



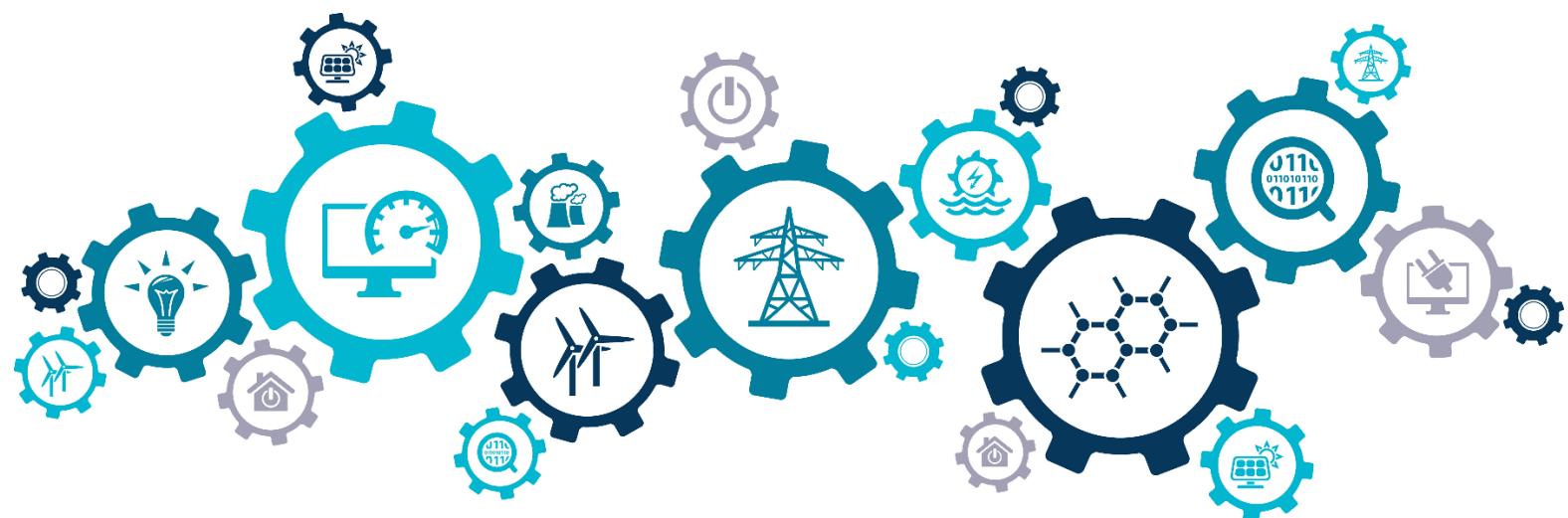
## JRC SCIENCE FOR POLICY REPORT

# Making energy regulation fit for purpose. State of play of regulatory experimentation in the EU

*Insights from running  
regulatory sandboxes*

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## **Contents**

Abstract .....	1
Acknowledgements .....	2
Executive summary .....	3
1 Introduction .....	5
1.1 Policy context .....	7
2 Methodology .....	9
3 Overview of regulatory experimentation in the EU .....	11
3.1 Geographical distribution of regulatory experimentations .....	11
3.2 Areas of regulatory experimentation .....	14
3.3 Stakeholders involved .....	19
4 Challenges and lessons learnt .....	20
4.1 Benefits of regulatory experimentation initiatives .....	20
4.2 Risks and limitations of regulatory experimentation initiatives .....	21
4.3 Obstacles and difficulties relating to regulatory experimentation initiatives .....	22
4.4 Possible EU support to the set-up of regulatory experimentation initiatives .....	23
4.5 Effectiveness of regulatory experimentation initiatives .....	24
4.6 Regulatory sandboxes – lessons learned from the field .....	25
5 Conclusions .....	29
References .....	30
List of abbreviations and definitions .....	33
List of figures .....	35
List of tables .....	36
Annexes .....	37
Annex 1. Regulatory experimentation in the EU - country profiles .....	37
Annex 2. Regulatory experimentation outside the EU .....	92
Annex 3. Questionnaire .....	104
Annex 4. Questionnaire answers .....	107

## **Abstract**

In this report, we investigate the role of regulatory experimentation as an innovation tool to enable and facilitate the energy transition. Regulation can help to accelerate the adoption of innovative technologies, solutions and business models, thus reflecting the fast-changing environment that digitalisation and decarbonisation bring about, while empowering and protecting consumers. Regulators have a range of tools for engaging with and addressing innovation (e.g. regulatory sandboxes, regulatory pilot projects and pilot regulations). We analyse regulatory experimentation initiatives conducted in EU Member States to identify forms of regulatory experimentation adopted, areas of experimentation, stakeholders involved, emerging trends and lessons learned. The analysis, based on the existing literature, desk research and interviews with competent authorities, includes initiatives already implemented at national level, as well as those under development or still in the planning phase. Differences in national regulatory frameworks and a lack of uniform information on the assumptions, requirements, and results of the initiatives, hinder comparisons of national experience. An overview of the main developments, however, may help to show the direction EU Member States are taking and to reflect on the opportunity for providing EU level guidance to support the implementation of regulatory experimentation initiatives at national level.

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## **Executive summary**

### **Policy context**

The European Union's energy system is confronted with a profound transformation, driven by the need to reach its ambitious climate objectives and to supply secure and affordable energy to consumers and businesses. The changes brought by the twin digital and energy transition require a dynamic approach to regulation, moving away from static, steady state regulation to an adaptable and agile one. Innovation is considered key for the success of the twin transition and should involve all sectors and components of the energy system and all of its actors. In this context, and encouraged by the Council of the European Union, the European Commission is looking into regulatory experimentation as a tool to foster innovation. The need to facilitate innovation through experimental approaches to regulation is highlighted in the European Commission Communication 'A new European Innovation Agenda'. The European Commission is currently working on policy documents to support EU policymakers and innovators in their experimentation activities.

### **Main findings**

The **geographical distribution** of regulatory experimentation initiatives in the EU is uneven. Early initiatives were reported in Italy and the Netherlands, while other countries started more recently to draft their regulatory experimentation strategy. At the time of writing, and based on the collected data, regulatory experimentation initiatives have been adopted or are under development in 12 Member States, while 3 more Member States are considering their adoption.

The **adoption timeline** of regulatory experimentation initiatives in the EU shows that although regulatory sandboxes had a later start, they have become the most recurring form of regulatory experimentation in the EU in recent years, reflecting a trend which is common also across different sectors.

Some countries have adopted only one **form of experimentation** (regulatory sandboxes, regulatory pilot projects or pilot regulations), while other countries have opted for a varied mix of measures.

Member States are testing different **areas** of regulatory experimentation: flexibility and balancing services; storage; integration of renewable and low carbon gases in the gas networks; electromobility; collective self-consumption and energy communities; smart grids; integration of RES; and tariff design.

The scope of the experimentation affects the range of **eligible stakeholders**. Next to regulated entities, we see a number of well-established energy producers and suppliers, but also a certain number of new players, such as energy service providers, ICT and software providers and public institutions.

As far as the **effectiveness** of the reviewed forms of experimentation is concerned, it is not possible to draw any general conclusion, as national schemes are difficult to compare and there is a very limited evidence base on their impacts. Most interviewees, however, view regulatory experimentation as a promising tool in the hands of regulators to promote the adoption of new solutions and to inform regulatory change. In the country profiles in Annex 1, we report some cases where experimentation led to a permanent evolution of the regulatory framework. The assessment of national experiences, however, requires further work and analysis, possibly including also the point of view of innovators and consumers.

Interviews and questionnaires provided interesting **insights** into the experience of national authorities and valuable information about the main perceived benefits, risks, limitations, obstacles, and difficulties relating to the set-up and implementation of national regulatory experimentation initiatives. Such a body of information may help to see the direction EU Member States are taking and to reflect on the opportunity for providing EU level guidance to support the implementation of regulatory experimentation initiatives at national level.

### **Related and future JRC work**

JRC will continue monitoring the development of regulatory experimentation in the energy sector at EU level, collecting lessons learned and disseminating best practices.

### **Quick guide**

Chapter 1 introduces the concept of regulatory experimentation and presents the policy context. Chapter 2 elaborates the methodology developed for data collection. Chapter 3 provides an overview of regulatory experimentation initiatives in the EU. Chapter 4 discusses findings, key insights and good practices. Annex 1

presents current developments at Member States level through comprehensive and detailed country profiles. Annex 2 provides some examples of regulatory experimentation outside the EU. Annex 3 reports the questionnaire used to collect information from the Member States. Annex 4 provides a summary of the answers to all questions.

## 1 Introduction

The European Union's energy system is confronted with a profound transformation, driven by the need to reach its ambitious climate objectives and to supply secure and affordable energy to consumers and businesses<sup>1</sup>. Energy efficiency and renewable energy are the main pillars of the energy transition, and their contribution will have to be enhanced throughout all sectors of the economy. The current political framework makes this evolution even more urgent to help the European Union (EU) reduce its energy dependence from unreliable suppliers and volatile fossil fuel markets without jeopardizing its climate objectives.

Innovation is considered key to achieving a new energy system based on clean, secure and affordable energy for everyone<sup>2</sup>. It should involve all sectors and components of the energy system and all its actors (IEA, 2020) (IRENA, 2017) (IRENA, 2019), and be supported by dedicated policy and regulatory frameworks.

Change is currently happening at a fast pace, but meeting the EU's ambitious targets requires action to further support innovation and the transformation of energy systems. Such transformation however raises issues that national regulatory authorities (NRAs) need to address, such as safeguarding consumer protection, ensuring privacy and enabling market entry by non-traditional players (QUEST and Pollution Probe, 2020).

The EU and Member States, acting at different levels, have an important role to play in promoting innovation. They can resort to a wide range of tools, including research and innovation funding, targeted financial instruments, favourable policies and enabling regulation.

NRAs in EU Member States have long started applying regulatory tools to stimulate innovation among regulated network companies (Cambini, Congiu, & Soroush, 2020) as well as among new market players (Schittekatte, Meeus, Jamasb, & Llorca, 2021). Some jurisdictions have addressed this challenge by launching time-limited regulatory experiments for new solutions, to see what works and what doesn't in a real-life and low-risk environment, where some of the usual rules do not apply. This approach limits the risks associated with innovation and offers at the same time the possibility to learn over time and inform future regulatory reforms.

Regulators navigate a complex system within contexts of uncertainty and change. Experimental regulatory regimes have emerged as a way to enable innovative solutions while anticipating unintended consequences and minimizing risks.

The admissibility of experimental legal and regulatory regimes has been the subject of discussion and debate for many years. As pointed out by (Ranchordás, 2021), such 'admissibility is nowadays consensually accepted, provided that they are based on clear legislative mandates' (Ranchordás, 2014).

Experimental regulation relies on the adoption of a 'legislative or regulatory instrument of a temporary nature with limited geographic and/or subject application which is designed to test a new policy or legal solution and includes the prospect of an evaluation at the end of the experimental period' (Heldeweg, 2015) (van Gestel & van Dijck, 2011) (Ranchordás, 2021).

The idea behind regulatory experimentation is that in a rapidly changing environment, where authorities cannot know in advance all underlying complexities, new rules can fail, hence it is better to adopt a trial-and-error approach (Poncibò & Zoboli, 2022) that allows them to make better informed decisions.

Regulatory experimentation allows the industry to test new products and services and the regulator to assess their impact before deciding on the appropriate regulatory treatment enabling evidence-based, outcome-oriented regulation. Regulatory experimentation can take different forms as regards its scope, objective, the derogation granted, the duration, the actors involved, the way of granting the derogations, etc. Such diversity is linked to a certain degree of terminological uncertainty, as similar experiments may take different names, such as pilot regulations, regulatory sandboxes, and pilot projects.

In any case, all different types of regulatory experimentation share some common characteristics:

- they are set up to support innovative solutions that require prior live testing to gather additional factual evidence of their risks and benefits,

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<sup>1</sup> COM/2019/640, The European Green Deal, 11 December 2019, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2019%3A640%3AFIN>

<sup>2</sup> COM/2016/763, Accelerating Clean Energy Innovation, 30 November 2016, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2016:763:FIN>

- they imply the possibility of granting derogations from the current regulatory framework, where the latter represents an obstacle to the feasibility or viability of the innovative solution,
- they are set up with a view to promoting regulatory learning.

Adopting a common language to refer to different forms of regulatory experimentation is a necessary condition to carry out international comparisons and get an overview of recent developments at EU level. Among the definitions proposed in the literature, we chose the following to describe the different forms of regulatory experimentation adopted in EU Member States in the energy sector.

**Regulatory sandboxes.** Tool#69 - *Emerging methods and policy instruments* of the Better Regulation Toolbox<sup>3</sup> defines regulatory sandboxes as ‘schemes that enable firms to test innovations in a controlled real-world environment, under a specific plan, developed and monitored by a competent authority. They are usually organised on a case-by-case basis, include a temporary loosening of applicable rules and feature safeguards to preserve overarching regulatory objectives, such as safety and consumer protection’. Two approaches are possible: 1) the request and identification of regulatory barriers is initiated by innovators (bottom-up approach); 2) the regulator identifies legislative provisions for testing and calls for applications by interested organisations (top-down approach). This definition is in line with the Conclusions on Regulatory Sandboxes and Experimental Clauses adopted by the Council of the European Union<sup>4</sup>, where the Council highlighted that regulatory sandboxes ‘can provide the opportunity for advancing regulation through proactive regulatory learning, enabling regulators to gain better regulatory knowledge and to find the best means to regulate innovations based on real-world evidence, especially at a very early stage, which can be particularly important in the face of high uncertainty and disruptive challenges, as well as when preparing new policies’.

**Regulatory pilot projects.** Regulatory pilot projects are real-life experiments put in place by the regulator to allow and support the trial of innovative solutions on a local basis (CEER, 2021) (EUUniversal, 2022). They usually involve network operators and are approved on a case-by-case basis by the regulator who strictly defines the scope of the experimentation, the application procedure and the derogations that may be granted.

**Pilot regulation.** Pilot regulations are transitional regulatory frameworks put in place for a limited time frame to learn through early applications before introducing a new regulatory regime. They are open to all market players willing to deploy innovation consistent with the proposed innovative framework (CEER, 2021)

These three forms of regulatory experimentation differ along several dimensions. Following and adapting (Schittekatte, Meeus, Jamasb, & Llorca, 2021), in this study we identify the following three main dimensions (Figure 1):

**Innovation approach.** This dimension relates to the different role of the regulator and the project proponents. In the top-down approach, typically, the regulator identifies the legislative provisions for testing and, if necessary, sets the boundaries of the experiment, calling for applications by interested organisations. In the bottom-up approach, the identification of the regulatory barriers is initiated by innovators.

**Way of granting the derogations.** Granting of the derogations could be subject to an application procedure, apply automatically to all parties that comply with certain eligibility criteria or follow a case-by-case analysis. This dimension is strictly connected with the innovation approach dimension.

**Geographical scope/extension of the experimentation.** Local experiments are limited to approved areas (e.g. the site of a project, a section of the grid, a region), while nationwide experiments are not linked to a specific site and can be implemented throughout the national territory.

In real life, categorising regulatory experimentation initiatives can be questionable, as the differences between the different forms of experimentation tend to blur when they are adapted to the national context. Furthermore, in many cases the same initiative is referred to in different ways in the literature. Despite these difficulties, we strove to identify a single form of experimentation for each reported initiative, while highlighting their singularities.

<sup>3</sup> European Commission Better regulation toolbox, 2021 [https://commission.europa.eu/law/law-making-process/planning-and-proposing-law/better-regulation/better-regulation-guidelines-and-toolbox/better-regulation-toolbox\\_en](https://commission.europa.eu/law/law-making-process/planning-and-proposing-law/better-regulation/better-regulation-guidelines-and-toolbox/better-regulation-toolbox_en)

<sup>4</sup> Council Conclusions of 16.11.2020 on Regulatory sandboxes and experimentation clauses as tools for an innovation-friendly, future-proof and resilient regulatory framework that masters disruptive challenges in the digital age and Council's Working Party on Better Regulation <https://data.consilium.europa.eu/doc/document/ST-13004-2020-INIT/en/pdf>

**Figure 1.** Characterisation of different forms of regulatory experimentations

	Regulatory sandboxes	Regulatory pilot projects	Pilot regulations
Innovation approach	Bottom up The identification of regulatory barrier is initiated by innovators	Top down The regulator identifies legislative provisions for testing and calls for applications by interested organisations	
Way of granting the derogations	Case-by-case basis	Derogations are only granted to the actors that are successful in the application procedure	Derogation automatically applies to all parties that comply with certain eligibility criteria
Geographical scope of the experimentation	Nationwide	Local	Nationwide

Source: JRC, 2023

In this report, we will look at initiatives carried out in Member States to map the state of play of regulatory experimentation in the EU.

## 1.1 Policy context

Regulation will play a central role in supporting innovation and the transformation of the energy system required to attain the EU decarbonisation objectives. Innovation as a general term is neither positive nor negative (Saltelli, Dankel, Di Fiore, Holland, & Pigeon, 2022) (Blok, 2018), but its usefulness depends on the adherence of its outcomes to the set of objectives and values that inspire it. In this respect, the 2019 **European Commission Communication on Better Regulation** acknowledges the need for a regulation that promotes and harnesses innovation ‘to the benefit of the environment, the economy and EU citizens’<sup>5</sup>. This statement is reiterated in the **Innovation Principle** that maintains that EU policy and legislation should encourage innovations that help realise the EU’s environmental, social and economic objectives, anticipating and harnessing future technological advances<sup>6</sup>. In the last decades, the concept of **responsible research and innovation** (RRI) has emerged from the context of EU funding initiatives, as an approach that anticipates and assesses potential implications and societal expectations of innovation (European Commission, 2013) to promote innovations that are economically profitable but also more sustainable, socially desirable and ethically acceptable (Blok, 2018).

The changes brought about by the twin digital and energy transition require a dynamic approach to regulation, moving away from static, steady state regulation to an adaptable and agile one. In this regard, the Council of the European Union affirms in the **Council conclusions of 16 November 2020**<sup>7</sup> that regulatory sandboxes can offer significant opportunities for innovation and growth for all businesses, especially SMEs, including micro-enterprises as well as start-ups, in industry, services and other sectors. In its conclusions the Council encourages the Commission to continue considering the use of experimentation clauses<sup>8</sup>, often the legal base for regulatory sandboxes, on a case-by-case basis when drafting and reviewing legislation, as well as to evaluate the use of experimentation clauses in ex-post evaluations and fitness checks on the basis of an exchange of information with Member States. Furthermore, it calls on the Commission to organise, in cooperation with Member States, an exchange of information and good practices regarding regulatory sandboxes between Member States.

<sup>5</sup> COM/2019/178, Better regulation: taking stock and sustaining our commitment, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2019:178:FIN>

<sup>6</sup> [https://research-and-innovation.ec.europa.eu/system/files/2022-07/ec\\_rtd\\_factsheet-innovation-principle.pdf](https://research-and-innovation.ec.europa.eu/system/files/2022-07/ec_rtd_factsheet-innovation-principle.pdf)

<sup>7</sup> See footnote 5

<sup>8</sup> Experimentation clauses: legal provisions which enable the authorities tasked with implementing and enforcing the legislation to exercise on a case by case a degree of flexibility in relation to testing innovative technologies, products, services or approaches, <https://www.consilium.europa.eu/en/press/press-releases/2020/11/16/regulatory-sandboxes-and-experimentation-clauses-as-tools-for-better-regulation-council-adopts-conclusions/>

Following the Communication on 'Better Regulation - Joining forces to make better laws'<sup>9</sup> <sup>10</sup> and the publication of the guidelines on the principles that the European Commission follows when preparing new initiatives and proposals and when managing and evaluating existing legislation<sup>11</sup>, in 2021 the European Commission revised the **Better Regulation Toolbox**<sup>12</sup> to include regulatory sandboxes as tools to foster a more innovation-friendly regulatory environment, contributing to resilience and sustainability (Tool#69 - *Emerging methods and policy instruments*).

More recently, the **Commission Recommendation** on speeding up permit-granting procedures for renewable energy projects and facilitating Power Purchase Agreements<sup>13</sup>, published on 18 May 2022 in the framework of REPowerEU<sup>14</sup>, notes the potential that sandboxes could have in supporting innovative decarbonisation technologies needed for climate neutrality and encourages Member States to put them in place<sup>15</sup>.

The need to facilitate innovation through experimental approaches to regulation is reaffirmed in the European Commission Communication '**A new European Innovation Agenda**'<sup>16</sup> of 5 July 2022. In the communication regulatory sandboxes as well as test beds and living labs are flagged as tools facilitating innovation.

The European Commission notes that further policy documents will be released in 2023 to support policymakers and innovators in their approach to experimentation in the EU. In this context, this report is intended as a contribution to the debate on regulatory experimentation, and specifically on regulatory sandboxes.

According the JRC science policy brief 'Regulatory learning in experimentation spaces' (Kert, Vebrova, & Schade, 2022) regulatory sandboxes, living labs and test beds are **experimentation spaces** that can generate evidence and learning useful to support innovation and regulatory governance. However, they have different features that require different form of actors' involvement and support different types or regulatory learning. The primary motivation of **regulatory sandboxes** is to test innovation and regulations in controlled real-world market conditions to improve legal certainty and focus on technologies mature for market deployment; **test beds** and **living labs** have as their primary motivation to develop, test and upscale innovative products or services in controlled (near) real-world (test beds) or uncontrolled (near) real-world physical or virtual environment (living labs).

<sup>9</sup> COM/2021/219, Better regulation: Joining forces to make better laws, 29 April 2021, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021DC0219&from=EN>

<sup>10</sup> EC Better regulation: why and how: [https://commission.europa.eu/law/law-making-process/planning-and-proposing-law/better-regulation\\_en](https://commission.europa.eu/law/law-making-process/planning-and-proposing-law/better-regulation_en)

<sup>11</sup> Commission Staff Working Document, Better Regulation Guidelines, SWD(2021) 305, [https://commission.europa.eu/system/files/2021-11/swd2021\\_305\\_en.pdf](https://commission.europa.eu/system/files/2021-11/swd2021_305_en.pdf)

<sup>12</sup> See footnote 2

<sup>13</sup> Commission Recommendation of 18 May 2022, C(2022) 3219 on speeding up permit-granting procedures for renewable energy projects and facilitating Power Purchase Agreements: [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=PI\\_COM%3AC%282022%293219](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=PI_COM%3AC%282022%293219); and accompanying Commission Staff Working Document 'Guidance to Member States on good practices to speed up permit-granting procedures for renewable energy projects and on facilitating Power Purchase Agreements Accompanying the document Commission Recommendation on speeding up permit-granting procedures for renewable energy projects and facilitating Power Purchase Agreements', SWD(2022) 149: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022SC0149>

<sup>14</sup> COM/2022/108, REPowerEU: Joint European Action for more affordable, secure and sustainable energy, 8 March 2022, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022DC0108&qid=1676910038582>

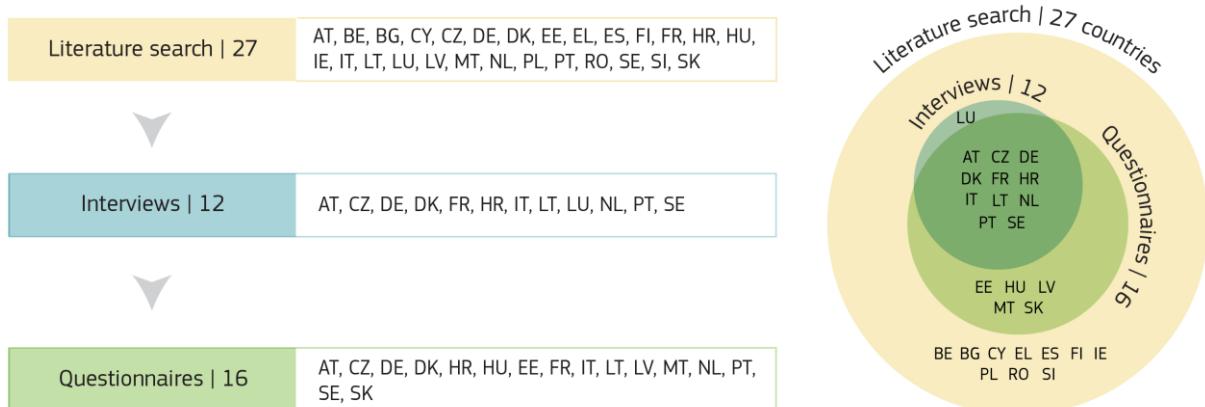
<sup>15</sup> C(2022) 3219, INNOVATIVE PROJECTS, paragraph (32) 'Member States are encouraged to put in place regulatory sandboxes to grant targeted exemptions from the national, regional or local legislative or regulatory framework for innovative technologies, products, services or approaches, to facilitate permit-granting in support of the deployment and system integration of renewable energy, storage, and other decarbonisation technologies, in line with Union legislation'.

