

## **Regulatory sandboxes in the energy sector: are they key to the transition to a net zero future?**

**Alexandra Schneiders, University College London (UCL) Energy Institute  
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**Abstract:** Regulatory sandboxes are becoming a popular policy tool. They can play a key role in allowing for experimentation with new business models and roles enabled by net zero policies. This paper aims to assess whether sandboxes in the energy sector can play a key role in the transition to net zero. It reviews literature on the rollout of energy sandboxes so far, and focuses on the early movers, namely the Netherlands' and United Kingdom's sandboxes. The paper concludes that sandboxes can be a useful complementary tool to existing regulatory processes, as long as current limitations around their lack of representation of consumer interests, transparency, knowledge of experimenters, financial help, as well as short timeframes and inability to derogate from all applicable laws are addressed. These inhibit sandboxes from fulfilling their main aim; namely to enable stakeholders to learn from the challenges raised by a net zero future.

**Keyword set:** regulatory sandboxes, energy sandboxes, peer-to-peer energy trading

## I. INTRODUCTION AND METHOD

Regulatory sandboxes have become a hot topic in recent years. With experimentation as their main aim, sandboxes can play an essential role in testing the risks and practicalities of new business models and roles foreseen in net zero policies recently introduced in countries around the world.

This paper assesses whether sandboxes being launched in the energy sector can play a key role in the transition to a net zero future. It reviews the literature by academics and practitioners on energy sandboxes, and summarises findings as regards their practical rollout. It focuses on first movers, namely the energy sandboxes of the United Kingdom and the Netherlands. It also reviews documents setting out the reasoning behind both sandboxes, drafted by Ministers and regulators. Lastly, it analyses a recent opinion of the highest advisory body of the Dutch government (Raad van State, RvS), which led to the ceasing of the Netherlands' energy sandbox. Due to the recency of the RvS opinion, the literature so far has not focused on this important event.

This paper is divided into five sections. The first section provides background information on the emergence of new business models and roles in the energy sector, as well as how regulatory sandboxes could play a role in developing these. The second section delves into the Dutch and UK regulatory sandboxes and their aims. The third section summarises the limitations set out in the literature on energy sandboxes. The fifth and sixth sections assess the need for a sandbox as well as how the Dutch sandbox came to an (abrupt) end following the opinion of the RvS. In the seventh section, the research question ***Can energy sandboxes play a key role in the transition to a net zero future?*** will be answered.

## II. BACKGROUND

### 1) Transition to net zero

To tackle climate change, an increasing number of countries are committing to economies underpinned by net-zero greenhouse emissions [1]. Widespread digitalisation and a decrease in the costs of decarbonising technologies are boosting this transition to net zero, along with policy developments giving consumers and consumer collectives a more active role in the energy market [2].

An example of such a policy is the European Union's Clean Energy Package (CEP). The 'active customer' is finally recognised, giving energy consumers the right to consume, store and sell self-generated electricity, including within communities. The CEP sets the framework for the new structures that are needed to support these new roles, such as the Citizen Energy Community (CEC) and Renewable Energy Community (REC) [3]. These are characterised by polycentricity, with numerous actors involved as opposed to the top-down relationship traditionally governing the energy sector [4].

This comes at a time when an increasing number of countries are retiring financial support for consumers and collectives generating their own renewable energy. An example of a financial incentive being phased out is the feed-in-tariff (FIT), which involves energy

suppliers buying energy produced by energy consumers at a fixed price. The removal of such financial incentives is predicted to provide a boost to financial models allowing for the selling of renewable energy, such as peer-to-peer (P2P) energy trading. These would provide revenues to consumers who previously benefited from the FIT [5].

New business models enabling consumers to actively offer services enhancing the sustainability of the grid, such as P2P energy trading, are being recognised by regulatory frameworks underpinning the transition to net zero (e.g. CEP). P2P energy trading lets consumers sell or donate their self-generated renewable energy to other consumers or businesses, through automated contracts executed by platforms enabling peer-to-peer (P2P) financial transactions [6]. Examples of P2P energy trading schemes include the CommUNITY project in Brixton (London, UK) [7] and the Schoonschip pilot in Amsterdam (The Netherlands) [8], both carried out within a regulatory sandbox. Such new business models would not only give consumers financial incentives to participate in the transition to net zero, but also potentially provide new grid services in the energy system of the future, such as the balancing of supply and demand [9].

