysis of the proposal is left for future research, a few preliminary remarks can be made here. First, the Member States would be required to promote testing of new renewable energy technologies, limiting the scope of the sandbox to technological innovations and excluding, for example, systemic and social innovations. Second, Article 15 of the Directive handles ‘administrative procedures, regulations and codes’ and, in principle, the Commission seems to link the regulatory sandbox to administrative procedures. However, the safeguards proposed by the Commission relate to the secure operation of the electricity system and functioning of the internal market. As the scope of the regulatory sandbox is not clarified further in the proposal, it remains somewhat ambiguous. Finally and most importantly, the proposed paragraph states that the applicable EU legislation should be followed. The provision is thus not to create an EU regulatory sandbox but to encourage establishing national sandboxes with a limited room for manoeuvre for deviations, which is already possible today. All in all, the sandbox provision in the Commission proposal seems, at first glance, to remain inadequate to address the challenges related to the innovations that are radical in the EU context. A more comprehensive EU regulatory sandbox regime is therefore needed.

3.3. Designing the EU regulatory sandbox for energy

Models for regulatory sandboxes already exist, and there is no need to re-invent the wheel. However, examples of EU sandbox regimes are still few and the most comprehensive ones have not even been adopted at the time of writing, ie they have not yet been tested. In addition, every sector has its own particularities, objectives and structure of competences, which all (should) affect the design of a sandbox regime. The electricity supply is crucial to modern societies; the sector is highly regulated and undergoing a massive transition. The competences between Member States and the EU are shared, and the EU legislation directly imbues independent national regulatory authorities with certain powers, as well as ACER. For example, these specificities should be taken into account to guarantee the appropriate division of powers, and level of flexibility and predictability, when designing the regulatory sandbox for energy.

Earlier literature provides useful building blocks when developing a more comprehensive EU regulatory sandbox for energy. The key legal requirements in experimental regimes have been related to the principles of legality, legal certainty and equal treatment as well as transparency and accountability. In addition, general guidelines and best practices inspired by scientific field tests and to be considered when designing regulatory sandboxes, have been suggested. These findings provide a good basis when considering an EU regulatory sandbox for energy, too, while keeping in mind

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82 Art 15(2) of the Renewable Energy Directive 2018/2001, under an earlier revision (Commission proposal COM(2021) 557 final, 14 July 2021), relates to the technical specifications that are to be met by renewable energy equipment and systems in order to benefit from support schemes
83 Ranchordás, Constitutional Sunsets and Experimental Legislation (n 67); Heldweg (n 11); Philipson, Stamhuis and De Jong (n 65)
84 Ranchordás, ‘Experimental Regulations and Regulatory Sandboxes’ (n 16)
that the EU-level provisions do not necessarily constitute a complete regulatory sandbox as such but rather a frame for it.

When developing a regulatory sandbox for energy in the EU context, a number of questions relating to the sandbox design need to be answered.\(^85\) The first set of questions relates to the organisation of the sandbox:

- What should be regulated on the EU level and what is to be left to the national legislators?
- What should be the division of competences between national and EU authorities?
- How do we ensure that a functional process for evaluation is established?

The second set covers more substantive topics:

- What principles and objectives should guide the development of sandboxes?
- What kinds of projects or innovations should the sandboxes be open to?
- What is the scope of possible deviations?
- What time limits, if any, should be established for the sandboxes?
- How will the projects be treated after the experimentation?

The principle of subsidiarity should also be considered when introducing new EU-level legislation in the area of shared competences.\(^86\) As discussed above, Europeanisation, ie the harmonisation and increasing level of detail of the EU energy and electricity market law, inevitably limits the leeway of the Member States for setting up national regulatory sandboxes. Therefore, the EU-level legislation is necessary to provide flexibility for the Member States and to enable testing of radical innovations. The EU-level framework could also positively affect the usefulness of lessons learned from the experiences and the knowledge sharing in the EU,\(^87\) as will be discussed in the following sections. The aforementioned questions provide the starting point for the discussion.