<sup>16</sup> COM/2022/332 of 5 July 2022, A New European Innovation Agenda, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022DC0332&from=ES>

## 2 Methodology

We chose to carry out a qualitative and quantitative (mixed-methods) analysis for this study, since we required a detailed understanding of the experience of NRAs<sup>17</sup> in dealing with novel regulatory approaches. Since it is still a nascent topic, documentation on the experiences of national regulators in applying regulatory experimentation in the energy sector is sparse. Our analysis has three complementary components: a literature search, semi-structured interviews with representative from NRAs and questionnaires. Figure 2 provides an overview of the methodology.

**Figure 2.** Overview of the methodology



Source: JRC, 2023

**Literature search.** To find examples of regulatory experimentation in the energy sector in the EU, a search was performed on both academic and grey literature (e.g. consultation documents, working papers, government documents, evaluation reports) between March and September 2022. The following keywords were used: sandboxes, pilot projects, pilot regulations, regulatory experiments, experimental legislation/regulation, experimental clauses, enabling clauses, regulatory innovation.

Grey literature were also searched by visiting websites of national regulators in EU Member States, other relevant organisations (e.g. CEER, IEA-ISGAN, Florence School of Regulation) or otherwise by performing google searches.

**Interviews.** Potential interviewees were recruited based on purposive sampling – i.e. due to their role in the regulatory authority. We identified one interviewee per Member State and sent him/her an email with an invitation to an interview. 12 people agreed to be interviewed.

The main aim of the interviews was to allow interviewees to elaborate further on the status of regulatory experimentation in their country. The interviews had three open-ended questions:

- what are the current and foreseeable regulatory developments in Member States?
- what are the main obstacles, difficulties, limitations, risks and benefits relating to the set-up and management of national regulatory experimentation initiatives?
- what are some possible forms of support/guidance at EU level?

Interviews were conducted in English, online via Webex between April and November 2022. Each interview lasted approximately 1 hour and was recorded with interviewee's permission.

**Questionnaire.** Following the interview, a questionnaire was sent to all potential interviewees (also the ones that did not agree to the interview) in order to provide a final opportunity for the researchers to gather any additional information. The questionnaire contained both open and closed questions (see Annex 3 for the list

<sup>17</sup> In some cases, the competent authority is not the regulator, but other entities such as ministries or independent authorities. For the sake of simplification, hereafter, we will refer to all of them as NRAs.

of questions). In some cases, the same question was repeated in both open and closed format, in order to provide respondent with enough freedom to elaborate on certain topics but also to provide the researcher with several options for analysis. For some closed questions we gave the respondents 3-4 choices, but asked them only to choose two.

We undertook basic data analysis using a deductive approach, based on pre-chosen themes of the interviews and questionnaires. Triangulating among the combination of methods and data sources allowed us to build a more holistic picture of the state of regulatory experimentation in the EU today.

This methodology presents however some limitations:

- not all regulators responded (Figure 2), therefore, the picture we provide is not complete and fully representative of the EU state of play,
- each country profile reflects the situation at the time the country profile analysis was finalised. Possible updates have not been covered,
- we limited the extent of interviews and questionnaires to NRAs without extending the coverage to all the possible involved actors (e.g. project proponents, impacted citizens, etc.).

In the next chapters we will focus only on EU Member States. Regulatory experimentation initiatives carried out in other European (Norway and UK) and non-European countries (Australia, Canada and Singapore) are reported in Annex 2.

### 3 Overview of regulatory experimentation in the EU

The literature search, interviews and questionnaires allowed us to get an overview of the current state of play of regulatory experimentation in the EU. In the following paragraphs we examine the different forms of regulatory experimentation adopted throughout the EU, their geographical distribution, the areas of experimentation concerned, and the stakeholders involved.

#### 3.1 Geographical distribution of regulatory experimentations

Regulatory experimentation initiatives are not yet evenly spread across the EU. Early initiatives were reported in Italy and the Netherlands, while other countries started more recently to draft their regulatory innovation strategy. Figure 3 shows the geographical distribution of regulatory experimentation initiatives in the EU. At the time of writing, and based on the collected data, initiatives have been adopted or are under development in 12 Member States, while 3 more Member States are considering their adoption.

**Figure 3.** Geographical distribution of regulatory experimentation initiatives in the EU

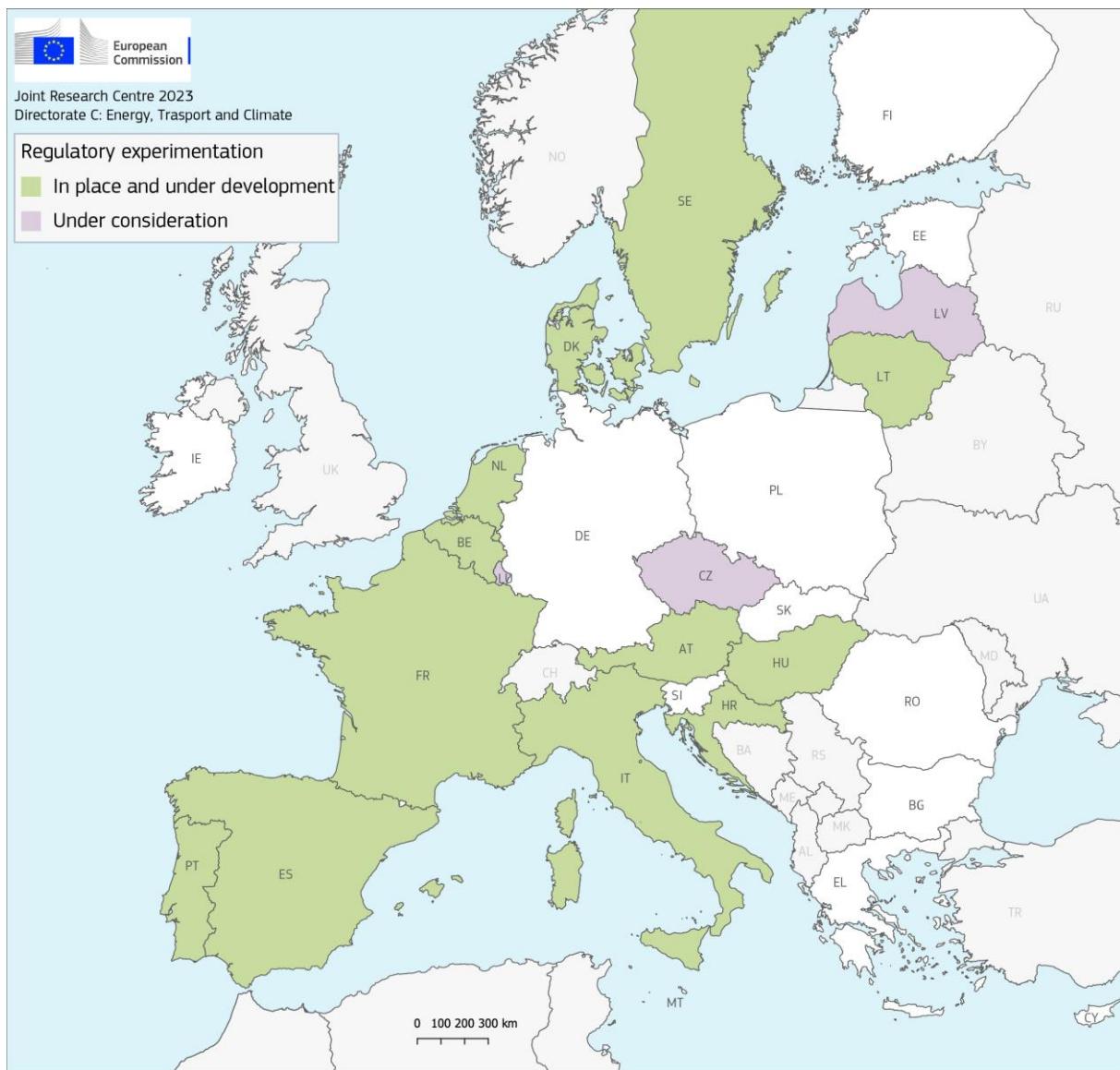
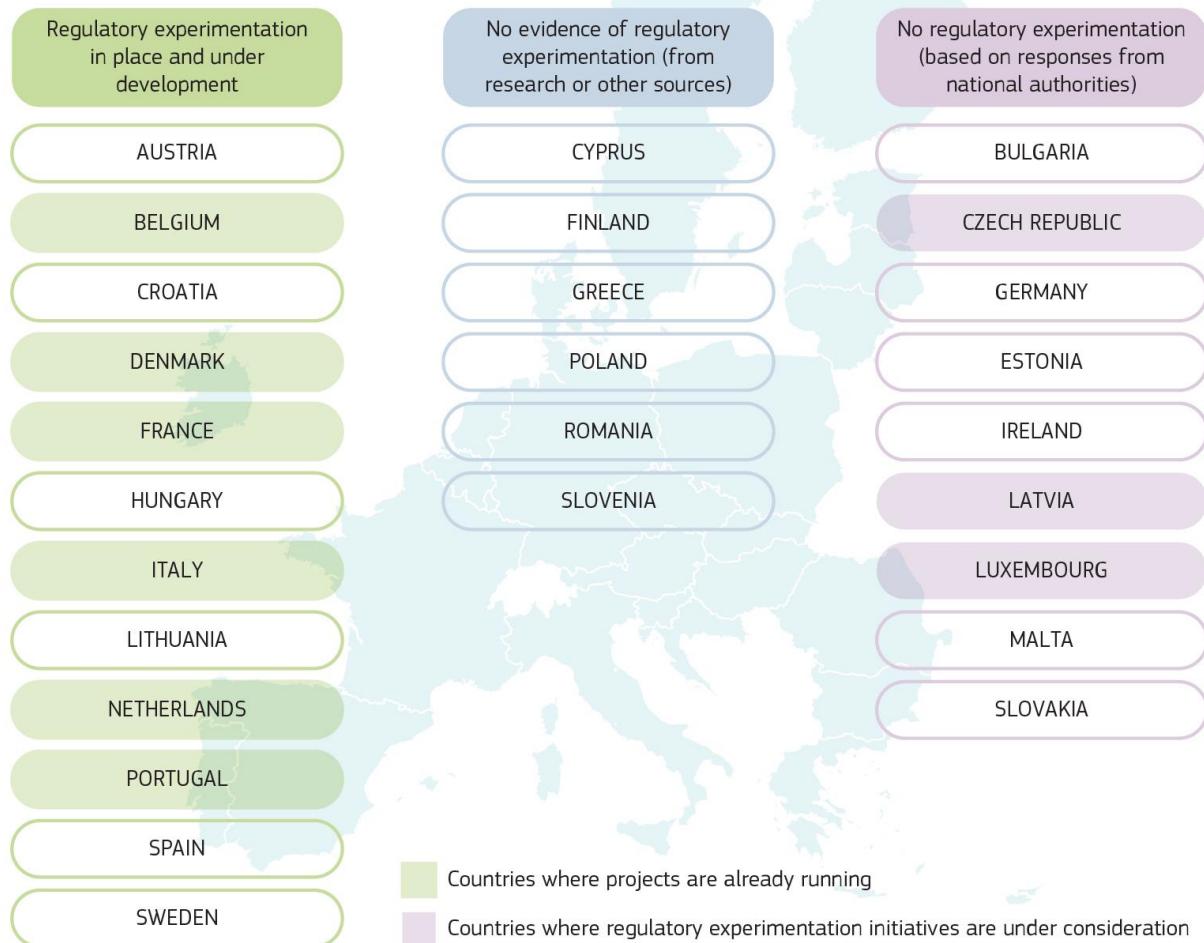


Figure 4 further details the results of our research. Of the 12 Member States where regulatory experimentation initiatives have been adopted or are under development, 6 have already launched projects. 9 Member States confirmed that no initiative have been adopted or are under development in their jurisdiction.

3 of them, however, reported that their adoption is under consideration by the competent authorities. Finally, for 6 Member States we did not find evidence of past or current regulatory experimentation initiative, but we did not receive any confirmation in this sense from the contacted national authorities. Detailed information on each country's situation can be found in the country profiles in Annex 1.

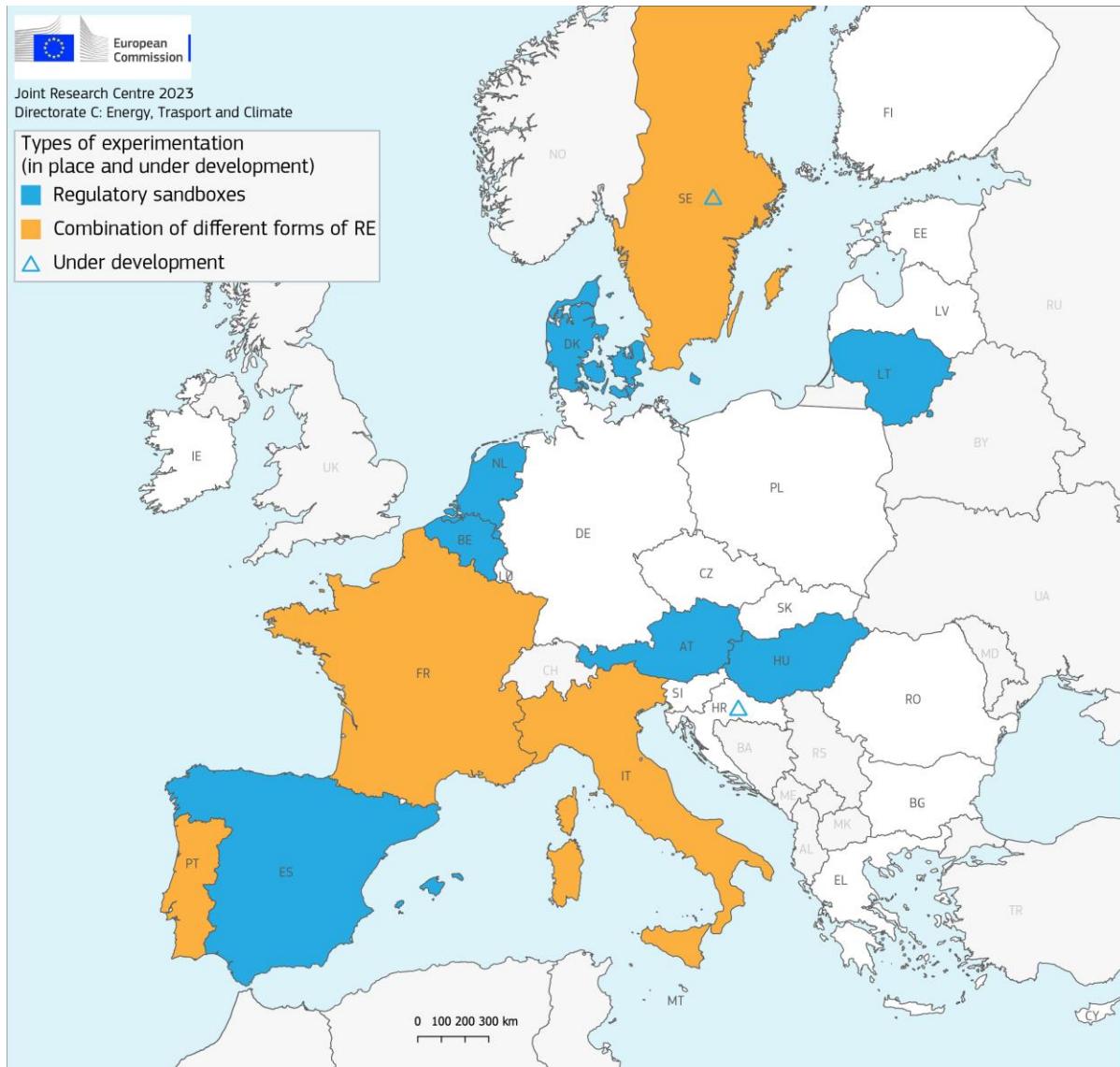
**Figure 4.** Overview of regulatory developments at EU level



Source: JRC, 2023

As for the form of regulatory experimentation, 7 Member States have adopted regulatory sandboxes, while 4 Member States have opted for a more varied mix of measures (Figure 5).

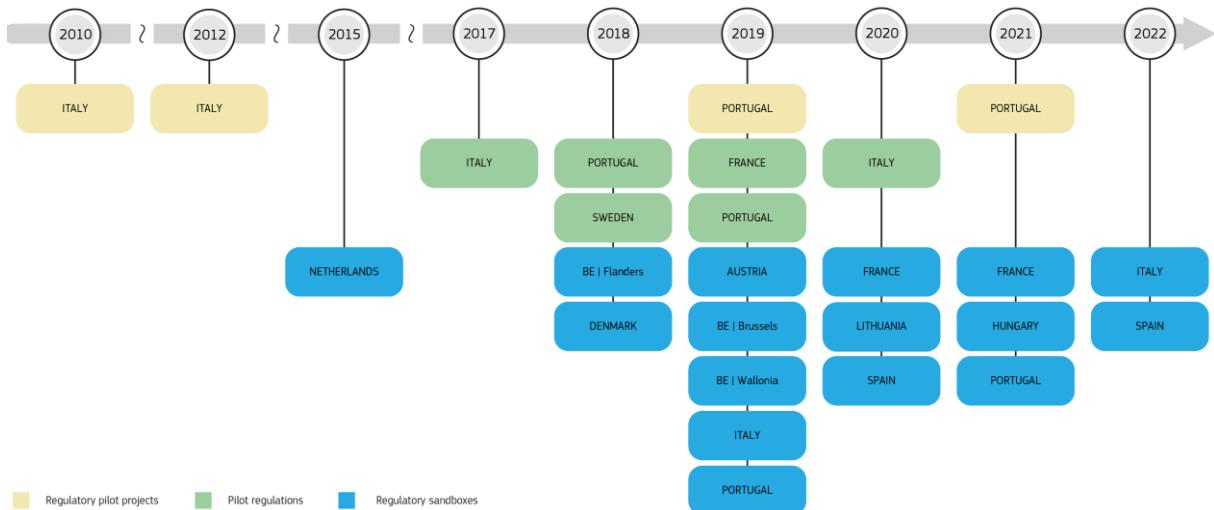
**Figure 5.** Forms of regulatory experimentation adopted across the EU



Source: JRC, 2023

Figure 6 shows the adoption timeline of the different forms of regulatory experimentation. The timeline shows that although regulatory sandboxes had a later start, they have become the most recurring form of regulatory experimentation in the EU in recent years, reflecting a trend which is common also across different sectors (e.g. financial, artificial intelligence) and jurisdictions outside the EU (e.g. UK, Norway, Singapore).

**Figure 6.** Adoption timeline of regulatory experimentation initiatives in the EU



Source: JRC, 2023

### 3.2 Areas of regulatory experimentation

Our research shows that Member States are testing innovative solutions in several fields. Although projects are often complex and span over different fields, we strove to assign each project to a single area of experimentation. In a small number of cases, when the project fell into more than one category, the attribution of the project to a single area of experimentation was based on the area of the granted derogation. The following 8 main areas of experimentation have emerged from the analysis of the regulatory experimentation initiatives adopted so far in the EU.

**Flexibility and balancing services.** Flexibility and balancing services include a range of solutions that electricity system users can provide to help balance demand and supply in the electricity network, support its efficient use and maintain security of supply. Several Member States have adopted initiatives in this sector, often with the aim to experiment with aggregation. In Italy for example, in 2017, a pilot regulation<sup>18</sup> opened the ancillary service and balancing markets to all participants able to provide flexibility, such as non-programmable renewable sources, distributed energy resources and demand side response and storage systems, including electric car batteries, also through aggregation. The pilot regulation was meant to collect useful elements for an overall reform of the ancillary services and balancing markets.

**Storage.** By balancing power grids and saving surplus energy, energy storage has a crucial role to achieve security of supply, reliability, and flexibility. It also represents a powerful tool to improve energy efficiency on a system level and integrate more renewable energy sources into electricity systems. According to the EU definition<sup>19</sup>, energy storage includes a wide variety of technologies and solutions. In this report, to allow a deeper level of detail, we decided to include in the ‘storage’ category only projects focusing on stationary batteries, while projects resorting to other storage solutions, e.g. electromobility or power-to-gas, are included under other categories. A recent example of projects in this area is provided by France where, during the first application window of the regulatory sandbox scheme, a project was approved that aimed to facilitate the

<sup>18</sup> ARERA decision 300/2017/R/EEL, as amended and supplemented by subsequent decisions (e.g. ARERA decisions 422/2018, 153/2020, 70/2021

<sup>19</sup> ‘energy storage’ means, in the electricity system, deferring the final use of electricity to a moment later than when it was generated, or the conversion of electrical energy into a form of energy which can be stored, the storing of such energy, and the subsequent reconversion of such energy into electrical energy or use as another energy carrier. Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (recast).

participation of battery storage in system services. The project was granted a derogation enabling its hybridization and dynamic aggregation with other means of production<sup>20</sup>.

**Integration of renewable and low-carbon gases (including H2) in the gas networks** (hereafter referred to as '**gas networks**'). The existing gas network provides ample capacities across the EU to integrate renewable and low-carbon gases into the gas networks (such as sustainable biogas, bio-methane and biofuels, renewable and low-carbon hydrogen or synthetic fuels)<sup>21</sup>. With renewable and low carbon gases injected into the gas network, and supply sources further diversified, there is an increasing need to understand technical as well as regulatory challenges. Member States have shown great interest in this area of experimentation and some of them have already started adopting regulation experimentation initiatives. In France, for example, during the second application window of the regulatory sandbox scheme several projects were approved: - one project<sup>22</sup> that aimed at experimenting with the injection into natural gas networks of gas produced from biomass and solid recovered fuels and - four projects<sup>23</sup> experimenting with the injection of methane produced by methanation, where the hydrogen is produced by electrolysis.

**Electromobility.** Reducing transport emissions is key to meeting the EU's climate objectives. Several sources predict that electric vehicles will expand massively in the coming years (IEA, 2021). The integration of electromobility into the power system, managing local demand peaks and exploiting the flexibility potential of electric vehicles, represents a challenge that needs to be urgently addressed. A recent example of projects in this field is found in Italy where in 2020, ARERA adopted a pilot regulation<sup>24</sup> to promote smart charging of electric vehicles in places not accessible to the public, thus reducing the impact on the power system of domestic charging. As a derogation from the ordinary tariff system, the experimental framework provides the possibility for consumers to recharge their EVs during off-peak hours (i.e., night time, Sundays, and holidays) without requesting a power increase from their electricity supplier, therefore avoiding the additional fixed costs due to the increase in contracted power.