However, little is known about the ‘functioning and innovative potential’ of these new business models [9]. Despite giving consumers new rights to trade energy and provide flexibility services, policies such as the CEP remains deliberately vague on how these should take place [10]. This room for interpretation opens the door to experimentation, enabling consumers and collectives to experiment with how to best organise themselves to deliver these services, as well as how to establish new modes of governance enabling these new business models to function efficiently [11]. The urgency of the transition to net zero also requires a ‘timely deployment of solutions and business models’ supporting it [2].

## **2) Regulatory sandboxes**

With empowered consumers and new business models comes an additional layer of uncertainty facing regulators and policymakers; namely how to protect consumers while enabling innovation. Taking the example of P2P energy trading, the consensus in the literature around the wider sharing economy phenomenon is that there is a need for ‘adaptive regulation’ tools to tackle this challenge [12] This is due to the speed of innovation and the fact that the regulator cannot keep up with technological developments.

An example of such an adaptive regulatory tool is the regulatory sandbox. The first regulatory sandbox was launched by the Financial Conduct Authority (FCA) in the United Kingdom (UK) in 2016, enabling the rollout of innovative (and not legally permitted) business models in the financial services sector. Following its success, sandboxes have also started to be rolled out in the energy sector in numerous countries [13].

The term ‘regulatory sandbox’ is borrowed from the IT world [14]. It provides a safe space in which new products, business models and services can be experimented with, ‘in a real-world environment without some of the usual rules and regulations applying’. A sandbox is usually run by the regulator, or a government agency, and limits apply including timeframe, number of consumers involved in the experiment, and rules that can be derogated from. The evidence collected during sandbox experiments helps policymakers understand how

and whether rules should be changed to allow for the rollout of these new innovations or business models in the long run [2].

Within the context of net zero, a sandbox can enable the testing of solutions related to new challenges affecting the energy system, for instance how to manage energy communities providing new services to the grid, and the impact of (risky) platform solutions commonly used for peer-to-peer energy models such as distributed ledger technologies (e.g. blockchain) [2].

Of crucial importance to a regulatory sandbox is that it should provide an environment for learning, not only allowing those participating in the sandbox to learn from an innovation, but also producing 'generalisable knowledge' letting the wider public learn from experiment outcomes [15]. By modelling real-life impacts of a new technology or business model, the sandbox leads to the reduction of the 'asymmetry of information' between innovators and the regulator [16]. The result is more informed policymaking [17].

A sandbox should also help limit risks, giving foresight on whether a certain innovation or regulation does not give the anticipated benefit or actually harms consumers and other market participants [16]. It is particularly important to test the impact of a new innovation or business model on consumers, since market participants, such as prosumers (consumers producing their own energy), are 'frequently uncertain about how consumer protections and other rules apply to new products and services' [18]. In fact, the earlier regulators can interact with an innovation, the more they are able to observe and address risks for the system, and particularly consumers [19].

Furthermore, it is essential for experiments in the regulatory sandbox to allow for 'polycentricity', i.e. be 'co-developed by a heterogeneous group of actors'. This not only includes industry and regulators, but also community energy groups, energy consumers, agencies representing consumers' interests and research organisations [4] [9].

This is necessary since the sandbox should reflect the reality of those new business models enabling the transition to net zero, namely their operational complexity due to their bottom-up nature. The more a sandbox experiment reflects reality, the more successful it will be in helping policymakers assess regulation and speed up the transition to net zero. Crucially, a sandbox would also allow consumers, who are now more empowered by net zero policies, to have a say on how new business models should be run and governed.

### **III. EXAMPLES OF NATIONAL APPROACHES**

The intention to learn from innovations and how to protect consumers is universal to all sandboxes in the energy sector. However, as this section shows, there are crucial differences in national approaches to reflecting the reality of the transition to net zero, which may have an impact on the potential to learn from sandbox experiments.