3.4. Organisation of the EU regulatory sandbox for energy

When talking about an ‘EU regulatory sandbox’, the first question is whether the EU legislation should provide room for national regulatory sandboxes, or whether it should constitute an EU-wide regulatory sandbox. The latter has also been suggested for energy, though having been considered an ambitious option.\(^88\) However, in the energy sector, which belongs to the shared competence between the Member States and the Union and where Member States have the sovereign right to choose their

\(^85\) The following questions are based on Ranchordás, ‘Experimental Regulations and Regulatory Sandboxes’ (n 16); Ranchordás, *Constitutional Sunsets and Experimental Legislation* (n 67); Heldeweg (n 11); Philipsen, Stahuis, de Jong (n 65); Schittekatte and others (n 18); Veseli and others (n 18)

\(^86\) The Consolidated Version of the Treaty on the Functioning of the European Union art 4(3)

\(^87\) Veseli and others (n 18)

\(^88\) Schittekatte and others (n 18)
own energy mix, the national energy systems and circumstances still deviate from each other. Even though this article has emphasised the Europeanisation of the energy sector, the harmonisation of the legislation is not complete and the Member States still have some differences in their legal frameworks. For these reasons and when taking into account that an EU-wide sandbox to which the projects would be accepted in a centralised way could in many cases mean that an EU authority (ACER or the Commission) accepts deviations from the national legislations, an EU-wide sandbox is not suggested here. In contrast, special cases of cross-border sandboxes could be considered in the framework that enables national sandboxes.

Regulatory sandboxes can be established in different ways, but usually a competent authority is entitled to accept projects into the sandbox and grant deviations from the applicable law. In any case, organisation of the sandbox requires a solid legislative basis, here referred to as experimentation clauses. Taking the enabling framework for national sandboxes as a starting point, it should be decided whether the Member States are granted the competence to enact experimentation clauses or whether the experimentation clause itself is directly stipulated at the EU level. In principle, delegating the competence to the Member States would provide more room to address the national circumstances in the regulatory sandboxes (ie what questions are of particular relevance in the national context), as well as the administrative and constitutional settings. This would better suit the idea of an enabling framework at the EU level. However, this competence should be limited by the EU-level provisions, as discussed below.

The division of powers between the EU and national authorities needs also to be defined. Who should be entitled to decide on the acceptance of projects for the regulatory sandboxes? If the sandboxes were national, instead of EU-wide, the national authorities would be the natural actors. The EU-level legislation could also directly entrust the national regulatory authorities, which have responsibility for the supervision of the legal compliance, with the tasks relating to the implementation of the (national) sandboxes, such as accepting eligible projects and granting deviations. In some cases an EU-level control to ensure uniform interpretation and praxis could be justified; nevertheless, accumulating bureaucracy should be avoided. In addition to the general monitoring of the implementing legislation, a separate EU approval procedure for certain (for example wider and longer) sandboxes could be considered.

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89 The Consolidated Version of the Treaty on the Functioning of the European Union 194(2). For example, the climate and renewable energy targets have their implications for the choices of the Member States. For a detailed analysis on the provision, see K Huhta, ‘The Scope of State Sovereignty Under Art 194(2) TFEU and the Evolution of EU Competences in The Energy Sector’, (2021) 70(4) International & Comparative Law Quarterly, 991
90 In principle, an EU sandbox could fit better for such cross-border (high-voltage) projects that are directly regulated on the EU level. The EU-level legislation enabling national sandboxes would allow ‘experimenting by devolution’ while ‘experimenting with derogations’; see Heldeweg (n 11) with references to DT Hornstein, ‘Complexity Theory, Adaptation, and Administrative Law’ (2005) 54 Duke LJ 913
91 See Schittekatte and others (n 18); ISGAN (n 17)
92 Schittekatte and others (n 18), 8
93 Electricity Directive (EU) 2019/944, art 59
94 Schittekatte and others (n 18) have proposed a somewhat similar concept
To find a balance between the Member States’ room for manoeuvre and harmonisation, the EU framework could consist of general objectives which the national sandboxes should promote, instead of, for example, listing the eligible project types or regulatory solutions. These kind of objectives have been adopted in some national regimes together with criteria for project developers. While at the national level they can be used as a type of selection criteria for the projects applying to the sandbox, on the EU level they could also be used as a tool to guide the national legislation. One of the biggest challenges when regulating (also) innovations is how to know what to regulate. As the energy systems are going through a drastic transition, it does not seem reasonable to limit the scope of the sandbox to pre-selected project types, specifically at the EU level. An objective approach would enable leeway for the Member States in the design but offer a common European ‘vision’ providing direction for the Member States and the project developers, leading to a more coherent set of experiments. To avoid giving carte blanche to Member States to deviate from the EU law, certain additional safeguards should be included in the EU-level provision. In addition to the common objectives and limitations, the scope of potential derogations is evidently needed in the EU-level legislation – it is the core idea of the legal framework. The substance of these elements is discussed in the next section.