**Collective self-consumption (CSC) and energy communities.** In recent years, collective energy initiatives have spread across Europe, emerging as a new paradigm of citizens' engagement in the transition towards cleaner energy systems. Member States have long started experimenting with possible regulatory developments, setting up transitional enabling frameworks to test innovative solutions and new business models. As pointed out by (REScoop and ClientEarth, 2020) allowing energy communities to apply for time-limited special regulatory conditions relating to, for instance, tariff settings and supplier obligations, could assist innovation and development of new business models. The Netherlands is a frontrunner in this field, as it launched a regulatory experimentation initiative already ahead of the adoption of the Clean Energy Package. As early as 2015, a regulatory sandbox scheme already offered citizens and businesses scope to deviate, by way of experiment, from some of the rules laid down by the Electricity Act 1998<sup>25</sup>, e.g. those related to the right to own and operate the grid, to grid tariff discounts, DSO metering obligations and invoicing and data management.

**Smart grids.** The energy sector has been an early adopter of digital technologies, using them to facilitate grid management and operation (IEA, 2017). In recent years, they have started penetrating deeper into power systems, with the roll out of smart meters and sensors, the application of the Internet of Things (IoT) and the use of large amounts of data with artificial intelligence (IRENA, 2019). Regulatory experimentation in this field can offer regulators a tool to test new technical solutions and new services for end consumers. In Portugal for example, a 2019 regulation<sup>26</sup> introduced the obligation for DSOs operating at low voltage level to submit a proposal for the execution of pilot projects experimenting with possible uses of smart meter data on technical quality of service.

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<sup>20</sup> Annex 1, France, project submitted by EDF SA. More information on the project can be found in pag. 5 of Decision 2021/59 of the Energy Regulation Commission (CRE) of 11 March 2021, available at <https://www.cre.fr/Documents/Presse/Communiques-de-presse/bac-a-sable-reglementaire-la-cre-accorde-des-derogations-a-9-projets-innovants>

<sup>21</sup> COM/2020/299, Powering a climate-neutral economy: An EU Strategy for Energy System Integration, 8 July 2020, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0299&from=EN>

<sup>22</sup> Annex 1, France, project led by Semardel

<sup>23</sup> Annex 1, France, projects led by Arkolia Energies, Enosis, la CUMA des éleveurs du Bergeracois, SIAH Crout et Petit Rosne

<sup>24</sup> ARERA decision 541/2020/R/eel, of 15 December 2020. Available at <https://www.arera.it/it/docs/20/541-20.htm>

<sup>25</sup> Besluit van 28 Februari 2015, Houdende Het bij Wege van Experiment Afwijken van de Elektriciteitswet 1998 voor Decentrale Opwekking van Duurzame Elektriciteit <https://wetten.overheid.nl/BWBR0036385/2015-04-01>

<sup>26</sup> ERSE Regulation 610/2019 of 2 August 2019. Available at <https://dre.pt/dre/detalhe/regulamento/610-2019-123675698>

**Integration of renewable energy sources (RES).** In the last decades, the European power sector has seen a sharp increase in the share of distributed and renewable energy sources. Given the central role of renewables for the achievement of the European climate objectives, as well as their importance for Europe's energy independence from unreliable suppliers and volatile fossil fuel markets, the removal of unnecessary administrative and regulatory obstacles to their cost-effective integration on a large scale has emerged as a priority theme at European as well as at national level. The recent European Commission recommendation on permit-granting procedures for RES projects<sup>27</sup> encourages Member States to put in place regulatory sandboxes to grant targeted exemptions from the national, regional or local legislative or regulatory framework for innovative technologies, products, services or approaches, to facilitate permit-granting in support of the deployment and system integration of renewable energy, storage, and other decarbonisation technologies, in line with EU legislation. It also requires Member States to ensure that system operators optimise the use of grid capacity by allowing its use by power plants combining multiple complementary technologies (i.e. hybridisation)<sup>28</sup>. In France we found some interesting examples of projects aimed at promoting the integration of growing shares of RES into the energy system, in particular projects aiming to optimise RES grid connection. In 2021, the French Ministry for the Ecological Transition granted derogations to four projects submitted under the first application window of the energy regulatory sandbox, while six more projects, already declared eligible by the Energy Regulatory Commission (CRE) under the second window of application, are still awaiting evaluation<sup>29</sup>.

**Tariff design.** Tariff structure design can play a pivotal role in supporting innovation in the energy sector, e.g. by promoting the proper integration of distributed energy resources (DERs) into the power system, stimulating demand flexibility and encouraging the uptake of innovative technologies. In Sweden for example, in 2018, a pilot regulation introduced the possibility for electricity network companies to test new tariffs on a limited group of electricity users within a customer category<sup>30</sup>. The objective of the experimental regime was to promote the efficient use of the electricity network. With this aim, network companies are enabled to develop and test innovative tariff structures that can stimulate the type of demand flexibility required within their own network area.

Figure 7 shows the geographical distribution of initiatives across areas of experimentation. The numbers in the blue and yellow squares represent the projects adopted under the respective schemes in each area. The initiatives adopted in some jurisdictions (Hungary, Lithuania, Spain) are not reported in the figure as their scheme does not specify or limit the areas of experimentation.

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<sup>27</sup> See footnote 13

<sup>28</sup> Commission recommendation of 15 May 2022 on speeding up permit-granting procedures for renewable energy projects and facilitating Power Purchase Agreements. Available at: [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=PI\\_COM:C\(2022\)3219&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=PI_COM:C(2022)3219&from=EN)

<sup>29</sup> CRE decision n. 2022/295 of 17 November 2022. Available at: <https://www.cre.fr/Documents/Deliberations/Communication/avancement-des-projets-beneficiant-de-derogations-acordées-dans-le-cadre-du-dispositif-d-expérimentation-réglementaire>

<sup>30</sup> Chapter 4, Sections 4 a - 4 b of the Electricity Act (1997:857). Available at: [https://www.riksdagen.se/sv/dokument-lagar/dokument/svensk-forfatningssamling/ellaq-1997857\\_sfs-1997-857](https://www.riksdagen.se/sv/dokument-lagar/dokument/svensk-forfatningssamling/ellaq-1997857_sfs-1997-857)

**Figure 7.** Overview of areas of experimentation across the EU

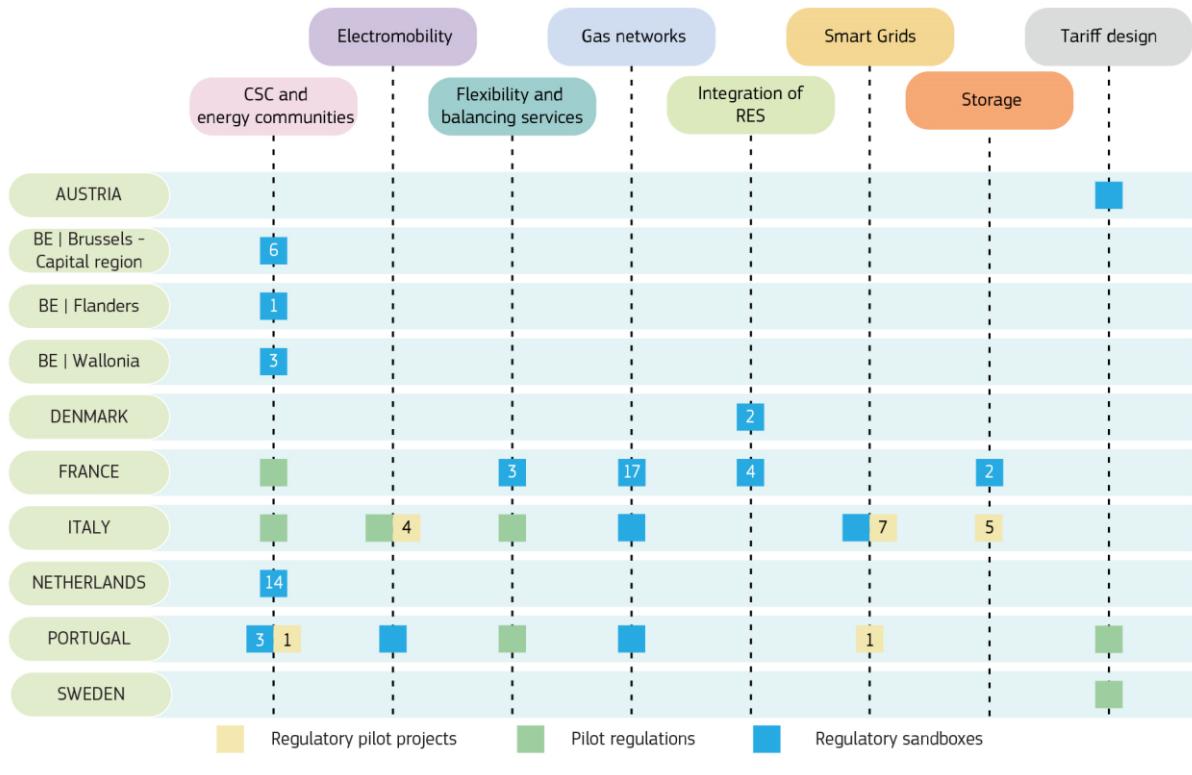
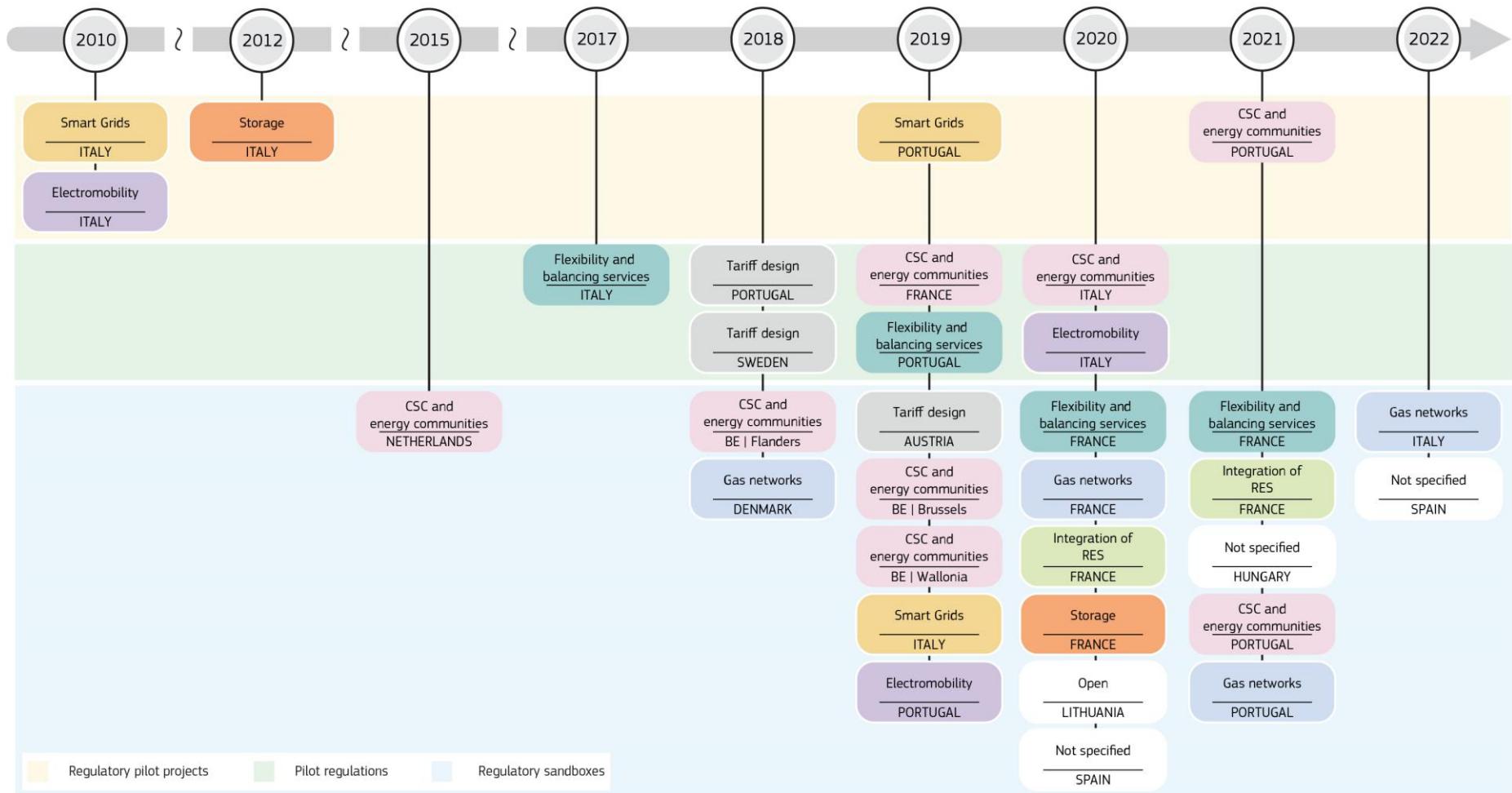


Figure 8 tracks the interest of Member States for specific topics and shows that some areas have emerged later than others as areas of experimentation<sup>31</sup>. Regulatory experiments concerning *gas networks*, for example, started in France only in 2020 but new initiatives were launched in Portugal and Italy in 2021 and 2022.

<sup>31</sup> The figure reports the start date of the regulatory experimentation initiative, i.e. either the publication of the decision launching the initiative or the opening of the window of application.

**Figure 8.** Time distribution of areas of experimentation across the EU



Source: JRC, 2023

### 3.3 Stakeholders involved

The scope of the regulatory experiment determines the range of eligible stakeholders. In France, for example, where the regulatory sandbox concerns the conditions of access to and use of networks and facilities<sup>32</sup>, project proponents are mainly market participants, while network operators are only required to cooperate for the implementation of the projects.

In some areas of experimentation, such as tariff design and smart grids, the main actors of the innovation process are network operators, i.e. DSOs and TSOs. Other areas, which are closer to the boundary between regulated and competitive activities, see the participation of a more varied range of stakeholders (Lo Schiavo, et al., 2013).

In the projects surveyed, as well as network operators, we identified several well-established energy producers and suppliers, but also a certain number of new players, such as energy service providers, ICT and software providers and public institutions. The Netherlands is a special case, where the regulatory sandbox involved non-professional stakeholders (i.e. energy communities and homeowner associations) which, however, found it quite difficult to navigate the complexity of the energy system. In the future, the effective inclusion in regulatory experiments may require the adoption of supporting tools (e.g. expert advice) and mechanisms (e.g. stakeholder collaboration, knowledge sharing platforms, community engagement).

Figure 9 presents an overview of the main participants in the surveyed projects by area of experimentation. Experimentation initiatives that do not have approved projects are not included in the figure.

**Figure 9.** Overview of main participants in the surveyed projects<sup>33</sup>

	NETWORK OPERATOR	MARKET PARTICIPANT	TYPE OF MARKET PARTICIPANT
CSC and energy communities	Yes	Yes	Energy market players   Public institutions   Research and technology orgs.   Technology and service providers   Others
Electromobility	Yes	Yes	Energy market players   Technology and service providers
Flexibility and balancing services	No	Yes	Energy market players   Technology and service providers   Others
Gas networks	No	Yes	Energy market players   Public institutions   Technology and service providers   Others
Integration of RES	Yes	Yes	Energy market players   Research and technology orgs.   Technology and service providers   Others
Smart Grids	Yes	No	-
Storage	Yes	Yes	Energy market players
Tariff design	Yes	No	-

Source: JRC, 2023

<sup>32</sup> See Annex 1, France, for further details

<sup>33</sup> Market participants are categorised according to the terminology and definitions adopted in: Vasiljevska, J., Gangale F., Covrig L., Mengolini, A., Smart Grids and Beyond: An EU research and innovation perspective, EUR 30786 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-36194-7, doi:10.2760/705655, JRC125980, <https://publications.jrc.ec.europa.eu/repository/handle/JRC125980>

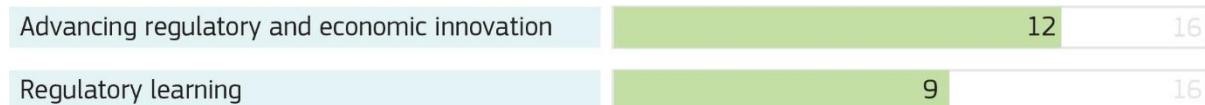
## 4 Challenges and lessons learnt

The interviews and questionnaires gave us the opportunity to get an insight into the experience of NRAs and to collect valuable information over the main perceived benefits, risks, limitations, obstacles, and difficulties relating to the set-up and implementation of national regulatory experimentation initiatives. As we already highlighted, regulatory sandboxes are the most widespread form of regulatory experimentation in the EU and the one that attracts most interest. Although in the interviews and questionnaires we referred to all types of experimentation, most of the feedback we received referred explicitly to regulatory sandboxes. In most cases however, praise and criticism directed at regulatory sandboxes can also be applied to the other forms of experimentation. In the following paragraphs, we will present the main results of the questionnaire, focusing on the two options that were ranked highest by respondents (see Methodology). The analysis is enriched with insights from the interviews and reflections from relevant literature. A summary of the answers to all questions can be found in Annex 4.

### 4.1 Benefits of regulatory experimentation initiatives

Regulatory experimentation initiatives have attracted great interest in many Member States, where they are increasingly seen as tools to provide a dynamic response to a rapidly changing environment, bringing together the interests of different public and private stakeholders. The benefits most commonly associated with regulatory experimentation initiatives are presented in Figure 10.

**Figure 10.** Results from questionnaires – Main benefits



Source: JRC, 2023

**Advancing regulatory and economic innovation.** The main benefit reported by NRAs is the possibility of advancing regulatory and economic innovation (12 out of 16 answers). Regulatory experimentation initiatives can improve regulatory capacity and quality, as they provide first-hand experience with the innovative solution prior to the adoption of permanent regulation. Interviews highlighted that the set-up of regulatory sandboxes, in particular, may be perceived as a signal of regulatory flexibility and open-mindedness towards new technologies and innovative firms, and thus attract international investment (Ringe & Ruof, 2020). In the FinTech sector, for example, the establishment of regulatory sandboxes has already added to the competition among financial centres as to which will become the pre-eminent FinTech hub (Zetsche D., Buckley, Arner, & Barberis, 2017).

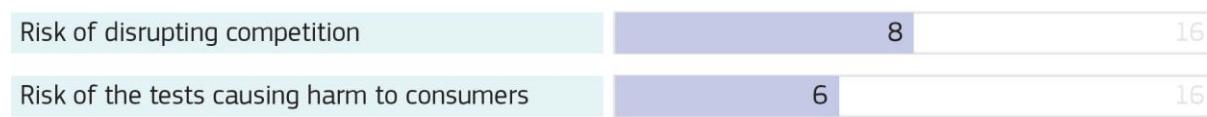
Regulatory sandboxes are also praised for supporting the development of innovative solutions and reducing their time-to-market, without putting consumers and the whole system at risk. As highlighted by (Ringe & Ruof, 2020), reducing the time-to-market cycle mitigates the risk for firms that their innovative solution or business model might be copied by a competitor with deeper pockets during a long authorisation process.

**Regulatory learning.** NRAs also praise the contribution that regulatory experimentation schemes can make to advancing regulatory learning and to reducing regulatory uncertainty (9 out of 16 answers). Academic literature confirms that regulatory sandboxes can promote mutual learning and help reduce regulatory uncertainty by providing evidence of what works and what doesn't to overcome identified barriers to innovation, and by informing on needed changes in existing rules, regulations, or policies (QUEST and Pollution Probe, 2020) (Ringe & Ruof, 2020). They also help innovators to navigate the complex world of regulation, to identify non-technological barriers and to experiment with new technologies, solutions and business models (QUEST and Pollution Probe, 2020) (Rachordás, 2021). Finally, they enhance transparency and promote collaboration between different national authorities, and between regulators and innovators. As highlighted by some interviewees, this is mostly the case when further supporting tools, such as regulatory advisory/feedback services, are provided. Such services could be relevant particularly for SME and start-ups, which may not have the resources to resort to private consultancy services. Running an advisory/feedback service however requires strong expertise and resources and so far, only two EU Member States have set it up as part of their regulatory sandbox scheme (i.e. Denmark and Lithuania).

## 4.2 Risks and limitations of regulatory experimentation initiatives

Despite their growing popularity, regulatory experimentation initiatives are still a relatively new tool in the hands of NRAs and claims about their suitability to enhance innovation have also been met with wariness if not with criticism. Regulatory sandboxes, in particular, raise concerns on several aspects that may hamper their adoption (Figure 11).

**Figure 11.** Results from questionnaires - Risks



Source: JRC, 2023

**Risk of disrupting competition.** Several regulators highlighted the risk that regulatory sandboxes may disrupt competition by granting advantages to certain firms or types of firms, excluding others from the favourable regime (8 out of 16 answers). Literature has often highlighted this risk. Since regulatory sandboxes, by design, reduce the regulatory costs that an admitted firm incurs, firms approved to participate in the sandbox may receive an advantage over their non-approved competitors (Knight & Mitchell, 2020). Such an advantage has the potential to weaken the overall competition in the market (Poncibò & Zoboli, 2022), giving rise to what has been referred to as the 'sandbox paradox' (Knight & Mitchell, 2020) (Poncibò & Zoboli, 2022). Being admitted to a sandbox can be particularly rewarding for SMEs or start-ups, as proving their business model in a live and regulated environment increases their credibility with both customers and investors. At the same time, however, this creates an uneven playing field between the start-ups which are accepted into the sandbox and those which are not.

In the interviews, regulators pointed out that possible solutions to mitigate the risk of disrupting competition may be the adoption of clear eligibility criteria (see section 4.6), objective and transparent selection and evaluation criteria, and clear knowledge sharing obligations.

**Risk of causing harm to consumers.** Another risk emerging from the interviews and questionnaires relates to possible detriment for consumers (6 out of 16 answers). As highlighted by several regulators, risks for consumers need to be identified and managed through the set-up of consumer safeguards, which usually represent one of the eligibility criteria or mandatory requirements of the test plan.

Other risks emerging from the interviews and questionnaires relate to the fear that the time required by the experimentation might delay the adoption of permanent general regulation and the fact that projects may affect quality of service and security of supply.

Besides the risks, other factors deterring the adoption of regulatory experimentation initiatives are the perceived limitations of such schemes (Figure 12).

**Figure 12.** Results from questionnaires - Limitations



Source: JRC, 2023

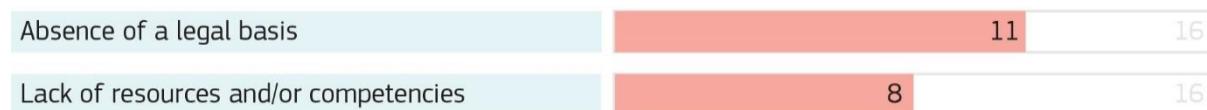
**Regulatory innovation alone may not suffice.** The main concern expressed by regulators is that experimentation schemes alone may not suffice to support the implementation of innovative solutions and that public funding is necessary to attract innovators (8 out of 16 answers). Regulatory sandboxes generally do not involve funding (e.g. France, Denmark) but in some cases economic support is available through other schemes (e.g. Portugal) or through the revenue setting process (e.g. Belgium – Brussels-Capital Region, Lithuania). Pilot regulations and regulatory pilot projects, on the other hand, often involve derogations from the ordinary tariff system to support the economic viability of the projects (e.g. Italy, Portugal).

**Limited validity of the experimentation results.** Another concern refers to the validity of the experimentation results (6 out of 16 answers). Especially in the case of regulatory sandboxes and regulatory pilot projects, the validity of the results may be limited due to the typically small size of the cohort accepted into the experimentation (non-generalizability of the results) and to the partial control over the other circumstances affecting the trial (attributability of the results). The experimentation bias may also affect the validity of results. The limited validity of the results limits the potential to advance regulatory and technological innovation and is considered by some national regulators as a deterrent to their adoption.

### 4.3 Obstacles and difficulties relating to regulatory experimentation initiatives

Interviews and questionnaires also revealed that beyond the initial enthusiasm for the adoption of regulatory experimentation initiatives, regulators often face obstacles (Figure 13) and difficulties (Figure 14) during their practical implementation.