The first example of a national approach is the Netherlands' energy sandbox ('Experimenteerregeling'), which ran from 2015-2018 and was overseen by the Dutch Enterprise Agency (RVO). One of the key aims of the sandbox was to involve energy

consumers more intensively in their own energy provision and consumption. The reasoning behind it was that due to technical developments it has become increasingly appealing for energy consumers to produce their own renewable energy. This is a positive development for the transition to net zero. It is however unknown what impact these (groups of) consumers will have on the rest of the energy system. The sandbox provides an environment to observe these impacts and adapt regulation to mirror these [20].

Experimenters in the Dutch sandbox could deviate from a number of pre-determined provisions in the Electricity Act. They could for instance be exempted from licensing requirements, enabling them to generate and supply electricity to participants, as well as decide their own electricity tariffs and the conditions determining supply. This allowed for new business models such as peer-to-peer energy trading to be tested within the sandbox. A key requirement for the experiments was that they needed to show active involvement of consumers [20].

A 'less stringent' consumer protection regulatory framework could be justified in experiments, since a requirement of the sandbox was that participants needed to be part of a housing association or energy co-operative. These legal entities were perceived as providing enough consumer protection to justify removing the licensing requirement (which typically carries strict consumer protection requirements). Members of the legal entity could hold each other accountable in this way [20].

Consumer protection and wellbeing was also maintained by involving an additional energy supplier in experiments to ensure participants' electricity demand was continuously met, and the RVO keeping an eye on tariffs set by the community. Consumer law deriving from European law, such as the right to switch suppliers, was upheld as the sandbox could not deviate from European (i.e. supranational) law [20].

Another approach is that of the United Kingdom, which has an energy sandbox run by the energy regulator Ofgem since 2017 ('Innovation Link'). As opposed to the Dutch sandbox, it does not pre-define which provisions may be derogated from, but derogations are limited to the body of rules enforced by the regulator or those bodies (governing industry codes) that are affiliated to the sandbox [21].

The Ofgem sandbox offers four options to innovators: 1) bespoke guidance on how to interpret regulations; 2) time-limited derogations from particular rules; 3) comfort about Ofgem's approach to compliance; 4) confirmation that an activity is permissible [22]. It stresses that any advice it provides is not an endorsement of a specific service or product. It wants a 'win-win situation', where innovators can learn from their trial and the success of their service or product, while the regulator learns about consumer attitudes, what works, as well as system and market operations [23].

As with the Dutch sandbox, the consumer is central to the experiment. Ofgem will only allow a pilot into the sandbox if the concept that is being tested offers a 'good prospect of benefits to consumers' [21]. It will only grant a derogation to a regulatory barrier identified by the experimenter if it is satisfied that 'the benefits to consumers warrant it, and the risk to the system and other players can be mitigated' [23].

Ofgem expects that those developing a trial ensure consumers' diverse needs are met in order to enable their participation; have in place effective management and risk monitoring plans; and avoid economic, social and personal consumer harm [22]. Another condition to the pilot is that experimenters must have a 'clear exit strategy', i.e. be prepared to end the pilot after two years [23].

The language used by the RVO and Ofgem when describing the sandboxes shows that the latter takes a much more cautious approach than the former, particularly when it comes to letting consumers take an active role in experiments. As stated above, for a sandbox to fulfil its role, experiments should reflect the reality of new business models in the transition to net zero (with more active consumers) as much as possible. The next section focuses on this question from a practical point of view, drawing mainly from the UK and Dutch sandboxes (and occasionally from the French energy sandbox, recently launched by the French regulator- CRE).

#### **IV. PRACTICAL LIMITATIONS**

##### **1) Consumer representation**

As stated above, it is crucial for regulatory sandboxes to provide an environment of learning and feedback, mimicking the polycentric nature of the new decentralised business models underpinning the transition to net zero. It is important to ensure participant heterogeneity, in order to have a comprehensive understanding of the effects of experiments on the different types of consumers (e.g. prosumers) involved in these models.