One of the characteristics of regulatory sandboxes is that they are limited in time, i.e. the changes in the applicable rules are not permanent. As the innovations vary, the time required to gather experience varies, too. It would be reasonable to leave the exact time limits to a case-by-case discretion and not to stipulate them in the EU legislation. However, to avoid excessively long experimentations, a maximum time limit could be set – for example, five years. The EU legislation could also stipulate possible extension criteria as well as when the sandbox can be prematurely ceased.

In the earlier literature as well as in practice, gathering information and evaluating, i.e. the processes of learning based on the experiences, are seen as key objectives of the regulatory sandboxes. To ensure that the evaluation is duly conducted on both the Member State and the EU level, there should be rules guiding the exchange of information between actors. ACER and CEER have suggested that the national regulatory
authorities could report to ACER and other national regulatory authorities about the results of the sandboxes.\textsuperscript{104} This option would emphasise carrying out an evaluation by experts and independent authorities, instead of a political evaluation – which, however, is needed, at the latest when drafting new legislation. Depending on the design of the regulatory sandbox, the Member States or national regulatory authorities could be required to inform the other Member States and their authorities as well as the EU institutions (ACER/Commission) in a structured manner. In addition, the Commission or ACER could be entrusted to evaluate (for example in cooperation with the Member States or national regulatory authorities) the results of the national regulatory sandboxes to ensure that the outputs are adequately considered in future law making. Stakeholder participation should also be ensured,\textsuperscript{105} preferably at both the national level (for each project or sandbox) and at the EU level (in a thematically aggregated form).

### 3.5. Substantive provisions guiding the regulatory sandboxes

Inspiration for the objectives of sandboxes can be taken from the current national regimes, even though they are not exactly ‘comparable’ to the EU-level legislation, which at the moment limits the scope of the national solutions.\textsuperscript{106} Despite this possible bias, national regulatory sandboxes provide an overview of the themes, which can be expected to be relevant for the near-future sandboxes, too, as they reflect larger trends in the energy sector. These include, at least, enhancement of sector integration (including power-to-X solutions), digitalisation of the energy sector, enhanced flexibility in energy/electricity systems, storage solutions, smart grids and efficient network operation as well as the use of self-produced energy and energy communities.\textsuperscript{107} Also, innovations increasing social acceptance of the energy transition could be added to the list.\textsuperscript{108} Some of these categories are partly overlapping but the Member States could further elaborate these objectives in the national legislation. These EU-level objectives should be evaluated on a regular basis to ensure their accuracy.

To what kind of projects, innovations and actors should the sandbox then be open? At the level of legislation, there could be either a list of the feasible projects or innovations which may enter into the regulatory sandbox, or criteria for approving the projects.\textsuperscript{109} While it is obviously important to stipulate these questions clearly, limitations that are too strict could be counterproductive on the EU level. In the current legislation, the definition of a demonstration project provides some sort of a starting point. As noted in Section 2.1, this definition is rather tight, focusing on new technological solutions and leaving social and systemic innovations out of its scope. In addition, it does not consider legal innovations, which is understandable given the limited scope of application. Nevertheless, in the sandbox framework, all these aspects should be considered. A wider definition of a demonstration project combined

\begin{itemize}
\item \textsuperscript{104} ACER, CEER (n 19)
\item \textsuperscript{105} Heldeweg (n 11)
\item \textsuperscript{106} This ‘bias’ is discussed by Schittekatte and others (n 18)
\item \textsuperscript{107} For an overview of different regimes, see ISGAN (n 17)
\item \textsuperscript{108} In the Austrian sandbox, this kind of strategic goal was suggested: see ISGAN (n 17), 14
\item \textsuperscript{109} Schittekatte and others (n 18), 4 compare the regimes of Great Britain, Netherlands and Italy. See also ISGAN (n 17)
\end{itemize}
with principle-based selection criteria relating to the objectives set for the sandboxes could be an appropriate option on the EU level. This would ensure that the solutions to be tested are innovative and aim to promote the selected objectives, but diminish the potential risk of regulatory disconnection.\textsuperscript{110}