**Figure 13.** Results from questionnaires - Obstacles



Source: JRC, 2023

**Absence of a legal basis.** The absence of a legal basis represents the main perceived obstacle (11 out of 16 answers). In some Member States the regulatory authority's remit includes the competence to carry out regulatory experimentation initiatives aiming at energy system innovation (e.g. Italy, Portugal). This is not the case for many other Member States, where the regulatory authority lacks the necessary powers to engage in regulatory experimentation and where an enabling legal provision is necessary to derogate from the general regulatory framework. The disparity between Member States' approaches and the opportunity to find an EU level solution, was discussed with several regulators during the interviews. An interesting suggestion came from the Italian regulator that proposed the adoption of an EU provision empowering NRAs to launch regulatory experiments and grant derogations from national regulation, e.g. through the amendment of art. 59 of Directive (EU) 2019/944<sup>34</sup>.

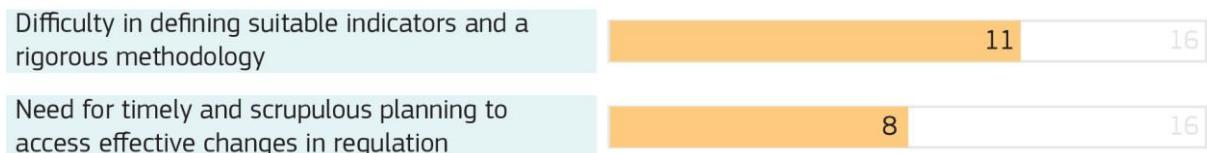
Another point that was raised during the interviews concerns the initiatives that require derogations from the rules falling under the competence of different authorities. In these cases, the adoption of a one-stop-shop approach would encourage innovators to submit project proposals and help the competent authorities to speed up the project approval process.

**Lack of resources and expertise.** Another frequently reported obstacle concerns the lack of resources and expertise required for the management and monitoring of experimentation initiatives (8 out of 16 answers). Adequate staffing and resources are required for all stages of the experimentation, including its design, personalised advice to participants, analysis of the applications, monitoring of the experimentation, analysis of its results and post-exit supervision. Regulatory authorities are already burdened with a multiplicity of tasks deriving from EU and national law and regulatory experiments would put a further strain on their limited time and resources. On this point, an interesting lesson learned comes from the French experience with regulatory sandboxes. During the first two windows of application, the analysis of the submitted projects proved to be very intensive and time consuming. Building on this experience, the French regulator (CRE) believes that it is preferable to process requests for derogation as they are received without limiting the application to specific timeframes. Such an approach favours project proponents who are free to submit their proposal whenever it is mature and ready, and it also helps the competent authority spreading the assessment workload throughout the year. The admission procedure was finally modified in November 2022<sup>35</sup> enabling applications to be processed as they come in.

<sup>34</sup> Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (recast).

<sup>35</sup> CRE decision n. 2022/299 of 24 November 2022. Available at: <https://www.cre.fr/Documents/Deliberations/Modification/modification-de-la-deliberation-n-2020-125-en-date-du-4-juin-2020-portant-decision-sur-la-mise-en-oeuvre-du-dispositif-d-experimentation-reglementaire>

**Figure 14.** Results from questionnaires - Difficulties



Source: JRC, 2023

#### **Defining suitable indicators and a rigorous methodology to measure the experimentation results.**

The definition of robust indicators is considered as a critical task by many regulators (11 out of 16 answers). Indicators are needed to help monitor the progress of the experimentations, to measure their results, assess their contribution to the achievement of the project objectives and to inform the competent authority on needed changes in existing rules and regulations.

During the interviews, it emerged that monitoring and evaluation of project results is particularly relevant in the case of pilot regulations, as they are tools meant to assess the functioning of a temporary experimental scheme and to decide on the possibility of permanently changing the regulation. Indicators are therefore typically set by the regulator, possibly in collaboration with universities and research institutes. In the case of regulatory sandboxes and pilot projects, where the focus is more on testing innovative solutions, it is usually the project promoter that sets the project goals and reports the findings to the competent authority at the end of the project. The competent authority should then assess the validity of the results and, in case of a positive evaluation, reflect on the opportunity of changing the current regulatory framework or preparing future regulation accordingly. The process through which the results of the experimentation inform regulatory change is usually sketched in general terms and not formally defined ex ante. One exception is provided by Lithuania, where the decision adopting the regulatory sandbox provides that within 2 months from the submission of the final report, the regulatory authority shall assess the results of the project and, in case it is deemed to be successful, within the following 6 months it shall identify and propose the changes to the legislative and regulatory provisions that represent an obstacle to the implementation of the tested innovation.

The interviews also revealed that the design of monitoring and evaluation indicators is often a complex task and that regulatory authorities don't always have enough internal resources and expertise to dedicate. In addition, in some cases, the evaluation may take a long time, as project results can only be assessed after many years (e.g. projects that aim to reduce the need for investment in grid capacity). Well-designed indicators should enable the assessment of the experiment against the pre-defined objectives, while also taking into consideration other technological, economic, and social implications. These considerations highlight the importance of carefully defining the objectives of the initiative to be able to capture the results of the experimentation in terms of innovation. Given the lack of internal resources and expertise on the side of many regulatory authorities, collaborating universities and research centres could play an important role to support them since the early design stage of the initiative.

**Planning.** This point corroborates what has already been highlighted so far. Regulators are aware that regulatory experimentation initiatives can be precious tools to support regulatory learning and inform regulatory change, as long as they are timely and carefully planned. Their set up typically involves wide stakeholder consultation to clarify the need for regulatory modernisation, to define the objectives and the main design elements of the experimentation and to set suitable indicators to monitor and evaluate projects results.

An interesting case of stakeholder consultation and engagement is provided by Sweden, where the regulator recently launched a project to investigate the conditions for the set-up of a regulatory sandbox scheme and to develop a model for its implementation. The project focuses on the necessary legal framework, the identification of eligibility and selection criteria for participation, the possibility of funding, the regulatory learning and change framework.

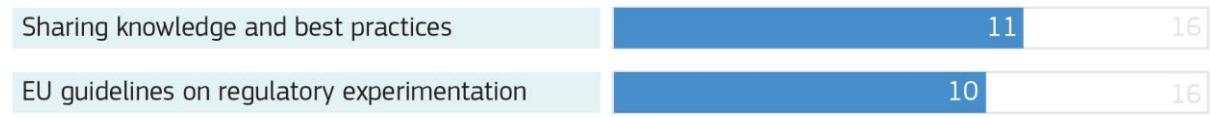
#### **4.4 Possible EU support to the set-up of regulatory experimentation initiatives**

Interviews and questionnaires revealed that Member States would mostly welcome support from the EU to promote the sharing of knowledge and best practices, enabling learning from the results of testing already undertaken in other jurisdictions and avoiding the need to replicate the pilots in each Member State. Many of them would also welcome EU guidelines on regulatory experimentation, but there is no common view on what

aspects should be covered (Figure 15). The only point on which we could detect some convergence is the need to support the attribution of competence to regulatory authorities to adopt regulatory experimentation initiative (see section 4.3).

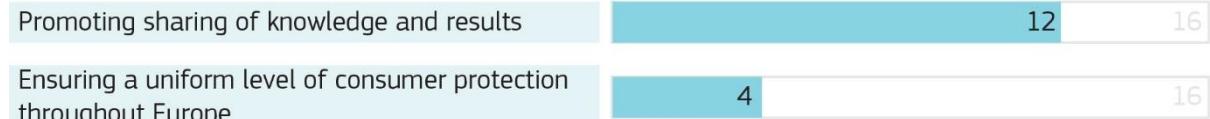
Interviews also revealed that, although EU law is not perceived as an obstacle for the set-up of regulatory experimentation initiatives, NRAs may be hesitant to grant derogations because they are concerned about the risk of misinterpreting EU law. Some interviewees suggested that in the short term, NRAs could benefit from EU support for the interpretation of relevant EU law and for granting derogations that are consistent with EU law provisions. Such a service could encourage NRAs, especially those most suffering from a lack of staff and expertise, to launch regulatory experimentation initiatives (Figure 16).

**Figure 15.** Results from questionnaires - EU support



Source: JRC, 2023

**Figure 16.** Results from questionnaires - Benefits of EU support



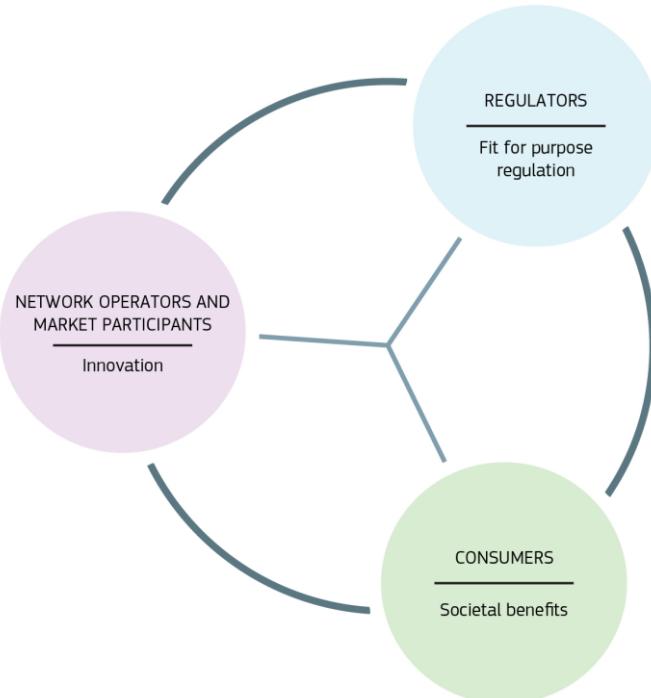
Source: JRC, 2023

## 4.5 Effectiveness of regulatory experimentation initiatives

As far as the effectiveness of the reviewed forms of experimentation is concerned, it is not possible to draw any general conclusion, as national schemes are difficult to compare and there is a very limited evidence base on their impacts. Most interviewees view regulatory experimentation as a promising tool in the hands of regulators to promote the adoption of new solutions and to inform regulatory change. In the country profiles in Annex 1, we report some cases where experimentation led to a permanent evolution of the regulatory framework<sup>36</sup>. The assessment of national experiences, however, requires further work and analysis, possibly including also the point of view of innovators and consumers together with the one of the regulators (Figure 17).

<sup>36</sup> In Italy, for example, the regulatory pilot projects on smart grids provided important elements for the design of tailored incentive mechanisms aimed at developing and promoting smart grid technologies and functionalities (ARERA, 2015). In Portugal, the pilot regulation on tariff design informed the regulatory process for the adoption of an optional network access tariff for high, high and medium voltage networks.

**Figure 17.** Comprehensive assessment of regulatory experimentation initiatives



Source: JRC, 2023

## 4.6 Regulatory sandboxes – lessons learned from the field

Questionnaires and interviews with national regulators confirmed that regulatory sandboxes are seen as a promising tool to promote innovation in the energy sector, but that their adoption and management is accompanied by a number of challenges. The wide diffusion that regulatory sandboxes have seen in recent years, across different sectors and jurisdictions, may have caused some Member States to rush towards their adoption. Regulatory sandboxes, however, are not always the best tool to address regulatory innovation needs. Other forms of experimentation are available, e.g. pilot regulations, regulatory pilots, living labs. Before deciding on the adoption of a regulatory sandbox, regulators should carefully scrutinise the need to resort to live testing and decide on the form of experimentation that is best suited to achieve the desired objectives. Once the decision to set up a regulatory sandbox is taken, careful planning and preparation should precede its launch, making sure that all the necessary time and human resources are in place. Attention should be given to all the different phases (Figure 18):

- **Design phase.** The design phase plays a fundamental role for the adoption of a sandbox that is fit for purpose and customised to local conditions (Jeník & Duff, 2020). It requires the definition of the main elements of the experimentation framework, in line with the country-specific key jurisdictional, institutional and market characteristics.
- **Experimentation phase.** During the experimentation phase, the regulatory authority has mainly a monitoring and supporting role, as the project is carried out by the project proponent.
- **Evaluation and regulatory development phase.** This phase implies the assessment of the experimentation initiative based on the indicators defined during the design phase and the possible incorporation of lessons learned in new or updated regulation.

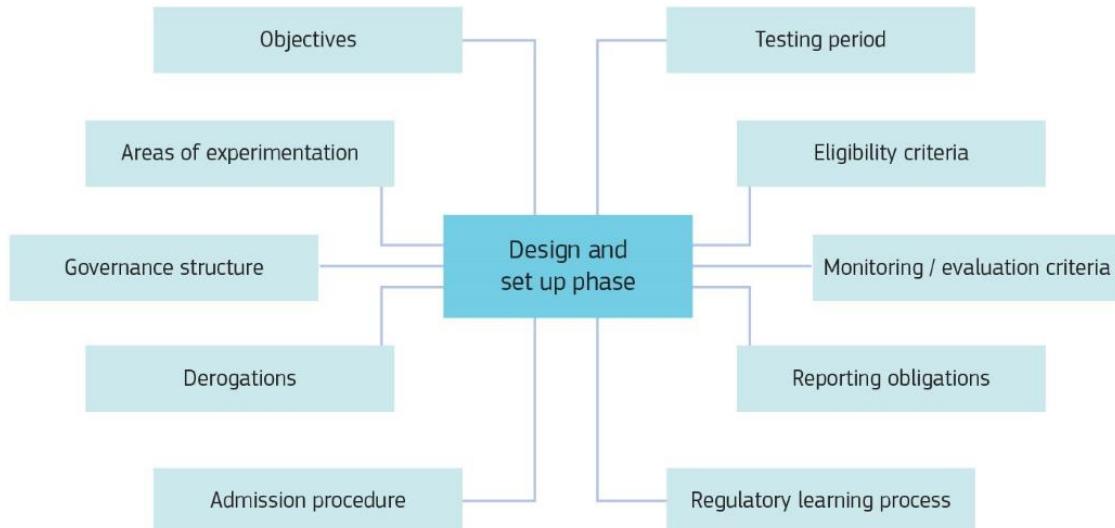
**Figure 18.** Regulatory sandboxes implementation phases



Source: JRC, 2023

Given the fact that most of the regulatory sandboxes set up in the EU are very recent, we can only report lessons learned during the design phase. During this phase, the regulator has wide discretion on the choice of the elements of the sandbox that are combined to accommodate local objectives and circumstances. The most recurring elements of a sandbox are reported in Figure 19. In the following paragraphs we will concentrate on those elements for which we could draw insights and lessons learned from the interviews.

**Figure 19.** Main regulatory sandbox elements



Source: JRC, 2023

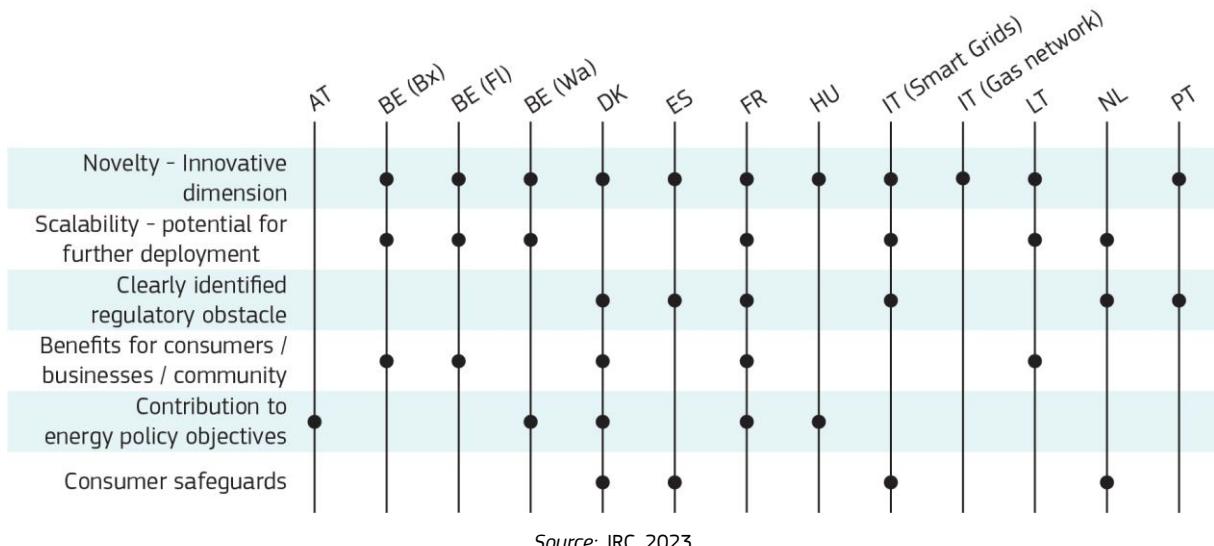
**Objectives.** Defining the objectives of the sandbox is crucial to be able to assess the results of the experimentation and capture its results in terms of innovation. It also helps to get stakeholder buy-in, set expectations and define other design elements (Jeník & Duff, 2020). Some regulators highlighted the importance of adopting a broader perspective including technological as well as social innovation among the objectives of the experimentation, when appropriate. In the Dutch case, for example, the adoption of such an approach could have helped to better value and promote the projects endeavours to bring together different stakeholders and maximise the collective gains.

**Admission procedure.** Two main procedures are used in the cases surveyed: - application windows (i.e. applications can only be submitted during a predetermined period) and - on demand (i.e. applications are processed as they come in). Each procedure has its advantages and disadvantages, and the choice should be made taking into consideration local circumstances. The application window procedure could enable better streamlining of the timeline of the sandbox with the regulatory process (CEER, 2021), but it can also put an administrative burden on the regulatory authority in case of a large number of applications. Furthermore, limiting application to specific timeframes could force projects proponents to submit their proposal even if it is not yet mature and ready. On the other hand, the on-demand procedure could help competent authorities to spread the assessment workload throughout the year and allow project proponents the time to carefully craft their project before submitting it. Most of the sandboxes surveyed adopted the on-demand procedure (Figure 21).

**Testing period.** The testing period can be limited to a predefined interval (that goes between 1 and 10 years, with possibility of extension, in the sandboxes surveyed) or be tailored to the specific project on a case-by-case basis. The length of the experimentation should be adequate to provide evidence of what works and what doesn't to overcome identified barriers to innovation and to inform the regulator on needed changes in existing rules. Projects requiring substantial investment may need a longer testing period to be able to recoup the investment costs.

**Eligibility criteria.** Designing sound eligibility requirements for the admission into regulatory sandbox schemes represents a crucial point to ensure transparency, equal opportunities, and the proper management of the scheme. Figure 20 lists the most common eligibility criteria adopted in sandbox schemes across the EU (i.e., those that are common to at least 4 jurisdictions). Interviews with regulatory authorities highlighted the main critical issues around them.

**Figure 20.** Main eligibility criteria for the admission to regulatory sandboxes in EU Member States



- *Novelty - Innovative dimension.* This eligibility requirement is common to most sandboxes surveyed. It has been criticised by some authors as it asks regulators to assess an innovation, a task that is considered as beyond their skill set (Zetzsche D. A., Buckley, Barberis, & Arner, 2017). The interviews confirmed that the practical application of this requirement implies some criticalities. Several regulators reported a lack of resources and expertise that makes it more difficult to assess the extent of the innovation, its impacts, and the risk involved. Other interviewees highlighted the difficulty of defining when a new solution ceases to be innovative. In case of many requests for the same derogation, only those filed first are of an innovative character. Drawing the line between what is innovative and what is not anymore implies a certain degree of discretion, but granting the derogation to too many projects risks to appear as an early generalization of the experimental regulation. An interesting solution has been adopted by the French regulator which, based on the lessons learned during the first window of application, reinforced the rule that any derogation granted should bring new information for regulatory change. In the event of many requests for derogations identical to those already granted, and not having any additional innovative characteristics compared to the projects already approved (e.g. as for the characteristics of the project location, the type of project proponent, etc.), the regulator may judge the experiments ineligible.
- *Scalability.* Many sandboxes require projects to show their potential for scaling up and further deployment. For some solutions, however, it is not easy to assess such potential, as experimentation activities are typically tailored to the needs and conditions of a specific context and of a particular constellation of stakeholders (Kert, Vebrova, & Schade, 2022).
- *Clearly identified regulatory obstacle.* Sandbox applicants are often required to clearly identify the regulatory requirement that represents an obstacle to the execution of the project and to clarify why the proposed innovation does not fit within the existing regulatory framework. Such requirement can help the regulatory authority to simplify and speed up the eligibility check, but it also represents a burden for applicants, who do not always have a clear picture of the regulatory framework and of the regulatory barriers that may affect their business model. Some regulators (i.e. Denmark and Lithuania) have set up a consultancy/feedback service supporting innovators to better understand the rules of the energy sector and to clarify the need for a regulatory derogation. Such service is quite demanding for the regulatory authority, as it requires significant time and human resources, but it can offer a valid support for innovators, especially those that are newer in the energy arena.
- *Benefits for consumers/businesses/community.* Regulatory sandboxes often require projects to demonstrate that the proposed innovation is likely to lead to benefits for consumers, businesses or the community at large. Benefits may derive directly or indirectly from the implementation of the innovative solution (e.g. lower energy bills from collective self-consumption or from heightened competition). The assessment of this eligibility criterion may be done based on quantitative measures (e.g. number of consumers that will benefit from the innovative solution) and qualitative predictions (e.g. how much they will benefit) (CRI, 2021). These indicators should also be used during the monitoring and evaluation process.

- *Contribution to energy policy objectives.* Some sandbox schemes explicitly require project proponents to describe how the project contributes to the attainment of the national energy and climate policy objectives. Even where this requirement is not explicitly formalised as an eligibility criterion, it is usually one of the objectives of the decision setting up the regulatory experiment or of the law enabling the regulator to launch such experiment.
- *Consumer safeguard.* The provision of consumer safeguards is often required as an eligibility requirement. Sandbox testing can pose financial and supply related risks to consumers and companies. Project proponents are required to provide the evidence that they have identified the potential risks stemming from live testing and envisaged the appropriate mitigation measures to address them. Mitigation measures may include disclosure about being involved in a sandbox test, limits on the number and types of consumers involved, compensation arrangements, dispute resolution and redress mechanisms.

In conclusion, there is no unique sandbox model, and the different design elements need to be tailored to national circumstances. The design phase however requires careful crafting and preparation as it has a strong influence on participation, costs and regulatory learning. Figure 21 presents an overview of how some key elements of regulatory sandboxes are applied across Member States.

**Figure 21.** Application of some regulatory sandbox elements across Member States

	AREA OF EXPERIMENTATION		ADMISSION PROCEDURE		LENGTH OF DEROGATION	DEROGATION		CONSULTANCY/FEEDBACK SERVICE
	Targeted to specific topics	Open to all topics	Application window	On demand		Predefined	Open	
AUSTRIA	●			●	3 years	●		
BE   Brussels - Capital Region	●			●	2 years (+2 years extention)	●		
BE   Flanders	●			●	10 years (+5 years extension)	●		
BE   Wallonia	●			●	5 years		●	
DENMARK	●			●	2 years*	●		●
FRANCE	●		●	●	4 years (+4 years extension)	●		
HUNGARY		●		●	2 years (+2 years extention)	●		
ITALY	●		●		3 or 4 years depending on the topic		●	
LITHUANIA		●		●	1 or 3 years (+1 or 2 years extention)	●		●
NETHERLANDS	●		●		10 years	●		
PORTUGAL	●			●	1 or 3 years		●	
SPAIN	Not specified		●		Not specified		●	

\*In special cases, the derogation can be longer

Source: JRC, 2023

## 5 Conclusions

This report provides a mapping of the state of play of regulatory experimentation initiatives in the energy sector in the EU. The **geographical distribution** shows that only few Member States have adopted or are in the process of developing regulatory experimentation initiatives. Early initiatives were reported in Italy and the Netherlands, while other countries started more recently to draft their regulatory experimentation strategy. At the time of writing, and based on the collected data, regulatory experimentation initiatives have been adopted or are under development in 12 Member States, while 3 more Member States are considering their adoption.