The practicalities of experiments so far show a mixed picture as regards the accurate representation of consumer interests in the sandbox. In their research on Dutch sandbox experiments, Lammers and Diestelmeier found that five out of the nine projects they studied were not in fact being led by housing associations or energy co-operatives, but by professional organisations such as real estate companies, project developers and research centres. This meant that 'consumers were not actively involved', which was a key requirement for experiments [11]. Van der Waal et al found that there were experiments in the Dutch sandbox where only board members of the energy co-operatives were actively involved in decision-making around the experiment [9].

In the UK sandbox, only license holders, as well as parties to those industry codes which may be derogated from in the sandbox, can run an experiment. These are overwhelmingly likely to be industry players [22]. The heterogeneity of participants is also hindered by the fact that participation is mostly voluntary, leading to 'self-selection' and most participants being involved due to ideological motivations (and financial means) [15] [24] [25]. Ofgem has acknowledged this by stating that not all consumers will be 'universally receptive and trusting of innovation' [22]. Other than financial reasons, further factors limiting participation could be the (regulatory) uncertainty around the business model and ensuing lack of clarity on what will happen after the experiment [4].

Therefore, it is obvious that both sandboxes, despite wanting to make consumers central to experiments, have limitations around the participation and representation of consumer interests.

## **2) Knowledge**

The lack of knowledge of the regulatory framework by experimenters also hinders participation. Those experiments in the Dutch sandbox that were not being developed by professionals had trouble relying solely on volunteers, since these were not energy professionals. Assistance was lacking and the complexity of the regulatory framework led to experiments 'progressing slowly' [9]. This 'made it harder to function as a local decision-making unit', since it was 'not always easy to acquire all of the required information for informed choices' [9]. Furthermore, associations with limited financial means could not afford special advisers, meaning they were in need of help from for instance representative associations, government bodies, or intermediaries [25].

Van der Waal et al also found that despite the exemption from a supply license being beneficial for Dutch experiments, it meant that housing associations and energy co-operatives had to take on more tasks (i.e. back office administration) than they were prepared or sourced for. The lack of external assistance for these difficulties demeaned the efficiency of experiments, since the burden of making sure experiments ran smoothly was disproportionately on the shoulder of experimenters [9].

The issues observed in the Dutch sandbox experiments so far may justify the stricter approach taken in the UK sandbox, where licensed parties (already having expertise on the applicable rules) run experiments. This however does not help enhance consumer representability and participation in the UK sandbox. A solution is to provide more assistance to experimenters running pilots, particularly those without expertise (e.g. community energy groups) [9].

## **3) Inability to derogate from all laws**

Another impediment to regulatory sandboxes accurately reflecting reality is the fact that not all laws applicable to new business models can be derogated from. This means that not all 'obstacles to innovation' are addressed in experiments [4]. An example is P2P energy trading, a business model being experimented with in many sandboxes. Aside from energy regulation, it has an impact on other areas of law such as data privacy, tax and contract law. Experiments in the Dutch and UK sandboxes have so far not been able to deviate from non-energy law derived rules.

This is because the sandbox is usually run by a regulator or government agency having no control over all applicable laws [26]. There is also a lack of collaboration between government bodies to test different fields of law within the same experiment. For example, in the first window of the French energy sandbox (June-September 2020), out of 41 applications the CRE only had the power to decide on 3, since many applications fell within the competence of other government bodies [14].

Furthermore, for sandboxes being rolled out in EU Member States, the supranational nature of European Union law means that it cannot be deviated from in sandboxes. Consumer law (e.g. right to switch suppliers) and data privacy law (e.g. GDPR) are largely based on European law, meaning experiments are not able to experiment with such rules. Data privacy is a sensitive topic in new business models used by prosumers and collectives to sell energy, due to their use of platforms collecting data to enable (financial) transactions between consumers [4].

#### **4) Transparency**

Learnings can only be applied by all actors in the experiment, as well as outside the experiment in the wider market, if these are made publicly available. The literature has been critical about the lack of transparency in energy sandboxes such as those of the UK and Netherlands [16].

By ensuring transparency and public dissemination of experiment findings, the sandbox helps create a level playing field between parties that are licensed and unlicensed, since the latter are becoming important in the transition to net zero (e.g. community energy groups) [27]. However, this cannot be said of the UK sandbox, which aside from centering around licensed parties, provides limited learnings online regarding its experiments so far. The Dutch sandbox also provides little public information on experiment results.