The deviations are in the core of the sandbox and their scope is probably one of the most difficult questions when designing the regime. The scope of those provisions from which a deviation can be granted could be defined in a closed list stipulated in the EU provision. The list could also be open. In some national regimes, such as Great Britain,\textsuperscript{111} the experimentation clause did not include a list of provisions at all, but on the EU level this could lead to legal uncertainty. If the list of provisions was closed, that would practically limit the projects, but this option would enhance clarity and legal certainty. Another option could again be a principle-based approach providing more flexibility, whilst still guaranteeing some level of predictability. Principles could also be combined with a ‘negative’ closed list, ie containing the rights and obligations that should always be respected and maintained. This would both protect, for example, the customers of the innovation developers and help the project developers and innovators in the longer run, as they could identify the most essential principles, duties and rights in the electricity market law that cannot be changed as the result of regulatory sandboxes after the experimentation ends. These could include, for example, third-party access to networks, consumer protection and general principles of the EU law, like prohibition of discrimination.\textsuperscript{112} A combination of a closed positive list (of the provisions from which the deviations can be granted) and a closed ‘negative’ list (of the provisions and principles which are always to be respected) could be the most robust approach.

Some more general safeguards could also be required in the EU-level legislation, as is done in the Commission’s recent sandbox proposal. According to the proposal, the Member States should set ‘appropriate safeguards to ensure the secure operation of the electricity system and avoid disproportionate impacts on the functioning of the internal market’. Similar requirements could be set with regard to consumer protection. If the scope of the deviations was limited to the electricity market rules, general safeguards regarding, for example, environmental protection would probably not be necessary as the environmental legislation would apply normally in the regulatory sandbox.\textsuperscript{113} However, if the sandbox was widened, the safeguards should also be reconsidered.

This article has focused on electricity market legislation, and the suggested regulatory sandbox would first and foremost address the development of radical innovations in the electricity sector. It can, however, be argued that for accelerating the energy transition, it would be beneficial to widen the scope of the deviations in the regulatory sandbox. The scope could include some provisions from the Gas Directive and Regulation,\textsuperscript{114} which are currently under revision but are not likely to include rules

\textsuperscript{110} See n 9
\textsuperscript{111} Schittekatte and others (n 18), table 1
\textsuperscript{112} The principles of Article 3 of Electricity Regulation (EU) 2019/943 could also provide the basis
\textsuperscript{113} K Garnett, G Van Calster and L Reins (n 67) emphasise the importance of environmental and consumer rights in relation to the innovation principle
4. Conclusions

The necessary transition towards clean energy systems inevitably requires the adoption of innovative solutions. As a consequence, promoting innovations has become an important objective in the EU energy policy, and more recently it has also been acknowledged in the sectoral electricity market legislation. Increasingly detailed and robust legislation can in general promote innovations, but this is not the case for radical innovations that do not comply with the current legislation. As this paper explains, the radical innovations remain inadequately addressed in the EU.

The EU electricity market design presented in the Clean Energy Package is hardly definitive but rather an evolving concept. The ongoing energy transition changes the premises on which the legislation is built. Therefore, legal flexibility and testing environments benefiting innovators, legislators and regulatory authorities should be considered at the EU level.

Regulatory sandboxes provide a promising solution to create the needed flexibility. In the best case, regulatory sandboxes can establish a channel for ‘dialogue’ between legislators and innovators. Top down, the innovative solutions can be guided by the principles and objectives laid down in the legal framework. Bottom up, the results from the sandboxes may be scalable and could lead to amendments in the generally applicable legislation. Obviously, implementing regulatory sandboxes also involves risks which need to be addressed in their design.

Earlier studies have already argued for an EU regulatory sandbox for energy. In this paper, the concept is elaborated further and core design principles for the regulatory sandbox are suggested. The sandbox framework would provide a robust legal basis for the national sandboxes in the Member States, which is currently lacking, and ensure that the dialogue is useful not only nationally but also in future EU law making. The suggested design principles strike a balance between flexibility and clarity, between national- and EU-level competences. While there should be a clear guidance from the EU level to avoid arbitrariness, a certain amount of leeway should be allowed for the Member States. The design principles provide building blocks for developing the EU framework of the regulatory sandbox for electricity and energy.

Evidently, the regulatory sandbox is not a panacea and does not solve all the challenges relating to the energy transition and its regulation. Radical innovations are most likely only a part of the solution. Nevertheless, taking into account the necessity to
move to clean energy systems and achieve climate targets, can we afford not to implement a regulatory tool that can enable and help to manage the energy transition?

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