The **adoption timeline** shows that although regulatory sandboxes had a later start, they have become the most recurring form of regulatory experimentation in the EU in recent years, reflecting a trend which is common also across different sectors. Among the different **forms** of regulatory experimentation, some countries have adopted only one form of experimentation (regulatory sandboxes, regulatory pilot projects or pilot regulations), while other countries have opted for a varied mix of measures. It appears that Member States are testing innovative solutions in different **areas**, with the most prevalent being collective self-consumption and energy communities. The scope of regulatory experimentation affects the range of **eligible stakeholders**. As well as regulated entities, we see a number of well-established energy producers and suppliers, but also a certain number of new players, such as energy service providers, ICT and software providers and public institutions.

As far as the **effectiveness** of the reviewed forms of experimentation is concerned, it is not possible to draw any general conclusion, as national schemes are difficult to compare and there is very limited evidence on their impacts. Most interviewees consider regulatory experimentation as a promising tool in the hands of regulators to promote the adoption of new solutions and to inform regulatory change. In the country profiles in Annex 1, we report some cases where experimentation led to a permanent evolution of the regulatory framework. The assessment of national experiences, however, requires further work and analysis, possibly including also the point of view of innovators and consumers.

From the data collected through interviews and questionnaire we could however highlight some interesting **insights and good practices** from Member States. Particularly interesting are those relating to: - the possible role of the EU to support regulatory experimentation across Member States; - the importance of providing regulatory authorities with the necessary powers to engage in regulatory experimentation and - the opportunity to set-up consultancy/feedback services to support innovators to better understand the rules of the energy sector and clarify the need for a possible regulatory derogation.

Further investigation and analysis is however necessary to get a broader understanding of the challenges that NRAs are encountering and of how these challenges are linked to specific national contexts.

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## **List of abbreviations and definitions**

AEMC	Australian Energy Market Commission
AER	Australian Energy Regulator
ACM	Autoriteit Consument & Markt
ARERA	Autorità di Regolazione per Energia Reti e Ambiente
BRP	Balance responsible party
BSP	Balancing service provider
CNMC	Comisión Nacional de los Mercados y la Competencia
CRE	Commission de Régulation de l'Énergie
CRU	Commission for Regulation of Utilities
CSC	Collective self-consumption
CWaPE	Commission wallonne pour l'Energie,
DC	Direct current
DER	Distributed energy resources
DSO	Distribution System Operator
Ei	Energimarknadsinspektionen
ERSE	Entidade Reguladora dos Serviços Energéticos
ERU	Energetický regulační úřad
EU	European Union
EWRC	Energy and Water Regulatory Commission
FFF	Fast frank feedback
FFG	Forschungsförderungsgesellschaft
FRU	Fast reserve unit
HERA	Hrvatska energetska regulatorna agencija
HV	High Voltage
ICT	Information and communication technology
IES	Innovation Enquiry Service
ILR	Institut Luxembourgeois de Régulation
IoT	Internet of Things
LV	Low Voltage
MAIFI	Momentary Average Interruption Frequency Index
MEKH	Magyar Energetikai és Közmű-szabályozási Hivatalról
mFRR	manual Frequency Restoration Reserves
MV	Medium Voltage
MVA	Megavolt amperes
NRA	National Regulatory Authority
NVE-RME	Norges vassdrags- og energidirektorat - Reguleringsmyndigheten for energi
OEB	Ontario Energy Board
OFGEM	Office of Gas and Electricity Markets

R&D	Research and Development
REC	Renewable energy community
RES	Renewable energy source
REWS	Regulator for Energy and Water Services
R&I	Research and Innovation
RVO	Rijksdienst voor ondernemend Nederland
SME	Small and medium enterprise
S3RnRS	Schémas Régionaux de Raccordement au Réseau des Énergies Renouvelables
SPRK	Public Utility Commission of Latvia
TFZ	Technological free zone
ToU	Time of Use
TSO	Transmission System Operator
UPR	Unità di produzione rilevante (Relevant production unit)
UVAC	Unita virtuali abilitate di consumo (Authorised virtual consumption unit)
URSO	Úrad pre reguláciu sieťových odvetví
VERT	Valstybinė Energetikos Reguliacimo Taryba
V2G	Vehicle-to-grid

## List of figures

<b>Figure 1.</b> Characterisation of different forms of regulatory experimentations .....	7
<b>Figure 2.</b> Overview of the methodology .....	9
<b>Figure 3.</b> Geographical distribution of regulatory experimentation initiatives in the EU .....	11
<b>Figure 4.</b> Overview of regulatory developments at EU level .....	12
<b>Figure 5.</b> Forms of regulatory experimentation adopted across the EU .....	13
<b>Figure 6.</b> Adoption timeline of regulatory experimentation initiatives in the EU .....	14
<b>Figure 7.</b> Overview of areas of experimentation across the EU .....	17
<b>Figure 8.</b> Time distribution of areas of experimentation across the EU .....	18
<b>Figure 9.</b> Overview of main participants in the surveyed projects .....	19
<b>Figure 10.</b> Results from questionnaires – Main benefits .....	20
<b>Figure 11.</b> Results from questionnaires – Risks .....	21
<b>Figure 12.</b> Results from questionnaires – Limitations .....	21
<b>Figure 13.</b> Results from questionnaires – Obstacles .....	22
<b>Figure 14.</b> Results from questionnaires – Difficulties .....	23
<b>Figure 15.</b> Results from questionnaires – EU support .....	24
<b>Figure 16.</b> Results from questionnaires – Benefits of EU support .....	24
<b>Figure 17.</b> Comprehensive assessment of regulatory experimentation initiatives .....	25
<b>Figure 18.</b> Regulatory sandboxes implementation phases .....	25
<b>Figure 19.</b> Main regulatory sandbox elements .....	26
<b>Figure 20.</b> Main eligibility criteria for the admission to regulatory sandboxes in EU Member States .....	27
<b>Figure 21.</b> Application of some regulatory sandbox elements across Member States .....	28
<b>Figure 22.</b> Location of regulatory sandbox projects in Belgium .....	45
<b>Figure 23.</b> Location of regulatory sandbox projects in Denmark .....	48
<b>Figure 24.</b> Timeline regulatory experimentation initiatives in France .....	50
<b>Figure 25.</b> Location of regulatory sandbox projects in France .....	53
<b>Figure 26.</b> Timeline regulatory experimentation initiatives in Italy .....	58
<b>Figure 27.</b> Types of regulatory sandbox projects in the Netherlands .....	73
<b>Figure 28.</b> Number of active regulatory sandbox projects in the Netherlands .....	74
<b>Figure 29.</b> Location of regulatory sandbox projects in the Netherlands .....	74
<b>Figure 30.</b> Timeline regulatory experimentation initiatives in Portugal .....	77
<b>Figure 31.</b> Location of regulatory sandbox projects in Portugal .....	81
<b>Table 27.</b> Pilot regulation in Sweden .....	88
<b>Figure 32.</b> Location of regulatory sandbox projects in UK .....	96
<b>Figure 33.</b> Location of regulatory sandbox projects in Norway .....	100

## List of tables

<b>Table 1.</b> Regulatory sandbox in Austria.....	39
<b>Table 2.</b> Regulatory sandbox in Brussels-Capital Region.....	41
<b>Table 3.</b> Regulatory sandbox in Flanders.....	43
<b>Table 4.</b> Regulatory sandbox in Wallonia.....	44
<b>Table 5.</b> Regulatory sandbox in Denmark.....	49
<b>Table 6.</b> Regulatory sandbox in France.....	53
<b>Table 7.</b> Pilot regulation in France .....	54
<b>Table 8.</b> Regulatory sandbox in Hungary.....	57
<b>Table 9.</b> Pilot projects in Italy - Smart grids.....	59
<b>Table 10.</b> Pilot projects in Italy - Electromobility .....	60
<b>Table 11.</b> Pilot projects in Italy - Storage .....	61
<b>Table 12.</b> Pilot regulation in Italy – Flexibility and balancing services.....	63
<b>Table 13.</b> Pilot regulation in Italy - CSC and energy communities.....	64
<b>Table 14.</b> Pilot regulation in Italy - Electromobility.....	65
<b>Table 15.</b> Regulatory experiment in Italy - Smart grid.....	67
<b>Table 16.</b> Regulatory sandbox in Italy – Gas networks.....	68
<b>Table 17.</b> Regulatory sandbox in Lithuania .....	71
<b>Table 18.</b> Regulatory sandbox in the Netherlands .....	75
<b>Table 19.</b> Regulatory sandbox in Portugal - CSC and energy communities.....	78
<b>Table 20.</b> Regulatory sandbox in Portugal - Electromobility.....	79
<b>Table 21.</b> Regulatory sandbox in Portugal - Gas networks.....	80
<b>Table 22.</b> Pilot projects in Portugal - CSC and energy communities.....	82
<b>Table 23.</b> Pilot projects in Portugal – Smart grids.....	83
<b>Table 24.</b> Pilot regulation in Portugal - Tariff design.....	84
<b>Table 25.</b> Pilot regulation in Portugal - Flexibility and balancing services .....	85
<b>Table 26.</b> Regulatory sandbox in Spain.....	87
<b>Table 28.</b> Regulatory sandbox in the United Kingdom .....	95
<b>Table 29.</b> Regulatory sandbox in Norway .....	99

## **Annexes**

### **Annex 1. Regulatory experimentation in the EU – country profiles**

#### **General overview**

In this Annex we report the results of the literature search, questionnaires and semi-structured interviews with representatives from national authorities. For the 12 Member States where we found evidence of regulatory experimentation initiatives, in place or under development, we have developed a country profile (AT, BE, DK, FR, HR, HU, IT, LT, NL, PT, ES, SE). These country profiles have been discussed and approved by the interviewees. For 9 more Member States we confirmed, through direct contact with national authorities, that there are no initiatives in place or under development (BG, CZ, DE, EE, IE, LU, MT, SK). In some of them however, such initiatives are under consideration by the competent authorities. Finally, for 6 Member States, we did not find evidence of any regulatory experimentation initiative, but we did not receive any confirmation in this sense by the contacted national authorities (CY, FI, EL, PL, RO, SI). For some Member States with advanced experience in regulatory experimentation we provide a paragraph on lessons learned. For the remaining countries it was not possible to extract lessons learnt due to the early stage of the initiatives.

## A. Member states with regulatory experimentation initiatives, in place or under development

### AUSTRIA

**Regulatory sandbox.** In recent years, Austria has been investigating the possibility of introducing a regulatory sandbox scheme to support innovation in the energy sector.

In 2019, the Federal Ministry for Climate Protection, Environment, Mobility, Innovation and Technology, launched the so-called Energie.Frei.Raum funding programme. The programme, managed by the Austrian Research Promotion Agency (FFG), aims to support testing of new technologies and business models for the integration of renewable energy, storage and energy efficiency solutions into the energy system. Two consecutive calls for proposals have been launched under the programme.

The first call (2019) explored the need and legal feasibility of establishing an experimentation clause, its possible scope and the structure of an energy regulatory sandbox. The project 'FRESCH - Freedom for Regulatory Experimentation Creation', funded under the first call, built on existing research, R&I projects and extensive workshops with relevant stakeholders to identify the main regulatory challenges for testing and implementing energy innovations in the Austrian energy system and developed a consensual list of areas where derogations would be needed to facilitate innovation<sup>37</sup>. It also advised on the set up of the programme along three main pillars: consultancy/feedback service; regulatory experimentation and regulatory learning (Kubeczko, et al., 2020).

Building on the results of the FRESCH project, in 2021 the Renewables Expansion Act (EAG) amended the Electricity and Gas Acts<sup>38</sup> to enable R&D projects to experiment with network charges, thus introducing the first sandbox scheme. To be admissible under the scheme, R&D projects need to be already co-funded under the Austrian Research and Technology Act or under an equivalent support programme. They also need to pursue at least two of the objectives specified for the electricity and gas sector, which include, inter alia: system integration of renewable energy, storage and energy efficiency technologies; digitisation; improving the conversion or storage of energy and implementation of sector coupling and sector integration; and increasing the flexibility potential and the efficiency or security of network operation. Project proponents can submit their application to the regulatory authority - E-Control – which has 3 months to decide on the requested derogations. The network operator in whose concession area the project is being carried out shall be notified of the granted derogation. The derogations apply only to the network users involved in the project and are granted for a maximum period of 3 years.

In October 2021, the second call for proposals under the Energie.Frei.Raum funding programme was opened. The call funded 9 projects testing new business ideas and innovative approaches to support system integration of storage technologies and increased system flexibility. Following the adoption of experimentation clauses in the Electricity and Gas Acts, projects admitted to the programme can now request E-control to grant them derogations from the current tariff system to test possible ways of structuring network charges (e.g. load-dependent and time-variable grid tariffs). Contacts with E-Control (October 2022) revealed that informal talks have been carried out with potential applicants and some applications were submitted, but E-control has not yet approved any derogation. Table 1 summarises the main elements of the regulatory sandbox scheme in Austria.

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<sup>37</sup> Such areas are: 1) alternative proximity criteria for renewable energy communities; 2) increasing the gas network limits for allowing more renewable gases; 3) dynamic electricity network charges; 4) direct feed-in of renewable gases into the gas grid; 5) differentiation of supplier status (e.g. energy communities); 6) integration of profit-oriented service providers in energy communities; 7) standardization / harmonization of power network communication and control infrastructure; 8) exemptions from regulated network charges in case of network-supporting behaviour; 9) exemption from network charges e.g. on batteries and power-to-heat; 10) central platforms for power grid measurement data; 11) Mainstreaming accreditation of smart technologies as network costs; 12) means of integrating local energy communities in the electricity system; 13) alternative benchmarking parameters for assessing network operator efficiency; 14) real-time status of the power grid ('traffic light system'); 15) participation in the balancing energy market for smart technologies and renewables (Kubeczko, et al., 2020).

<sup>38</sup> The Renewables expansion legislative package (Erneuerbaren-Ausbau-Gesetzespaket) of 27 July 2021 introduced an experimentation clause in both the Electricity and Gas Acts [art. 58a of the Electricity Act 2010 (EiWOG 2010) and art. 78a of the Gas Act 2011 (GWG 2011), respectively]. Available at: [https://www.parlament.qv.at/PAKT/VHG/XXVII/I/I\\_00733/index.shtml](https://www.parlament.qv.at/PAKT/VHG/XXVII/I/I_00733/index.shtml)

**Table 1.** Regulatory sandbox in Austria

<b>AUSTRIA – Regulatory sandbox</b>	
<b>Legal basis</b>	Art. 58a of the Electricity Act 2010 (ElWOG 2010) and art. 78a of the Gas Act 2011 (GWG 2011)
<b>Brief description</b>	Projects admitted to the scheme can request derogations to test possible ways of structuring network charges
<b>Areas of experimentation</b>	Tariff design
<b>Objectives</b>	To support testing of new technologies and business models for the integration of renewable energy, storage and energy efficiency solutions into the energy system
<b>Derogations</b>	By way of derogation from the ordinary tariff system, projects can test alternative ways of structuring network charges
<b>Length of derogations</b>	Max 3 years
<b>Eligible project promoters</b>	Any participant in projects funded under the Austrian Research and Technology Act or under an equivalent support programme
<b>Knowledge sharing obligations</b>	Not specified

*Source:* JRC, 2023

## BELGIUM

As part of its efforts to support the energy transition, Belgium adopted sandbox schemes in each of its regions in the collective self-consumption and energy communities sector. We will analyse each of the regions separately.

### **Brussels-Capital Region**

**Regulatory sandbox.** The regional regulator BRUGEL opened up the application process for regulatory sandboxes in June 2019. The scheme was adopted with a decision<sup>39</sup> based on Article 90 of the ordinance of 23 July 2018<sup>40</sup> which states that BRUGEL can adopt specific rules for limited geographic areas or electricity zones for a limited time. These zones are specifically set up through the implementation of innovative projects, and their purpose is to find solutions to the problem of connecting decentralised production with the distribution networks. Table 2 summarises the main elements of the regulatory sandbox scheme in Brussels-Capital Region.

The framework makes it possible to test innovative technologies, new models and new businesses for the development of the energy transition. All parties are eligible to take part in the scheme and exemptions can be related to distribution and metering tariffs, the conditions for the supply of electricity or measures to optimise supply and demand.

The standard duration of an experiment is 2 years, with the option of extending it by another 2 years.

The project applicant must submit a report to BRUGEL every 6 months and a final report will be published online at the end of the project or at the end of the derogation period.

To be eligible a project needs to:

- be innovative in nature,
- be complementary with ongoing projects,
- have potential in terms of social added value to society as a whole and have the potential to be reproduced on a regional scale.

So far (October 2022), the following six projects have been approved by BRUGEL:

- Les Bambins project<sup>41</sup> involves the establishment of a renewable energy community by a school and an individual. The derogation request was initiated by Apere,
- Greenbizz.energy<sup>42</sup> is an energy community project that will share the photovoltaic electricity generated on the roof of the Greenbizz incubator with the companies occupying their workshops. The derogation was initiated by Newide (trade name WeSmart),
- Marius Renard project<sup>43</sup> aims to share electricity using a cogeneration system within the same building. The derogation request was sent by Managimm bv,
- SunSud project<sup>44</sup> aims to share photovoltaic electricity within a social housing complex. The derogation request was filed by Apere,

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<sup>39</sup> BRUGEL decision 20190605-97 of 05 June 2019. Available at:

<https://www.brugel.brussels/publication/document/decisions/2019/fr/DECISION-97-CADRE-DEROGATOIRE.pdf>

<sup>40</sup> Ordinance of 23 July 2018. Available at: [https://etaamb.openjustice.be/fr/ordonnance-du-23-juillet-2018\\_n2018031814.html](https://etaamb.openjustice.be/fr/ordonnance-du-23-juillet-2018_n2018031814.html)

<sup>41</sup> BRUGEL decision 20210604-161 of 04 June 2021. Available at:

<https://www.brugel.brussels/publication/document/decisions/2021/fr/DECISION-161-AMENDEMENT-DECISION-DEROGATION-PROJET-LES-BAMBINS.pdf>

<sup>42</sup> BRUGEL decision 20210209-158 of 09 February 2021. Available at:

<https://www.brugel.brussels/publication/document/decisions/2021/fr/DECISION-158-PROJET-INNOVANT-GREENBIZZ-DECISION-DEROGATION.pdf>

<sup>43</sup> BRUGEL decision 20211221-184 of 21 December 2021. Available at:

<https://www.brugel.brussels/publication/document/decisions/2021/fr/DECISION-184-OCTROI-DEROGATIONS-REGLES-MARCHE-TARIFAIRES-PROJET-INNOVANT-MARIUS-RENARD.pdf>

<sup>44</sup> BRUGEL decision 20211221-183 of 21 December 2021. Available at:

<https://www.brugel.brussels/publication/document/decisions/2021/fr/DECISION-183-OCTROI-DEROGATIONS-REGLES-MARCHE-TARIFAIRES-PROJET-INNOVANT-SUNSUD.pdf>

- HG Stockel.energy project<sup>45</sup> will share photovoltaic electricity within the same building. The derogation was initiated by Newide (trade name WeSmart),
- Tour&Taxis.energy project<sup>46</sup> will test sharing of photovoltaic electricity and its management between different types of consumers. The derogation was initiated by Newide (trade name WeSmart).

**Table 2.** Regulatory sandbox in Brussels-Capital Region

BELGIUM   Brussels Capital Region – Regulatory sandbox	
<b>Legal basis</b>	BRUGEL decision of June 6, 2019
<b>Brief description</b>	Decision to implement the regulatory experimentation system
<b>Areas of experimentation</b>	CSC and energy communities
<b>Objectives</b>	- Innovative solutions, new tariff model and new business model - Development of solutions to connect decentralised production to distribution networks
<b>Derogations</b>	The deviations can relate to the distribution and metering rates, the conditions for the supply of electricity or measures to optimise the offer and the requests
<b>Length of derogations</b>	Max 2 years, with another 2 years possible extension
<b>Eligible project promoters</b>	All parties
<b>Knowledge sharing obligations</b>	Every six months report to BRUGEL, and a final report will be published online

Source: JRC, 2023

## Flanders

**Regulatory sandbox.** The Flemish Government has provided, through the Decree of 16 November 2018<sup>47</sup>, a decision<sup>48</sup> for the recognition of low-regulation zones for energy (Regelluw zones voor energie) in the Energy Decree<sup>49</sup> as a means of finding innovative solutions for a flexible energy system with social relevance. The Energy Decree states that the Flemish Government is responsible for determining the procedure and conditions for the application, for the recognition, suspension or withdrawal of the recognition as a low-regulation zone for energy. Table 3 summarises the main elements of the regulatory sandbox scheme in Flanders.

A low-regulation zone can be requested for specific living labs. These low-regulation zones are intended as a testing ground for experimenting with innovative techniques or practices, without being hindered by the applicable generic regulations.

All parties are eligible to submit proposals to the Ministry through VEKA, the Flemish Energy and Climate Agency. Depending on the requested deviations, advice will have to be obtained from the Flanders' regulator (VREG), VEKA, the Flanders innovation and Entrepreneurship Agency (VLAIO) or the relevant grid operator.

<sup>45</sup> BRUGEL decision 20220329-195 of 29/03/2022 <https://www.brugel.brussels/publication/document/beslissingen/2022/nl/Beslissing-195-afwijkingen-innovatief-project-Stockel-energy.pdf>

<sup>46</sup> BRUGEL decision 20220329-196 of 29 March 2022. Available at: <https://www.brugel.brussels/publication/document/beslissingen/2022/nl/Beslissing-196-afwijkingen-innovatief-project-Tour-Taxis-energy.pdf>

<sup>47</sup> Decree of 16 November 2018 TITEL XIV/1. Experimentregelgeving en regelluw zones voor energie. Available at: <https://codex.vlaanderen.be/portals/codex/documenten/1018092.html#H1089233>

<sup>48</sup> Low-regulation zones for energy TITEL X/1. Regelluw zones voor energie. Available at: <https://codex.vlaanderen.be/portals/codex/documenten/1019755.html>

<sup>49</sup> Energy Decree of 8 May 2009. Available at: <https://codex.vlaanderen.be/portals/codex/documenten/1018092.html>

The request can be for up to 10 years with a possible extension by a maximum of 5 years. Although the list of regulations to which exemptions can be granted is fixed and limited to the Flemish Ministry, project promoters can apply for a derogation of provisions dealing with the organisation of electricity and gas market, the organisation and exploitation of thermal grids, some provisions concerning energy efficiency, RES and the energy performance of buildings.

The Flemish Government will assess project by project. The following eligibility criteria need to be met:

- the project is sufficiently mature and elaborated,
- the project is innovative and the results of the project can be reproduced,
- the project has a demonstrable social interest that exceeds the purely individual interest, and where the social benefit potentially exceeds the social cost. Projects that only pursue an individual interest are not eligible for recognition as a low-regulation zone for energy,
- the project does not impose a disproportionate burden on third parties.

Every year by the beginning of July, the project applicant must report to the minister on the progress of the project, the critical success factors, the preliminary results achieved so far, and the lessons already learned. The project will be completed with a final report that will be published online.

The regulatory scheme does not include funding, but projects can access financing through other channels.

Due to the lack of Flemish legislation, the creation of an energy community can only be achieved via a regulation-free zone. Until February 2022, two applications for low-regulation zones were submitted in Flanders, with one being granted.

Thor Park<sup>50</sup> in Genk was granted by the Flemish Government on 7 February 2020 as being the first low-regulatory zone in Flanders that is open to companies for testing their new technologies and experiments on a real-life scale. Thor Park is focusing on three research areas: exchanging locally generated renewable energy; experimenting with an innovative thermal network to optimally integrate renewable sources; developing innovative direct current (DC) networks and connections. Derogations were granted in regard to the Energy Decree of 8 May 2009, which requires suppliers of electricity and natural gas to have a supply license. However, since thermal energy and DC networks are not covered under Article 4.3.1 of the Energy Decree, the scope of the requested low-regulation zone is effectively limited to the first research part, which pertains to new market organisation models for energy services. Nonetheless, the project can still utilise thermal energy and DC grids without needing a supply permit. Companies at Thor Park are automatically part of the regulatory sandbox and can benefit from the regulatory deviations.