This gives the impression of the regulator or government agency talking to innovators behind closed doors, and giving them advice on how to implement their business model in the current market (at the expense of competitors). It will end up making the public 'worse off', as the regulator or government agency is 'acting more like a private law firm than a public body' [28]. A further risk for consumers is that the experimenters will try to use the sandbox as 'a means of legitimising their unlicensed schemes' [29].

There is a careful balance to be struck here. On the one hand, innovators may be put off from participating in the sandbox if too much information on their business ideas is disclosed publicly. However, the key aim of a sandbox is to learn from experiments, and if other parties have no access to learnings this will result in a slower evolution to net zero [16].

#### **5) Financial help and duration of experiments**

The fact that most sandboxes do not provide financial help to experimenters also limits the range of experiments that can take place, with organisations such as companies having more means to fund experiments. For instance, research on Dutch sandbox experiments found that cash-strapped entities such as energy co-operatives had difficulty taking on the financial risk of running projects [9]. Financial issues can also delay experiments and waste the regulator's time when assessing applications for experiments that will end up not taking place due to a lack of funding [30].

In addition, the length of trials has an impact on the learnings that can be derived from experiments. In the UK sandbox, trials may last up to two years (which includes 'set-up,



running and exiting the trial'). This has been criticised in the literature as being far too short [22]. It is difficult for experiments to get properly started within such a short window of time and particularly recruit enough participants. On the other hand, experiments in the Dutch sandbox could run up to ten years. Whereas a short timeframe can allow for faster learning, a longer period of time provides more certainty to innovators (who have to fund the experiments themselves) [16].

## **V. IS THERE A NEED FOR A SANDBOX?**

The limitations listed above show a fragmented picture of the efficiency of sandboxes and whether they can fulfil their role of enabling learning, particularly on the challenges around net zero. Interestingly, figures reported by organisations running sandboxes in the UK, Netherlands and France show that only a small percentage of the total number of applications are granted a trial in the sandbox.

In France, 22 out of 41 applications were rejected in the first round, several of which because they were not innovative enough or could take place without changing the regulatory framework [14]. The Dutch sandbox was also reportedly a 'complicated procedure with limited attractiveness for local energy initiatives', since only 18 experiments were granted out of 'the potential 80 in a four-year period' [9].

As for the UK sandbox, Ofgem found that a lot of the applications for trials 'failed to identify a specific regulatory barrier', with it being likely that 'many of these can operate within the current regulatory framework'. It ended up giving advice to several innovators on how they could apply the current rules to accommodate their business model, i.e. there was no need for a sandbox to enable derogation from rules [31].

Interestingly, the first sandbox to ever be launched (the financial services sandbox in the UK) encountered similar experiences, with firms wanting to use it primarily to 'understand how regulatory requirements would apply to their innovative services or products' and also what type of authorisation might be needed (if any) [32]. Therefore, the focus did not seem to be the granting of derogations to test new business models, which is the main aim of a regulatory sandbox.

Despite the literature being largely enthusiastic about the use of regulatory sandboxes for more agile and responsive policymaking in the age of fast innovation and empowered consumers, there are also many open questions as to whether a sandbox is essential or even necessary. There is little evidence so far on what impact, if any, regulatory sandboxes have had on legislation [33] [16]. This may be because sandboxes are a relatively new phenomenon. Policymakers and regulators may also be informally taking on the findings from experiments (i.e. helping them 'reconsider the interpretation of existing rules'), with this not being formally recorded [33].

Sandboxes should not be seen as the be all and end all. As Ofgem makes clear, it is not a tool for 'permanently changing policy', since this can only be done through 'legally established procedures involving evidence gathering, assessment and consultation'. It is mostly a learning tool for the regulator, innovators and consumers- where insights gleaned

by the regulator during experimentation are fed into policymaking [34]. The sandbox should therefore be seen as ‘not a substitute, but a complement’ to the ‘more traditional regulatory tools to enable innovation’ [16].

However, only a sandbox fully reflecting the reality of the new business models and roles in the transition to net zero can provide useful learnings to policymakers. Therefore, the practical limitations set out in this paper need to be addressed for the sandbox to play this complementary role.

## **VI. THE END OF A SANDBOX**

The Dutch sandbox was recently ended after the highest advisory body of the Dutch state (Raad van State, RvS) published a negative advice in 2020 on the sandbox and its potential impact. It noted how the entire responsibility for the set up and costs of the experiment, as well as responsibility for the risks, were in the experimenters’ hands. This is concerning, particularly since the experiment can have a negative impact on other parties in the energy market that are not part of the experiment. The RvS found that there were not enough safeguards in place to monitor or mitigate such risks. It advised that the decision of the RVO granting an experiment should include rules precisely defining and framing the space for experimentation in advance [35].

In his response to the RvS, the Minister for Energy pointed out that the energy transition is not a ‘clear and well-defined path’. The aim of the sandbox is to investigate whether the granting of derogations ‘is favourable to the energy transition and whether an adjustment or repeal of those regulations is desirable’. This aim requires a flexible and open set-up, where the initiative for the design of the experiment is in the hands of experimenters. If it is not known in advance which experiments will be carried out, it is not possible to set conditions on the way in which the experimenter will ‘safeguard certain interests’ [36].

The opinion of the RvS shows a misunderstanding of the fact that the sandbox is supposed to be an adaptable tool reflecting the evolution of society and new business models. Pre-defining exactly how an experiment should be conducted defeats the point of a sandbox. The Dutch sandbox was innovative in how it allowed actors such as prosumers and energy collectives to provide services to the grid, something that will be part of the transition to net zero. Ending it is not the answer, but

The Dutch sandbox provided a more reflective experience of the realities of net zero compared to other sandboxes (such as the UK’s), since it gave a central role to consumers and energy communities in running and shaping experiments. It therefore had a higher potential to provide learnings on how consumers could best be mobilised to drive the transition to net zero. Its limitations (identified in the previous sections) should have been addressed, instead of the sandbox being ended altogether after the RvS’ opinion.

## **VII. CONCLUSION**

This paper sought to answer the question whether regulatory sandboxes in the energy sector can play a key role in the transition to net zero.

Countries around the world are prioritising the transition by changing their policies to enable new business models granting energy consumers and collectives more powers to generate renewable energy and sell it to other consumers or collectives. An example of such a new business model is peer-to-peer energy trading.

A regulatory sandbox, enabling for regulatory derogations under supervision of the regulator or a government agency, can play an essential role in allowing experimentation with these new business models and providing learnings on how they should be governed and run. In order to provide insightful learnings for policymakers and all other energy sector actors, they should reflect reality as much as possible. This includes the reality of the bottom-up nature and heterogeneity of the new business models underpinning the net zero transition.

However, analysis carried out in this paper shows that despite this being the intention of energy sandboxes launched in countries such as the Netherlands and United Kingdom, the practical realities led to shortcomings that hinder learning. These include limitations such as limited representation of consumer interests, limited knowledge of experimenters on the energy regulatory framework, the inability to derogate from all applicable rules, the lack of transparency around experiment findings, and the absence of funding as well as short experiment timeframes.

The low success rate of applications for energy sandboxes so far, due to most applications being able to run without a sandbox or not being innovative enough, raises questions as to whether there is even need for a sandbox. Despite evidence of the usefulness of sandboxes being scarce so far, they can still play a role as a *complementary* tool to traditional policy-making processes by enabling policymakers and other actors to informally learn from new business models and innovations. Learning can only take place if the sandbox reflects reality, and the limitations listed in this paper hinder this.

Sandboxes can therefore play a complementary role in the transition to net zero, on the condition that they are improved on the points mentioned in this paper. If these limitations are not addressed, sandboxes cannot fulfil their main role of enabling parties to learn how to tackle challenges associated with the net zero transition.

The solution is not to end sandboxes due to these limitations, as with the Dutch case, but to explore solutions to improve them and increase their reflection of the reality of net zero. Further research will be needed to find potential solutions to the limitations summarised in this paper, particularly on ways to accurately represent the different types of consumers involved in new business models such as peer-to-peer energy trading.

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