On September 16, 2020, Lovitas BV submitted an application to be recognised as a low-regulation zone for energy for the Hoogveld industrial estate in Dendermonde. Lovitas aim was to optimally match the local production of energy with local consumption. To do this, the applicant wanted to be able to construct and manage virtual direct lines in addition to direct lines and apply a levy for the direct lines. After reviewing the application, in December 2020, the government of Flanders, with advice<sup>51</sup> from the regulator, has decided not to recognise the project (with Lovitas request for greatly reduced distribution network tariffs) as a restricted zone because there is no legal basis. The principle of equitable application of rules has guided the government's decision, emphasizing that low-regulation zones should not be exploited to obtain unjustified advantage by securing greatly reduced distribution network tariffs that other households and SMEs have to pay.

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<sup>50</sup> Besluit van de Vlaamse Regering tot erkenning van Thor Park in Genk als regellewe zone voor energie. Available at: [https://etaamb.openjustice.be/nl/besluit-van-de-vlaamse-regering-van-07-februari-2020\\_n2020040800.html](https://etaamb.openjustice.be/nl/besluit-van-de-vlaamse-regering-van-07-februari-2020_n2020040800.html)

<sup>51</sup> VREG advice of 22 December 2020. Available at: <https://www.vreg.be/sites/default/files/document/adv-2020-11.pdf>

**Table 3.** Regulatory sandbox in Flanders

BELGIUM   Flanders – Regulatory sandbox	
<b>Legal basis</b>	Decree and Decision on low-regulation zones for energy
<b>Brief description</b>	Low regulation zones for energy for specific living labs
<b>Areas of experimentation</b>	CSC and energy communities
<b>Objectives</b>	To test new techniques or applications for a flexible energy system with social relevance
<b>Derogations</b>	Derogation of provision dealing with the organisation of electricity and gas market, the organisation and exploitation of thermal grids, some provisions concerning energy efficiency and renewable energy and the energy performance of buildings
<b>Length of derogations</b>	Max 10 years, with another 5 years possible extension
<b>Eligible project promoters</b>	All parties
<b>Knowledge sharing obligations</b>	Annually report to Ministry, and a final report will be published online

Source: JRC, 2023

### Wallonia

**Regulatory sandbox.** A decree<sup>52</sup> was introduced in Wallonia on 2 May 2019 which aims at promoting the development of renewable energy communities (REC).

All parties can submit projects to the regional regulator, CWaPE, which will also make decisions and evaluate the projects. Derogations can be granted for a period of 5 years for any regulation that falls under the CWaPE jurisdiction.

According to the decree, the renewable energy community (REC) is exempt from having to obtain a license to supply electricity for collectively self-consumed electricity within the REC.

For projects to qualify, they must:

- have as their object of study the implementation of optimal technological solutions for the Walloon electricity market, particularly in terms of energy efficiency, the flexibility of demand, optimization of development, management of decentralised production, and the promotion of local self-consumption and short lines,
- be innovative,
- not breach the obligations imposed on players in the regional electricity market by or under this decree, unless it is demonstrated that departing from these rules is necessary for the proper functioning of the project,
- not have as its main objective to totally or partially evade, all forms of taxes and charges for which they would be liable if they were not within the scope of the project,
- be reproducible to the entire Walloon market in a non-discriminatory manner,
- make results public,

<sup>52</sup> 2 MAI 2019. - Décret modifiant les décrets des 12 avril 2001 rela... if à l'organisation du marché régional de l'électricité, du 19 décembre 2002 relatif à l'organisation du marché régional du gaz et du 19 janvier 2017 relatif à la méthodologie tarifaire applicable aux gestionnaires de réseau de distribution de gaz et d'électricité en vue de favoriser le développement des communautés d'énergie renouvelable. Available at: [https://www.ejustice.just.fgov.be/cqi/article\\_body.pl?language=fr&caller=summary&pub\\_date=2019-09-13&numac=2019204063](https://www.ejustice.just.fgov.be/cqi/article_body.pl?language=fr&caller=summary&pub_date=2019-09-13&numac=2019204063)

- have a limited duration that does not exceed five years.

Interested parties can apply for derogations from the following market and tariff rules:

- metering rules,
- the obligation related to the supply of electricity,
- the invoicing terms of the network's operator tariffs.

So far, three projects have been approved by CWaPE:

- HospiGREEN project<sup>53</sup> led by Ideta. For a period of 28 months, it will examine periodic distribution tariffs in the context of RECs. Will end in March 2023,
- MérGrid projec<sup>54</sup>t led by Nethys. It combines photovoltaic production, hydropower, and storage solutions controlled by an energy management system, to meet the energy needs of three companies, being granted an exemption for 2 years,
- E-Cloud project<sup>55</sup>. During the course of the project, neighbouring companies will share the electricity produced by their photovoltaic panels and a wind turbine in the Tournai Ouest business park. The derogation request submitted by Ores Assets was granted for 1 year.

The sandbox projects are required to submit interim reports and the final report will be available on CwaPE website. It is unclear whether the projects can receive funding through regulatory or other channels.

Table 4 summarises the main elements of the regulatory sandbox scheme in Wallonia.

**Table 4.** Regulatory sandbox in Wallonia

BELGIUM   Wallonia – Regulatory sandbox	
<b>Legal basis</b>	Walloon Decree of 2 May 2019
<b>Brief description</b>	Exploring different innovations in the scope of energy communities
<b>Areas of experimentation</b>	CSC and energy communities
<b>Objectives</b>	Promoting the development of RECs
<b>Derogations</b>	Open to all regulation under regional responsibility
<b>Length of derogations</b>	Max 5 years
<b>Eligible project promoters</b>	All parties
<b>Knowledge sharing obligations</b>	Interim reports and a final report will be published online

*Source:* JRC, 2023

Figure 22 shows the locations of all accepted regulatory experimentation projects carried out in each of the three regions of Belgium.

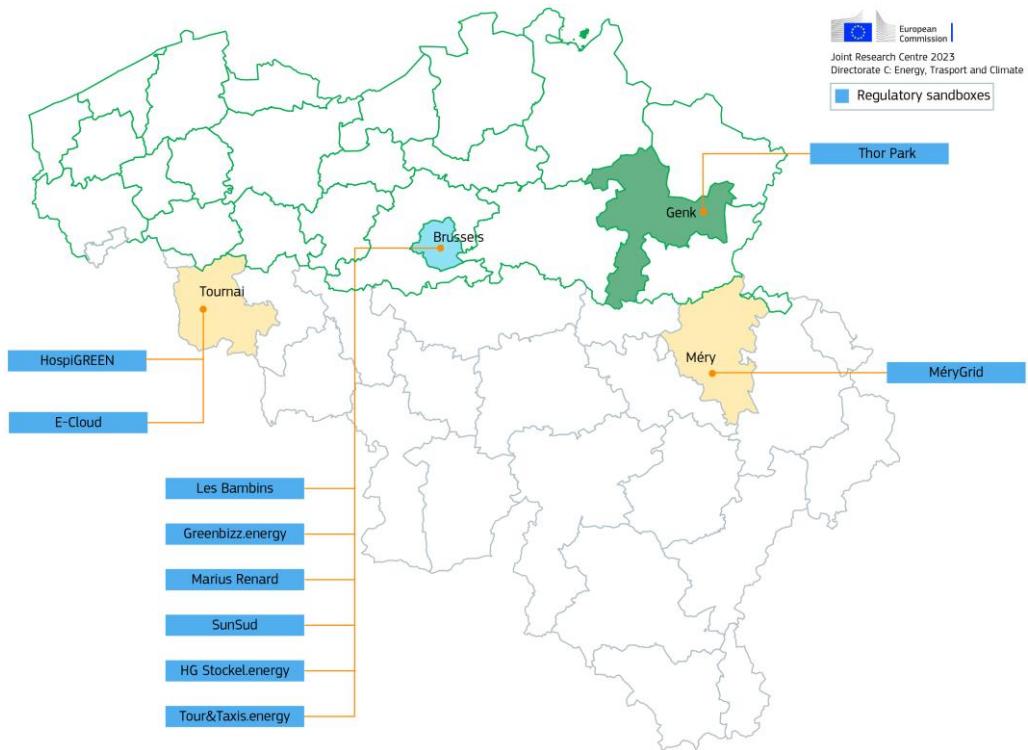
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<sup>53</sup> CWaPE decision CD-20j15-CWaPE-0451 of 15 October 2020. Available at: <https://www.cwape.be/publications/document/4284>

<sup>54</sup> CWaPE decision CD-19b07-CWaPE-0294 of 7 February 2019. Available at: <https://www.cwape.be/publications/document/2819>

<sup>55</sup> CWaPE decision CD-19c21-CWaPE-0303 of 22 March 2019. Available at: <https://www.cwape.be/en/node/3979>

**Figure 22.** Location of regulatory sandbox projects in Belgium



## CROATIA

The Croatian Energy Regulator (Hrvatska energetska regulatorna agencija - HERA) has recently launched a regulatory sandbox initiative to promote innovation in the electricity sector. Art. 16 of the Electricity transmission tariff methodology<sup>56</sup> and art. 19 of the Electricity distribution tariff methodology<sup>57</sup> foresee the possibility of approval by HERA of the costs incurred by network operators for the implementation of innovative projects. Such projects must be included and duly justified by network operators in their ten-year network development plans. The possibility of granting regulatory derogations, not explicitly foreseen by the two methodologies, is currently under investigation. In this report we considered the initiative as under development since the two methodologies were only issued in July 2022, and no further detail on the scheme is yet available.

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<sup>56</sup> HERA decision 1284/84/2022 of 14 July 2022 'Metodologija za određivanje iznosa tarifnih stavki za prijenos električne energije'. Available at: [https://narodne-novine.nn.hr/clanci/sluzbeni/2022\\_07\\_84\\_1284.html](https://narodne-novine.nn.hr/clanci/sluzbeni/2022_07_84_1284.html)

<sup>57</sup> HERA decision 1283/84/2022, of 14 July 2022 'Metodologija za određivanje iznosa tarifnih stavki za distribuciju električne energije'. Available at: [https://narodne-novine.nn.hr/clanci/sluzbeni/2022\\_07\\_84\\_1283.html](https://narodne-novine.nn.hr/clanci/sluzbeni/2022_07_84_1283.html)

## DENMARK

**Regulatory sandbox.** With the broad political Energy Agreements of 29 June 2018<sup>58</sup>, political parties agreed on the set up of a regulatory sandbox scheme (Regulatoriske Testzoner) where selected innovative projects in the energy sector can be granted a temporary exemption from specific rules that prevent their progress. A regulatory sandbox may be issued to projects that experiments with new business models, technologies and solutions in any area, including, for example:

- energy sector integration (electricity, heating and gas sectors),
- energy system flexibility,
- electricity grid balancing,
- optimisation of the market for system services,
- integration of fluctuating renewable energy production, including energy conversion and storage,
- digitisation,
- energy efficiency and savings.

The regulatory sandbox scheme provides two main services to project developers:

- a consultancy/feedback service to applicants to determine whether a derogation is actually needed, or whether the project can be carried out under the current regulatory framework. This service is provided by the Danish Energy Agency (Energistyrelsen) which is also responsible for handling the applications,
- the possibility to apply for derogations in case the regulatory framework does not allow the realization or progress of an innovative project. The legal basis for the derogations provided so far is by a specific provision of the Electricity Act<sup>59</sup>, which enables the Ministry for Climate, Energy and Utilities to wholly or partially exempt installations covered by the act from its own provisions. A similar provision is found in the Gas Act<sup>60</sup>, but so far no application has pointed to specific rules in the Gas Act, as a barrier to the progress of the project.

To be eligible for the regulatory sandbox, a project needs to meet the following 10 eligibility criteria that are used for the overall assessment of the application<sup>61</sup>:

- it is subject to regulation under the remit of the Ministry of Climate, Energy and Utilities,
- its implementation is challenged by a regulatory barrier,
- it is innovative,
- it promotes the green transition,
- the solution to be adopted is not yet commercially available,
- it benefits consumers and businesses,
- it is mature enough to enter a test phase,
- it ensures consumers and businesses protection during the test phase,
- it is time limited,
- the results of the experimentation will be disseminated publicly.

All applications are evaluated on a case-by-case basis and derogations are granted only if the proposed innovative solution may help to advance regulation and make it future-proof. There is no application deadline

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<sup>58</sup> Energy agreement of <https://en.kefm.dk/Media/C/5/Energy%20Agreement%202018%20a-webtilgængelig.pdf>

<sup>59</sup> Section 2, subsection 4 of the Danish Electricity Act, Legislative Decree No. 984 of 12 May 2021. Available at: <https://www.retsinformation.dk/eli/ta/2021/984#P4>

<sup>60</sup> Section 2, subsections 5, 6 and 7 of the Danish Gas Act, legislative Decree No. 126 of 6 February 2020. Available at: <https://www.retsinformation.dk/eli/ta/2020/126>

<sup>61</sup> DEA webpage for the Danish regulatory sandbox scheme: <https://ens.dk/ansvarsomraader/forskning-udvikling/regulatoriske-testzoner> (only available in Danish).

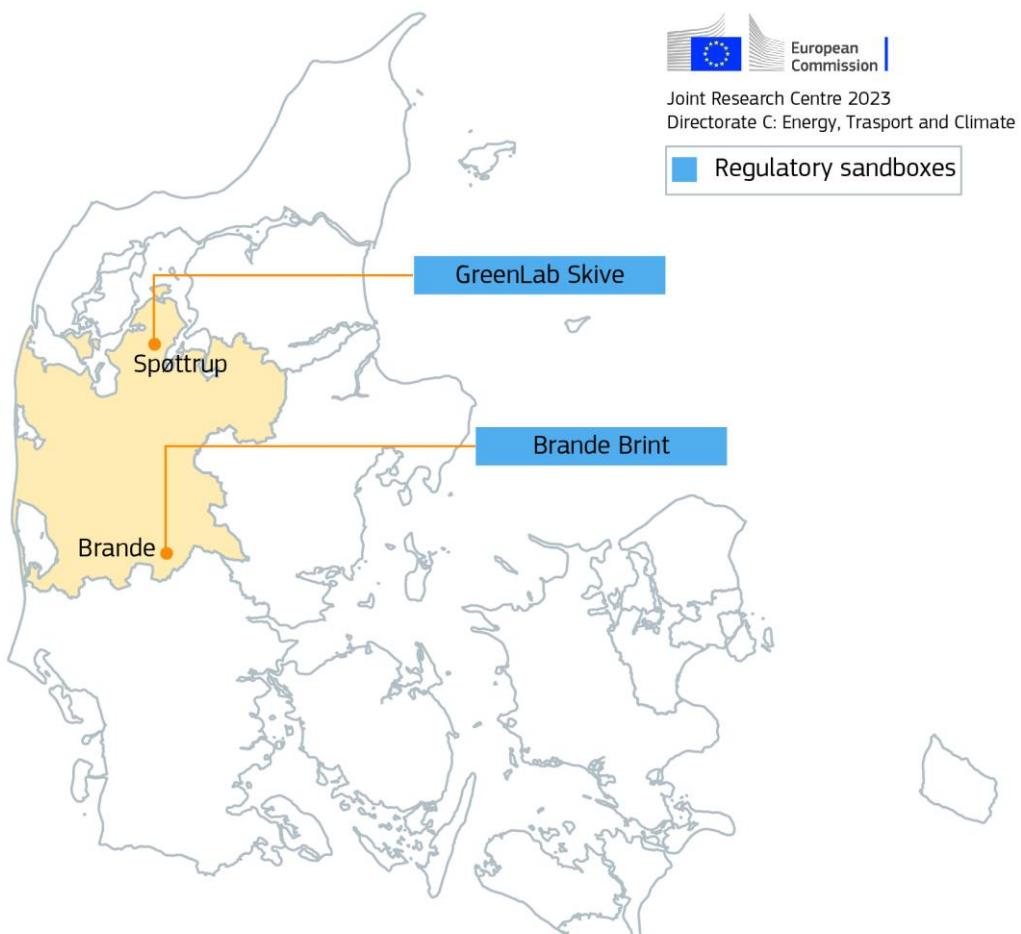
and applications are processed by the Agency's secretariat as they come in. If a project is issued a regulatory sandbox, the applicant is required to draw up a test plan, in collaboration with the Agency.

On 5 May 2021, the following two projects were issued a regulatory sandbox (Figure 23):

- GreenLab Skive project. The project will demonstrate production of green hydrogen, including the development of a viable value chain, by enabling different companies to share each other's surplus resources, such as for instance CO<sub>2</sub> and energy,
- Siemens Gamesa's Brønde Hydrogen project. The technology-focused project couples an existing onshore 3 MW wind turbine with a green hydrogen systems electrolyzer stack, with the possibility to produce green hydrogen in 'island mode', i.e. without any connection to the grid. The green hydrogen fuel produced is then distributed by the Danish company Everfuel to the Copenhagen's fuel cell taxi fleet<sup>62</sup>.

Table 5 summarises the main elements of the regulatory sandbox scheme in Denmark.

**Figure 23.** Location of regulatory sandbox projects in Denmark



<sup>62</sup> More information on the project can be retrieved at: <https://stateofgreen.com/en/news/new-danish-test-zones-show-the-way-for-european-energy-transition/>

**Table 5.** Regulatory sandbox in Denmark

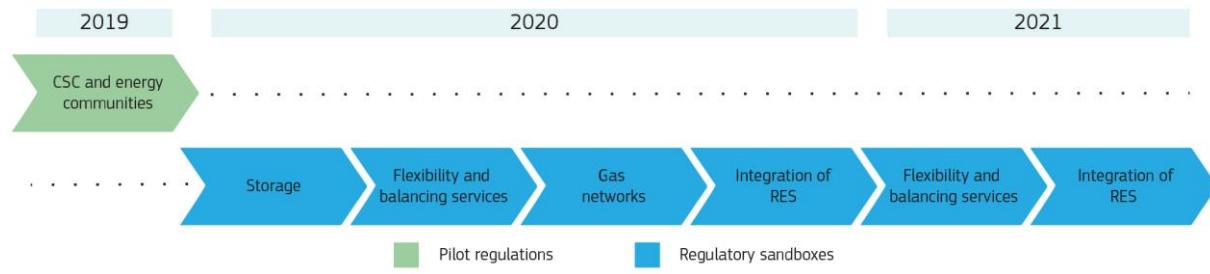
DENMARK – Regulatory sandbox	
<b>Legal basis</b>	Energy Agreements of 29 June 2018
<b>Brief description</b>	The regulatory sandbox provides two main services to project developers: a guidance service and the possibility to grant time limited derogations from rules that prevent innovative projects from progressing
<b>Areas of experimentation</b>	The regulatory sandbox scheme is open to any type of project in the energy sector. Once admitted to the scheme, the design of the regulatory sandbox is tailored to the specific project
<b>Objectives</b>	Promote the green transition and the fulfilment of Denmark's climate goals
<b>Derogations</b>	Open. The regulatory (or legislative) barrier impeding the progress of the applicant's innovative project must be a provision issued under the remit of the Ministry of climate, energy and utilities
<b>Length of derogations</b>	Normally 2 years. The time limit is set after a specific assessment in each individual case. In special cases a project may be granted longer derogations
<b>Eligible project promoters</b>	All parties
<b>Knowledge sharing obligations</b>	Project applicants must report to the Danish Energy Agency and disseminate the project results publicly

*Source:* JRC, 2023

## FRANCE

France has adopted different types of regulatory experimentation (Figure 24). In 2019, a regulatory sandbox scheme was set up that enabled experimentation in a number of sectors, including storage, power-to-gas, provision of flexibility and balancing services and RES integration. In the same year, a pilot regulation enabled experimentation in the field of collective self-consumption and energy community initiatives. We will examine the two forms of experimentation separately.

**Figure 24.** Timeline regulatory experimentation initiatives in France



Source: JRC, 2023

**Regulatory sandbox.** According to article 61 of the Law of 8 November 2019 on Energy and Climate<sup>63</sup>, the competent authority - either the relevant Ministry or the national regulatory authority (CRE) may, each in their respective areas of competence, grant exemptions from the conditions of access to and use of networks and facilities<sup>64</sup> for the experimental deployment of innovative technologies or services in favour of the energy transition and smart networks and infrastructures. These exemptions are granted for a maximum period of four years, renewable once for the same duration and under the same conditions as the exemption initially granted. The experimentations must contribute to the achievement of the national energy policy objectives and the exemptions cannot be granted if they are likely to jeopardise the safety and security of the energy networks or the quality of their operation.

With a decision dated June 4, 2020<sup>65</sup>, CRE adopted a framework for the implementation of the regulatory experimentation system, formalizing the application and reviewing process. The analysis of the projects is carried out in two main steps - an eligibility analysis and a technical assessment – after which CRE designates, by decision, the selected projects and the conditions of the experiment. During the eligibility analysis, CRE verifies whether the applications comply with the following five cumulative criteria: (i) contribution to the objectives of the French energy policy defined in Article L. 100-1 of the Energy Code, (ii) innovative dimension, (iii) clearly identified legislative or regulatory obstacle, (iv) potential for further deployment, in particular if the experimentation achieves its objectives and (v) benefits for the community if the solution is ultimately deployed. During the technical assessment, CRE appraises the relevance of the experimentations and their suitability to inform regulatory change. For projects that passed the evaluation, CRE discusses with the project proponent and the concerned network operators the indicators that need to be used to report the progress of the project. The indicators are specified in the decision granting the derogations and will also be used to assess the projects results.

Applications to CRE can be submitted following the opening of an application window by the regulator. CRE can only grant a derogation if the competent Minister – i.e. the Minister responsible for energy and the Minister responsible for consumption – does not express its opposition within a period of two months from the notification of the request for exemption. So far, the competent Ministers have never used their veto power. Table 6 summarises the main elements of the regulatory sandbox scheme in France.

<sup>63</sup> Law nr. 2019-1147 of 8 November 2019. Available at: <https://www.legifrance.gouv.fr/loda/id/JORFTEXT000039355955/>

<sup>64</sup> Such conditions are those provided for by the following provisions of the Energy Code (<https://www.legifrance.gouv.fr/codes/id/LEGITEXT000023983208/>): Book III, Titles II (transport and distribution of electricity) and IV (access and connection to the electricity grid); Book IV, Titles II (gas storage), III (transport and distribution of gas) and V (access and connection to gas networks and facilities).

<sup>65</sup> CRE decision 2020-125 of 4 June 2020. Available at: <https://www.cre.fr/Documents/Deliberations/Decision/mise-en-oeuvre-du-dispositif-d-experimentation-reglementaire-prevu-par-la-loi-relative-a-l-energie-et-au-climat>

First application window. During the first window of applications (15 June – 15 September 2020), 42 applications were received, falling within the competence of different authorities. 22 of them were declared ineligible on different grounds (e.g. the application was not complete, the proposal was not considered innovative, there was no need for a derogation, and the proposal was out of the scope of the experimental framework)<sup>66</sup>. Out of the 20 eligible projects, 9 were granted a derogation by CRE<sup>67</sup>, 15 were transmitted to the Ministry responsible for energy for its determination, out of which 2 were granted a derogation.

The following are the 9 projects that benefited from exemptions granted by CRE (Figure 25):

- one project led by EDF aimed at facilitating the participation of battery storage in system services,
- one project led by Engie to experiment with a mobile peak tariff option. The innovative electricity network tariff aims to reflect more accurately network costs and to smooth consumption peaks by enhancing the flexibility potential of individuals<sup>68</sup>,
- seven projects aimed at experimenting with the injection of synthetic methane into distribution networks, the gas coming from different production processes (Energo; The Pau Béarn Pyrénées agglomeration community; Perpignan Mediterranean Metropolis Urban Community; Storengy Hycaunais, Storenergy Méthycentre; SAS GDL; Hymoov).

Conversely, the Ministry responsible for energy has not formalised its own application and reviewing process. Applications are therefore processed as they come in and project proponents can submit their proposal throughout the year (ISGAN, 2021). As of July 2021, the Ministry has granted exemptions to the following 4 projects (Figure 25):

- the BayWa r.e. project. It aims to pool the connection of a wind farm and a photovoltaic plant on the same connection point, building on their complementarity. The project wishes to derogate from the provision of the French energy code which stipulates that production installations with an installed capacity over 17 MW cannot be connected to the public distribution but need to be connected at transmission level,
- the Boralex project. It aims to increase the capacity of 2 wind farms, which would require an adaptation of the Regional Renewable Energies Connection Master Plans (S3REnR in French)<sup>69</sup>. Boralex wishes to pursue its connection request without waiting for the outcome of the adaptation of the S3REnR, in exchange for the possibility for the TSO to trigger uncompensated load shedding of its production in the event of grid congestion. The project also applies for a derogation from the above mentioned 17 MW ceiling,
- the Enedis project ReFlex. It aims to optimise investments within the S3REnR by experimenting with two different methods for sizing primary substations:
  - connection capacity increase with direct generation curtailments (according to constraints),
  - market based flexibilities procurement as an alternative to direct generation curtailments.
- One project led by the companies Fibre excellence Tarascon SAS and Hervey Investment B.V aiming to optimise the connection of a production site by connecting the installation to the medium voltage instead of the high voltage network<sup>70</sup>.

The first two applications (Boralex and BayWas r.e.) were originally received by CRE and transmitted to the Ministry as the only competent authority, while the other two applications were received directly by the Ministry.

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<sup>66</sup> CRE decision n. 2020/269 of 5 November 2020. Available at: <https://www.cre.fr/Documents/Deliberations/Decision/eligibilite-des-dossiers-sousmis-a-la-cre-dans-le-cadre-du-premier-quichet-du-dispositif-d-experimentation-reglementaire-prevu-par-la-loi-relative-a>

<sup>67</sup> CRE decision 2021/59 of 11 March 2021. Available at: <https://www.cre.fr/Documents/Presse/Communiques-de-presse/bac-a-sable-reglementaire-la-cre-accorde-des-derogations-a-9-projets-innovants>

<sup>68</sup> More info available at: <https://www.smartgrids-cre.fr/projets/netflex>

<sup>69</sup> Regional Renewable Energies Connection Master Plans (S3REnR in French). Decision of the Ministry for the ecological transition of July 16, 2021, <https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000043847510>

<sup>70</sup> Ministerial decision of the Ministry for the ecological transition of 21 June 2021. Available at: <https://www.bulletin-officiel.developpement-durable.gouv.fr/documents/Bulletinofficiel-0031920/TRER2118255S.pdf>

Second application window. In its decision of July 22, 2021<sup>71</sup>, CRE announced the opening of a second application window. Project proponents had until January 14, 2022, to submit their application on the dedicated platform. 38 applications were filed.

16 projects were declared ineligible, as they did not fall within the scope of the sandbox, did not present the required innovative character or could have been implemented without modifying the effective regulatory framework. 22 files met the eligibility criteria provided for by law and specified by CRE, with particular attention paid to the innovative nature and the effective identification of regulatory obstacles<sup>72</sup>. Of these 22 files, 4 fell within the competence of CRE, 12 fell within the competence of both CRE and the Ministry responsible for energy and 6 fell exclusively within the competence of the Ministry. Consequently, CRE transmitted the requests for which it was not exclusively competent to the Ministry and carried out an in-depth analysis of the files falling within its competence, involving the network operators concerned.

At the end of this analysis, CRE decided to grant the requested derogations to the following 14 projects falling wholly or partly within its competences<sup>73</sup>:

- one project led by Eqinov where, by way of derogation from current regulation<sup>74</sup>, the company may value not only downward but also upward modulations of its customers' consumption, within the limit of a portfolio to be defined in number and power in the experimental agreement,
- one wind park project in Magnac-Laval, led by WDP. The project sought an alternative connection solution that could speed up the timing of the connection. The wind park will be connected to the distribution network with a single direct outgoing feeder and a reactive power range that deviates from the applicable industry standards for new connections. The derogation granted by CRE is subject to the acceptance by the project proponent to bear the costs related to the additional losses generated by this connection solution,
- one project led by Amarenco, regarding the development of a 4 MW storage project. Amarenco proposes to optimise the connection of this storage facility, taking into consideration its countercyclical nature. CRE requested Enedis to derogate from its connection standards and to carry out connection studies based on operating curves and assumptions provided by Amarenco. If these studies demonstrate the technical and economic relevance and feasibility of the project, Enedis will have to propose an alternative connection offer to Amarenco. Otherwise, Amarenco could request the Ministry responsible for energy a derogation to benefit from a connection offer associated with dynamic management of storage according to the real constraints of the network, currently open only to renewable energy producers,
- one project led by SEM Energie Mayenne (Evron area), that aims to test the resort by the gas DSO to a compressed natural gas (CNG) station to provide the flexibility needed to allow the injection of biomethane without resorting to further investments in the network,
- three projects led by SAS HYMOOV and one project led by Bordeaux Métropole Energies, aimed at experimenting with the injection into natural gas networks of methane produced by a combination of methanation and pyrogasification processes,
- four projects (led by Arkolia Energies, Enosis, la CUMA des éleveurs du Bergeracois, SIAH Crout et Petit Rosne) aimed at experimenting with the injection into natural gas networks of methane produced by methanation, the hydrogen of which comes from electrolysis,
- one project led by Semardel, aimed at experimenting with the injection into natural gas networks of gas produced from biomass and solid recovered fuels.

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<sup>71</sup> CRE decision n. 2021-237 of 22 July 2021. Available at: <https://www.cre.fr/Documents/Deliberations/Communication/retour-d-experience-du-premier-quichet-du-dispositif-d-experimentation-reglementaire-prevu-par-la-loi-relative-a-l-energie-et-au-climat-et-ouverture>

<sup>72</sup> CRE decision n. 2022-90 of 22 March 2022. Available at: <https://www.cre.fr/Documents/Deliberations/Decision/eligibilite-des-dossiers-soumis-a-la-cre-dans-le-cadre-du-deuxieme-quichet-du-dispositif-d-experimentation-reglementaire-prevu-par-la-loi-relative>

<sup>73</sup> CRE decision n. 2022-191 of 30 June 2022. Available at: <https://www.cre.fr/Documents/Deliberations/Decision/octroi-des-derogations-des-dossiers-soumis-a-la-cre-dans-le-cadre-du-deuxieme-quichet-du-dispositif-d-experimentation-reglementaire-prevu-par-la-lo>

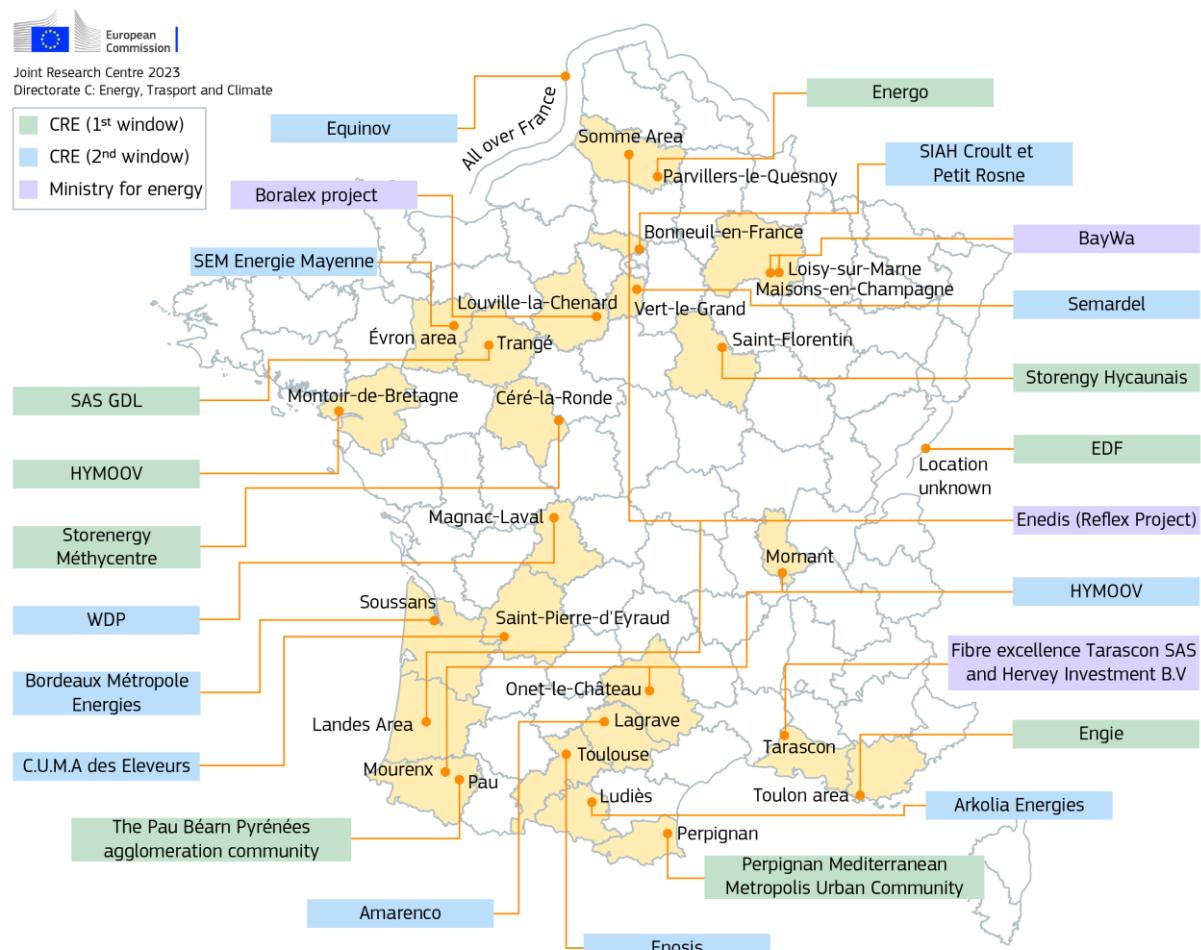
<sup>74</sup> The NEBEF (Notification d'Echanges de Blocs d'Effacement) rules, currently allow only for the valorisation of load shedding

**Table 6.** Regulatory sandbox in France

FRANCE – Regulatory sandbox	
<b>Legal basis</b>	CRE deliberation of 4 June 2020   CRE deliberation of 22 July 2021
<b>Brief description</b>	Decision to implement the regulatory experimentation system
<b>Areas of experimentation</b>	Storage; Gas networks; Provision of flexibility and balancing services; Integration of RES
<b>Objectives</b>	The experimentations must contribute to the achievement of the national energy policy objectives
<b>Derogations</b>	Targeted to specific list of regulation, but open for any proposal within this list
<b>Length of derogations</b>	Max 4 years, possible to renew one time for the same duration
<b>Eligible project promoters</b>	Any legal entity
<b>Knowledge sharing obligations</b>	Annual progress report to CRE

Source: JRC, 2023

**Figure 25.** Location of regulatory sandbox projects in France



**Pilot regulation.** France introduced collective self-consumption of customers situated under the same MV/LV transformer already in 2016<sup>75</sup>. This criterion was however too restrictive and led to the result that two neighbours could not be part of the same collective self-consumption scheme because they were not located downstream of the same transformer station (REScoop and ClientEarth, 2020). To further promote CSC initiatives, in 2019 the so-called Loi Pacte<sup>76</sup>, introduced an experimental framework where, by way of derogation from the previous rule, the law enlarged the maximum CSC perimeter for CSC operations below 3 MW of total power, to a circle with a 1-Km radius. The length of the derogation was originally established in 5 years from the entry into force of the law (until the end of 2023). The derogation was made permanent in 2021<sup>77</sup>. Recently, a bylaw has introduced the possibility to ask for a wider derogation<sup>78</sup>, bringing the maximum CSC perimeter to 10 km radius. According to the new bylaw, the derogation can be granted by the Ministry responsible for energy, at the reasoned request of the legal person organizing an extended CSC project located on mainland metropolitan territory, taking into consideration the isolation of the site of the project, the dispersed nature of its habitat and its low population density. Table 7 summarises the main elements of pilot regulation in France.

**Table 7.** Pilot regulation in France

FRANCE – Pilot regulation	
<b>Legal basis</b>	Art. 126 Law n° 2019-486 of 22 May 2019 (later made permanent by art. 8, ordinance n°2021-236 - 3 March 2021)
<b>Brief description</b>	Introduction of an experimental framework to promote CSC initiatives
<b>Areas of experimentation</b>	CSC and community energy
<b>Objectives</b>	Promotion of CSC initiatives
<b>Derogations</b>	By way of derogation from the previous rule, where the entirety of a CSC operation had to be behind the same low-voltage transformation station, the law introduced a temporary experimental framework that enlarged the maximum CSC perimeter for CSC operations below 3 MW of total power, to a circle with a 1-Km radius
<b>Length of derogations</b>	Originally 5 years from entry into force of the law (until end 2023). The derogation have been made permanent by art. 8 of Ordinance n° 2021-236 - 3 March 2021
<b>Knowledge sharing obligations</b>	The Law provided that by December 31, 2023, the competent ministry and the CRE drew up an assessment of the experiment. To this aim, data were collected regularly by legal persons organizing CSC operations and DSOs concerned

Source: JRC, 2023

<sup>75</sup> Law decree n. 2016-1019, of July 27, 2016, later ratified by Law No. 2017-227 of 24 February 2017. <https://www.legifrance.gouv.fr/loda/id/JORFTEXT000032938257/>

<sup>76</sup> Article 126, Law No. 2019-486 of May 22, 2019, <https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000038496102/>, complemented by Bylaw November 21, 2019 of the Ministry for the ecological transition, <https://www.legifrance.gouv.fr/loda/id/JORFTEXT000039417566/>

<sup>77</sup> Article 8 of law decree n° 2021-236 of March 3, 2021, <https://www.legifrance.gouv.fr/jorf/id/JORFSCTA000043210211>

<sup>78</sup> Bylaw of October 20, 2020 of the Ministry for the ecological transition. [https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000042434286.](https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000042434286)

## LESSONS LEARNED

Desktop research and direct contacts with the NRA allowed us to collect the lessons learned during the first two years of operation of the regulatory sandbox.

**General assessment of the regulatory experimentation to date.** In the opinion of the NRA, the regulatory sandbox to date has revealed as a valid tool to foster innovation. The 'bottom up' logic allows new ideas to emerge and be tested, while approval by the public authorities ensures that the derogations granted are compatible with the general interest<sup>79</sup>. The projects approved under the first window are still running and it is therefore too early to assess their results. The annual progress reports and the feedback at the end of the experimentations are important tools to inform a possible permanent evolution of the regulatory framework.

**Eligibility requirements.** Clear eligibility requirements are needed to ensure transparency and equal treatment. The requirement that projects need to present an innovative character has proven to be the most controversial, as it is difficult to define when a new solution ceases to be innovative. In case of many requests for the same derogation, only those filed first present the innovative character; granting it to too many projects risks to appear as an early generalization of the experimental regulation. To address this issue, CRE has reinforced the rule that any derogation granted should bring new information for regulatory change. In the event of many requests for derogations identical to those granted during the previous windows of application, and not presenting any additional innovative character compared to the projects already approved (e.g. as for the characteristics of the project location, the type of project proponent, etc.) CRE may judge the experiments ineligible.

Also, the eligibility requirement that projects need to face a clearly identified legislative or regulatory obstacle was reconsidered on the basis of the lessons learned with the first window of application. Many projects did not make a specific reference to the legislative and regulatory provisions constituting possible obstacles to the realization of the projects concerned. This lack of information made the eligibility check more difficult and time consuming. Based on this experience, CRE decided that projects that do not identify a legislative and/or regulatory obstacle or that do not specify the reasons why such provisions constitute an impediment to the realization of the projects concerned will be considered incomplete and therefore ineligible.

**Competent authority.** The legislation enabling regulatory experimentation attributed the competence to receive applications and grant derogations to different authorities (in particular CRE and the Ministry responsible for energy), according to their respective areas of competence. Each authority follows its own procedure to process the requests. This system has been subject to criticism by project proponents who denounced its complexity and lack of clarity, particularly in the case of applications including requests for derogations falling within the competence of different authorities. To ensure transparency and efficiency, CRE believes that it would be advisable to have only one authority in charge of the whole application process. In this respect, CRE proposes that it could, with the agreement of the Ministry responsible for energy, take charge of the technical assessment of all applications falling within the competences of the two institutions. For applications falling under the sole competence of the Ministry, the latter could ask CRE to examine them, with each authority remaining in charge of ultimately granting the exemptions that concern it.

**Submission of the applications.** Under the current system, applications to CRE can be submitted following the opening of an application window by the regulator, while applications to the Ministry responsible for energy can be submitted throughout the year and are processed as they come in. Building on its experience with the first two windows of application, CRE now believes that it is preferable to process requests for derogation as they are received without limiting the application to specific timeframes. Such an approach favours project proponents who are free to submit their proposal whenever it is mature and ready, and it also helps the competent authority spreading the assessment workload throughout the year. The admission procedure was thus modified in November 2022<sup>80</sup> enabling applications to be processed as they come in.

**Assessment procedure.** Under the current system, the assessment procedure is split in two phases, the eligibility check (one month) and the technical assessment of the project (three months). This approach has

<sup>79</sup> CRE decision n. 2021/237 of 22 July 2021. Available at: <https://www.cre.fr/Documents/Deliberations/Communication/retour-d-experience-du-premier-quichet-du-dispositif-d-experimentation-reglementaire-prevu-par-la-loi-relative-a-l-energie-et-au-climat-et-ouvertur>

<sup>80</sup> CRE decision n. 2022/299 of 24 November 2022. Available at: <https://www.cre.fr/Documents/Deliberations/Modification/modification-de-la-deliberation-n-2020-125-en-date-du-4-juin-2020-portant-decision-sur-la-mise-en-oeuvre-du-dispositif-d-experimentation-reglementaire>

proven to be effective especially for those projects that require the active participation and collaboration of network operators for their implementation. Network operators can start focusing only on projects that passed the eligibility check, ahead of the technical assessment.

**Length of the derogations.** Derogations are granted for a maximum period of four years, renewable once for the same duration and under the same conditions as the exemption initially granted. CRE is of the opinion that the length of the derogations is adequate to provide the evidence of what works and what doesn't to overcome identified barriers to innovation and to inform the regulator on needed changes in existing rules. The relevance of a longer period could be assessed for projects requiring substantial investments (e.g. projects testing innovative grid connection solutions).

## HUNGARY

**Regulatory sandbox.** In 2021, an amendment to the Electricity Act (VET)<sup>81</sup> provided the legal basis for the set-up of a regulatory sandbox scheme. The scheme aims to support the implementation of innovative solutions that can contribute to the sustainable and cost-effective operation of the electricity system, to meet consumer needs, and to increase the security of supply. Such solutions can refer to products, services, technologies, business models or any other innovation that has not yet been adopted in Hungary.

The amended Electricity Act sets some basic rules for the design and operation of the sandbox, and entrusts the NRA, the Hungarian Energy and Public Utility Regulatory Authority (MEKH), to specify further implementing rules. Applications are filed with the MEKH, which shall assess the project admissibility to the sandbox based on the following criteria:

- the project contributes to the aims of the sandbox scheme (sustainable and cost-effective operation of the electricity system, meeting consumer needs, and increasing security of supply),
- it does not endanger the security of the electricity supply, and,
- it is in line with further rules to be adopted by MEKH with its own decree.

Projects can be granted derogations from the electricity supply codes and from other regulations issued by MEKH. Such derogations can be granted for a period of 2 years, renewable once, in justified cases, if the above eligibility criteria are met.

Pending the entry into force of the amendment, MEKH started preparatory work for the implementation of the scheme. After reviewing international practices, it launched an invitation to submit innovative project ideas and plans, specifying the possible regulatory barriers to their implementation, with the aim to map the state of play of energy innovation in Hungary and to identify the main regulatory hurdles. Thirty proposals were received, mostly relating to energy communities, energy efficiency of power plants, electromobility, smart metering, energy storage, hydrogen, and flexibility and balancing services. Although the majority of the received project plans did not identify any regulatory barrier, the exercise helped the MEKH to get a better overview of the challenges at stake and to inform the adoption of the implementing rules of the sandbox scheme. Table 8 summarises the main elements of the regulatory sandbox scheme in Hungary.

**Table 8.** Regulatory sandbox in Hungary

HUNGARY – Regulatory sandbox	
<b>Legal basis</b>	Section 114/I of the Electricity Act 2007 (VET)
<b>Brief description</b>	The sandbox scheme is open to innovative solutions involving products, services, technologies, business models or any other innovation that has not yet been adopted in Hungary
<b>Objectives</b>	To encourage and support the spread and entry into the market of innovative energy achievements that can promote the sustainability and cost-effective operation of the electricity system, the adequate supply of consumer needs, or the increase of security of supply
<b>Derogations</b>	Derogations from electricity supply codes and from regulations issued by MEKH
<b>Length of derogations</b>	Max. 2 years, which can be extended once, in justified cases, by a max. of another 2 years
<b>Eligible project promoters</b>	Not specified
<b>Knowledge sharing obligations</b>	Not specified

Source: JRC, 2023

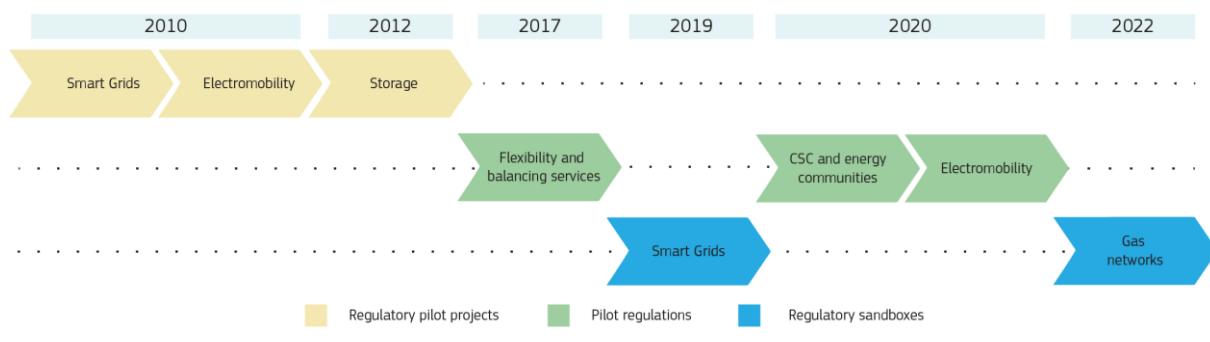
<sup>81</sup> Law CXXXVI of 2021, effective since September 2022, introduced Section 114/I to the Electricity Act LXXXVI of 2007. The text of the Electricity Act is available at: <https://net.jogtar.hu/jogsabaly?docid=a0700086.tv>

## ITALY

The Italian regulatory Authority (ARERA) is vested by law<sup>82</sup> with wide regulatory powers which enable it to carry out regulatory experiments aiming at energy system innovation. Since 2010, ARERA has promoted several experiments to test new technologies, services and business models to inform possible regulatory change. So far, all of them have been rooted in its regulatory mandate, with the exception of the collective self-consumption and energy community pilot regulation, where a change in the legislation was necessary (ISGAN, 2021).

Over time, building on its own experience, ARERA trialled different approaches to experimentation (Figure 26). Initially (2010 – 2016) it promoted the adoption of innovative solutions through the set-up of pilot projects. Three different experiments were carried out, in the smart grids, electric mobility and storage sectors. In a second phase (2017 – 2021), ARERA resorted to pilot regulations to trial new solutions at large scale, involving market players in a non-discriminatory manner. More recently (2019), ARERA resorted to regulatory sandboxes, tailoring the tool to large scale experiments in the regulated industry. The different forms of experimentation have been in place side by side, promoting innovation in different areas of experimentation and among different stakeholders.

**Figure 26.** Timeline regulatory experimentation initiatives in Italy



### Pilot projects

**Smart grids.** Already in 2007<sup>83</sup>, ARERA started to define an experimental framework to support R&D and demonstration investments in smart grids, with the aim to promote improved quality of service and the connection of significant amounts of distributed generation.

ARERA decision ARG/elt 39/10<sup>84</sup> defined the procedure and selection criteria for the admission of pilot projects to the experimental regime. The decision concerned projects carried out by DSOs in automation, protection and control systems in critical MV network zones<sup>85</sup>, provided that only open communication protocols with network users were used. Selected projects were awarded an extra remuneration of capital cost (+2% in addition to the ordinary return rate) for a period of 12 years.

The Authority received 9 proposals from 8 DSOs. 8 projects passed the selection phase<sup>86</sup>, but 1 was aborted shortly after. The 7 selected projects, carried out in the period 2012-2015, trialled the following six innovative functionalities:

- observability of active resources connected to MV networks,

<sup>82</sup> Law nr. 481/1995 of 14 November 1995. Available at: [https://www.arera.it/it/inglese/about/legge\\_istitutiva.htm](https://www.arera.it/it/inglese/about/legge_istitutiva.htm)

<sup>83</sup> Consultation document n. 47/07 of 30 November 2007. Available at: [https://www.autorita.energia.it/allegati/docs/dc/07/071130\\_47.pdf](https://www.autorita.energia.it/allegati/docs/dc/07/071130_47.pdf), later complemented by the provisions of the integrated text on the provision of electricity transmission, distribution and measurement services, [https://www.autorita.energia.it/allegati/docs/07/348-07\\_all\\_a.pdf](https://www.autorita.energia.it/allegati/docs/07/348-07_all_a.pdf)

<sup>84</sup> ARERA decision ARG/elt 39/10 of 25 March 2010. Available at: [https://www.arera.it/allegati/docs/10/039-10arg\\_ti.pdf](https://www.arera.it/allegati/docs/10/039-10arg_ti.pdf)

<sup>85</sup> Decision ARG/elt 39/10 defines a critical MV network zone as a MT distribution network or portion of MT network where the reverse power flow (RPF) exceeds 1% yearly on each primary substation transformer.

<sup>86</sup> ARERA decision ARG/elt 12/11 of 8 February 2011. Available at: <https://www.arera.it/it/docs/11/012-11arg.htm>

- advanced voltage regulation,
- active power modulation,
- anti-islanding,
- fast fault isolation in MV networks,
- electricity storage at MV level.

Overall, the projects showed an increase in hosting capacity and provided important elements for the design of tailored incentive mechanisms aimed at developing and promoting smart grid technologies and functionalities (ARERA, 2015). Following a public consultation<sup>87</sup>, two out of the six smart functionalities trialled in the pilots (i.e. observability of active resources and advanced voltage regulation) were identified as worth specific output-based regulatory incentives for large scale implementation<sup>88</sup>. Table 9 summarises the main elements of the pilot project scheme for smart grids in Italy.

**Table 9.** Pilot projects in Italy - Smart grids

ITALY – Pilot projects   Smart grids	
<b>Legal basis</b>	Decision ARG/elt 39/10
<b>Brief description</b>	Call for proposals for smart grid pilot projects
<b>Objectives</b>	To promote improved quality of service and the connection of significant amounts of distributed generation
<b>Derogations</b>	By way of derogation from the ordinary tariff system, the decision provided for a 2% increase in the rate of return on invested capital for a period of 12 years
<b>Length of derogations</b>	12 years
<b>Eligible project promoters</b>	DSOs
<b>Knowledge sharing obligations</b>	Biannual reports and a final report at the end of the demonstration period.

Source: JRC, 2023

**Electromobility.** In 2010, ARERA launched a call for proposals<sup>89</sup> for pilot projects for EV charging points in public places. The project was meant to test different business models for EV charging with the aim to inform legislative developments and set up the regulatory framework needed to support the large-scale development and diffusion of electro-mobility in Italy (Lo Schiavo, Bonafede, Celaschi, & Colzi, 2017).

Up to six projects could be approved, two per business model. Ten proposals were submitted and evaluated, five projects were selected<sup>90</sup> and the following four have been carried out:

- Enel Distribuzione – Hera SpA jointly ran the pilot that adopted the ‘DSO business model’, where the recharging infrastructure is developed and managed by the DSO in its concession area. Special requirements were introduced by the enabling decision to limit distortions with retail competition and cross-subsidisation issues: freedom of choice of electricity supplier for consumers ('multi-vendor requirement'), and separation of accounts between the EV charging and the regulated activities for DSOs,
- A2A SpA ran the pilot that adopted the ‘area-licensed service provider’ business model, where the recharging of electric vehicles in public places is carried out by a single player, other than the DSO, that

<sup>87</sup> Consultation document 255/2015 of 29 May 2015. Available at: <https://www.arera.it/allegati/docs/15/255-15.pdf>

<sup>88</sup> ARERA decision 646/2015/R/EEL of 22 December 2015. Available at: <https://www.arera.it/allegati/docs/15/646-15ti.pdf>

<sup>89</sup> ARERA decision ARG/elt 242/10 of 15 December 2010. Available at: <https://www.arera.it/allegati/docs/10/242-10arg.pdf>

<sup>90</sup> ARERA decision ARG/elt 96/11 of 13 July 2011. Available at: <https://www.arera.it/it/docs/11/096-11arg.htm>

- operates in a defined area according to a local license for public service (e.g. selected through a public tender by a local administrative authority),
- Enel energia SpA and Class Onlus ran the pilots that adopted the competing service provider business model, where the recharging of electric vehicles is carried out by different players, other than the DSO, providing the service in the same area in competition with each other.

Overall, about 500 charging points were included in the pilots. By way of derogation from the ordinary tariff system, the pilots could benefit from a special network tariff structure, without fixed costs. They were also entitled to a further contribution for each charging point for the whole duration of the pilots.

The pilots started in 2011-12 and lasted till the end of 2015. According to the reporting obligations provided for in the call for proposal, project coordinators had to submit biannual reports - including information about the load curve and usage patterns of the charging points - as well as a final report to be issued at the end of the whole demonstration period.

Besides more technical findings, one of the main points that emerged from the assessment of the pilots (Lo Schiavo, Bonafede, Celaschi, & Colzi, 2017) (RSE, 2017) (ISGAN, 2019) was that the DSO business model, while bearing distortions with retail competition and cross-subsidisation issues, does not bring any particular advantage with respect to the other business models trialled. Also, the multivendor requirement proved to be too complex to be implemented. Following the adoption of Directive 2014/94/EU<sup>91</sup>, ARERA took the position that the DSO business model should be considered no longer applicable to any further experimentation or initiatives for the development of electric charging<sup>92</sup>. Table 10 summarises the main elements of the pilot project scheme for electromobility in Italy.

**Table 10.** Pilot projects in Italy - Electromobility

ITALY – Pilot projects   Electromobility	
<b>Legal basis</b>	Decision ARG/elt 242/10 of December 15, 2010
<b>Brief description</b>	Call for proposals for pilot projects for EV charging infrastructure in public places
<b>Objectives</b>	The main aims of the demonstration projects were: testing different business models for EV charging; testing suitable electricity network tariffs; integrating e-mobility into the wider transformation of the power system
<b>Derogations</b>	By way of derogation from the ordinary tariff system, a special network tariff structure was introduced, without fixed costs, applicable only to network points of delivery dedicated to EV charging in public places. Further, a tariff-funded contribute was awarded to selected demonstration projects, in a non-discriminatory manner between DSOs and independent service providers
<b>Length of derogations</b>	The call for demonstration projects was launched in 2010, projects were selected in 2011, installed and operated in 2012-2015  The special network tariff structure has been confirmed at the end of the pilot projects for the regulatory period 2016–19, and in 2019 for the current period (2020-23)
<b>Eligible project promoters</b>	Charging Service Providers (CSPs); DSOs
<b>Knowledge sharing obligations</b>	Biannual reports and a final report at the end of the demonstration period

Source: JRC, 2023

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<sup>91</sup> Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure

<sup>92</sup> ARERA consultation paper 5/2015/R/EEL of 15 January 2015. Available at: <https://www.arera.it/allegati/docs/15/005-15.pdf>

Overall, the pilots helped the regulator to better define the role of the involved actors, the applicable business models and the most suitable electricity network tariffs to support the development of electric mobility in Italy and promote its integration in the evolving power system (Lo Schiavo, Bonafede, Celaschi, & Colzi, 2017).

**Storage.** In 2011, TERNA, the Italian TSO, was authorised by law<sup>93</sup> to include electricity storage systems in its ten-year development plan, with a view to support the dispatching of non-programmable plants, specifically wind-base generation units. In 2012, following its approach of gradual implementation and progressive learning through pilot projects (Lo Schiavo & Benini, 2018), ARERA adopted a decision<sup>94</sup> to regulate the admission procedure, selection criteria, reporting obligations and incentive treatment relating to pilot projects involving the use of storage systems in the transmission grid. The experimental regime aimed to collect information on storage technologies, costs, benefits, sizing, optimal location and operating methods with a view to inform possible regulatory change. The decision provided for a 2% increase in the rate of return on invested capital for a period of 12 years, provided that a given target of wind curtailment was avoided (50% in the first two years of operation). With 2 following decisions, ARERA selected 3 'energy-intensive' storage projects (i.e., with high stored-energy to installed-power ratio) up to 35 MW in critical high voltage (HV) network zones<sup>95</sup> and 2 'power intensive' storage projects (short-term, high power output) up to 16 MW in major islands<sup>96</sup>.

Although storage units may have several capabilities, the operation of TSO-owned 'energy intensive' storage was aimed at a specific network service, i.e., avoiding curtailment of wind-sourced generation units. The energy intensive storage units involved in the pilot had the obligation to install Dynamic Thermal Rating (DTR) in the same HV network zone and could be awarded an extra WACC (Weighted Average Cost of Capital) only if at least a minimum amount of curtailed energy was proved to be avoided.

As for the energy intensive storage units, results were assessed by the regulatory Authority in 2019<sup>97</sup>. In these units, DTR proved to be much more effective for the purpose of reducing wind curtailment than storage (ISGAN, 2019). Table 11 summarises the main elements of the pilot project scheme for storage in Italy.

**Table 11.** Pilot projects in Italy - Storage

ITALY – Pilot projects   Storage	
<b>Legal basis</b>	Decision 288/2012/R/EEL and 66/2013/R/eel ('energy intensive' storage units) Decision 43/2013/R/eel ('power intensive' storage units)
<b>Brief description</b>	Call for proposals for pilot projects involving the use of storage systems in the transmission grid
<b>Objectives</b>	To collect information on storage technologies, costs, benefits, sizing, optimal location and operating methods with a view to inform possible regulatory change
<b>Derogations</b>	By way of derogation from the ordinary tariff system, the decision provided for a 2% increase in the rate of return on invested capital for a period of 12 years
<b>Length of derogations</b>	12 years
<b>Eligible project promoters</b>	Italian TSO (TERNA)
<b>Knowledge sharing obligations</b>	Biannual reports and a final report at the end of the demonstration period

Source: JRC, 2023

<sup>93</sup> Legislative decree 28/2011 of 3 March 2011. Available at: <https://www.gazzettaufficiale.it/eli/id/2011/03/28/011G0067/sq>

<sup>94</sup> ARERA decision 288/2012/R/EEL of 12 July 2012. Available at: <https://www.arera.it/allegati/docs/12/288-12.pdf>

<sup>95</sup> ARERA decision 66/2013/R/EEL of 21 February 2013. Available at: <https://www.arera.it/allegati/docs/13/066-13.pdf>

<sup>96</sup> ARERA Decision 43/2013/R/EEL of February 7, 2013. Available at: <https://www.arera.it/allegati/docs/13/043-13.pdf>

<sup>97</sup> ARERA decision 169/2019/R/EEL of 7 May 2019. Available at: <https://www.arera.it/allegati/docs/19/169-19.pdf>

## **Pilot regulations**

**Provision of flexibility and balancing services.** In May 2017, ARERA adopted an experimental framework to experiment with aggregation of distributed energy resources and collect useful elements for an overall reform of the ancillary services and balancing market (ARERA decision 300/2017/R/EEL)<sup>98</sup>. The pilot regulation aimed to involve non-programmable renewable-sourced generation, distributed generation and demand response in the ancillary services market and to achieve greater integration of renewable energy sources into the network without compromising the principle of technological neutrality (Schwidtal, et al., 2021). Experimentation on a large scale, at system level, was considered necessary to involve market parties, in a fully non-discriminatory manner (ISGAN, 2021).

The ancillary services market was open to all participants able to provide flexibility resources, such as non-programmable renewable sources, distributed energy resources, demand side response and storage systems. Small production and consumption units were allowed to participate on an aggregate basis as UVAs (Unità Virtuali Abilitate, i.e. Authorised Virtual Units). The pilot regulation defined the perimeter of the experimentation and the main eligibility criteria, and assigned TERNA, the Italian TSO, the responsibility to design innovative pilots to be submitted for its approval.

Approved projects could be granted several derogations, including (ISGAN, 2019):

- a reduction of the minimum threshold to participate in the ancillary service market from 10 MVA to 1 MW,
- non-programmable renewable generation and demand units, previously excluded from the ancillary service market, were allowed to participate, even for sizes smaller than 1 MW, provided that the virtually aggregated unit as a whole reached the threshold,
- the possibility that the balancing service provider (BSP) is a different entity from the balance responsible party (BRP). The BSP is responsible for non-compliance with dispatching orders, while the dispatching user continues to be responsible for the regulation of imbalances (ARERA, 2019).

Different virtual units were admitted and tested during the trials. The first UVA project was the UVAC project (Authorised Virtual Consumption Units). The enacting regulation for this experimentation was approved in May 2017<sup>99</sup> and applied on 1 June 2017, enabling the UVACs to supply upward tertiary power reserves and balancing resources.

The second UVA project was the UVAP (Authorised Virtual Production Units) project. The enacting regulation for this experimentation was approved in August 2017<sup>100</sup> and applied on 1 November 2017. This project aimed at clustering production sites to supply resources for congestion management, tertiary power reserve and balancing (upward or downward).

The third UVA project was the UVAM (Authorised Mixed Virtual Units) project, which combined the first two pilots. The enacting regulation for this experimentation was approved in August 2018<sup>101</sup> and applied on 1 November 2018. The mixed virtual units were authorised to supply resources (upward and/or downward) for programme congestion resolution, for the tertiary reserve and for balancing (ARERA, 2019)<sup>102</sup>.

In a first assessment of the results of the pilots, ARERA highlighted their valuable contribution to test real life aggregation for the provision of ancillary services, as well as the functioning of BSPs and their interaction with the TSO and with the other parties involved in the aggregation (ARERA, 2019).

In the context of the described experimental framework, other pilots were launched in 2018. In July 2018<sup>103</sup> a pilot was approved for the supply of primary frequency regulation service in large production units by means of integrated storage systems. In August 2018<sup>104</sup>, another pilot was launched for voluntary participation in the ancillary service market by relevant production units (UPRs, Unità di Produzione Rilevanti) not subject to mandatory participation. This category includes, for example, large-scale wind and solar plants (>10 MVA),

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<sup>98</sup> ARERA decision 300/2017/R/EEL of 5 May 2017. Available at: <https://www.arera.it/allegati/docs/17/300-17.pdf>

<sup>99</sup> ARERA decision 372/2017/R/EEL of 25 May 2017. Available at: <https://www.arera.it/allegati/docs/17/372-17.pdf>

<sup>100</sup> ARERA decision 583/2017/R/EEL of 3 August 2017. Available at: <https://www.arera.it/allegati/docs/17/583-17.pdf>

<sup>101</sup> ARERA decision 422/2018/R/EEL of 2 August 2018. Available at: <https://www.arera.it/allegati/docs/18/422-18.pdf>

<sup>102</sup> The most recent assessment report (ARERA Report on RES integration, n. 356/2021, 3 August 2021) is available at: <https://www.arera.it/docs/21/356-21.htm>

<sup>103</sup> ARERA decision 402/2018/R/EEL of 26 July 26 2018. Available at: <https://www.arera.it/allegati/docs/18/402-18.pdf>

<sup>104</sup> ARERA decision 383/2018/R/EEL of 12 July 2018. Available at: <https://www.arera.it/allegati/docs/18/383-18.pdf>

which are not subject to mandatory participation in the ancillary services and balancing markets (Marchisio, Genoese , & Raffo, 2019). The counterpart to the supply of dispatching resources is the dispatching user, owner of the dispatching point, which is always the BSP (ARERA, 2019).

More recently, ARERA approved two more pilot projects. The first pilot<sup>105</sup> concerns the provision of ultra-fast frequency regulation service by so called Fast Reserve Units (FRUs), which can be composed of stand-alone or aggregated devices (aggregation is allowed within the same bidding zone). FRUs must fulfil a set of eligibility criteria regarding their size (between 5MW and 25 MW), performance (e.g. the activation time must be within 1 second after the event), location and measuring and verification capabilities. The service is procured via a competitive bidding process in a descending price auction aimed at the conclusion of 3 or 4-year fixed term contracts valid from 1 January 2022<sup>106</sup>. The second pilot<sup>107</sup> concerns the provision of frequency and load regulation services by resources not previously enabled.

Table 12 summarises the main elements of the pilot regulation scheme for flexibility and balancing services in Italy.

**Table 12.** Pilot regulation in Italy – Flexibility and balancing services

ITALY – Pilot regulation   Provision of flexibility and balancing services	
<b>Legal basis</b>	ARERA decision 300/2017/R/EEL, as amended and supplemented by subsequent decisions (e.g. ARERA decisions 422/2018, 153/2020, 70/2021)
<b>Brief description</b>	The ancillary service and balancing markets were open to all participants able to provide flexibility resources, such as non-programmable renewable sources, distributed energy resources and demand side response and storage systems, including electric car batteries, also through aggregators
<b>Objectives</b>	To experiment with aggregation of energy resources and collect useful elements for an overall reform of the ancillary services and balancing markets
<b>Derogations</b>	Main derogations: - reduction of the minimum threshold to participate in the ancillary service market from 10 MVA to 1 MW, - renewable generation and demand units, previously excluded from the ancillary service market, were allowed to participate, even for sizes smaller than 1 MW, provided that the virtually aggregated unit as a whole reached the threshold, - the possibility that the BSP is a different entity than the BRP.
<b>Length of derogations</b>	Different durations
<b>Eligible project promoters</b>	BSPs and BRPs (for UVA), Generators (for URP), Storage owners (for FRS)
<b>Knowledge sharing obligations</b>	For the entire duration of the pilot projects, Terna presents to the Authority, on a quarterly basis, a report illustrating the results obtained

Source: JRC, 2023

**CSC and energy communities.** In March 2020, pending the transposition of the recast renewable energy directive (Directive (EU) 2018/2001)<sup>108</sup>, Italy adopted a provisional legal framework to enable the set-up of collective self-consumption initiatives (including jointly acting renewable self-consumers and RECs). The purpose of this provisional framework is to acquire the elements necessary for the full transposition of the

<sup>105</sup> ARERA decision 200/2020/R/EEL of 3 June 2020. Available at: <https://www.arera.it/allegati/docs/20/200-20.pdf>

<sup>106</sup> More information on the pilot can be found at: <https://www.terna.it/it/sistema-elettrico/progetti-pilota-delibera-arera-300-2017-reel/progetto-pilota-riserva-ultra-rapida> (in Italian only).

<sup>107</sup> ARERA decision 215/2021/R/EEL of 25 May 2021. Available at: [https://download.terna.it/terna/Delibera%20ARERA%202021-21\\_8d9276d9f958023.pdf](https://download.terna.it/terna/Delibera%20ARERA%202021-21_8d9276d9f958023.pdf)

<sup>108</sup> Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast).

directive by testing new tariff and business models on the field. The new law<sup>109</sup> applies to power plants from renewable energy sources with a total capacity not exceeding 200 kW that entered into operation after its coming into force and within 60 days from the entry into force of national legislation transposing Directive (EU) 2018/2001.

In the case of RECs, both consumers and producers must be connected to the same low voltage grid under the same MV/LV transformer substation, while in the case of jointly acting renewable self-consumers they must be located in the same building or multi-apartment block. In both cases, participants stay connected to their point of delivery and the energy produced is shared using the existing distribution network. Shared energy is equal to the minimum, in each hourly period, between the electricity produced and fed into the grid by renewable energy plants and the electricity withdrawn by all associated end customers. Within their respective perimeter, self-consumption initiatives can also take place through storage systems.

Participants retain their consumer rights, including the freedom to choose their own supplier and to opt in and out of the collective scheme. They regulate their relations by means of a private-law contract that identifies a delegated party responsible for allocating the shared energy.

This ‘virtual regulatory model’ avoids building new distribution grids and accelerates the set-up of the initiatives, in line with the objectives of the experimental regime.

The new law delegated ARERA to define the technical and economic measures for its implementation<sup>110</sup> and the Ministry of Economic Development to define an incentive tariff for the remuneration of renewable sources included in the experimental configurations<sup>111</sup>. ARERA decided that the unitary tariff components related to the transmission and distribution network are not applicable to the shared energy. Furthermore, it decided that jointly acting self-consumers receive extra revenue for the shared energy, motivated by the reduction of network losses (Zatti, et al., 2021). The Ministry of Economic Development fixed the incentive tariff at 100 €/MWh for the electricity self-consumed among jointly acting renewable self-consumers and at 110 €/MWh for the electricity shared within a renewable energy community, for 20 years.

Table 13 summarises the main elements of the pilot regulation scheme for CSC and energy communities in Italy.

**Table 13.** Pilot regulation in Italy - CSC and energy communities

ITALY – Pilot regulation   CSC and energy communities	
<b>Legal basis</b>	Law decree nr. 162/2019, of 30 December 2019, converted into law n. 8/2020 of 8 February 2020
<b>Brief description</b>	Provisional legal framework to enable the set-up of CSC and REC initiatives
<b>Objectives</b>	To acquire the elements necessary for the full transposition of Directive (EU) 2018/2001 by testing new tariff and business models on the field
<b>Derogations</b>	By way of derogation from the ordinary tariff system, the unitary tariff components related to the transmission and distribution network are not applicable to the shared energy. Furthermore, collective self-consumption participants receive an extra revenue for the shared energy (100 €/MWh for jointly acting self-consumers and 110 €/MWh for RECs)
<b>Eligible project promoters</b>	Collective self-consumption participants using power plants from renewable energy sources, with a total capacity not exceeding 200 kW, that entered into operation after its coming into force and within 60 days from the entry into force of national legislation transposing directive 2018/2001
<b>Knowledge sharing obligations</b>	RSE was mandated to support the Authority with an in-field research activity

Source: JRC, 2023

<sup>109</sup> Art. 42 bis of law decree nr. 162/2019, of 30 December 2019, converted under law nr. 8/2020 of 8 February 2020. <https://www.gazzettaufficiale.it/eli/id/2020/02/29/20G00021/sq>

<sup>110</sup> ARERA decision 318/2020/R/EEL of 4 August 2020. Available at: <https://www.arera.it/allegati/docs/20/318-20.pdf>

<sup>111</sup> Ministerial decree 16 September 2020. Available at: <https://www.gazzettaufficiale.it/eli/id/2020/11/16/20A06224/sq>

**Electromobility.** In 2020, ARERA adopted a pilot regulation<sup>112</sup> to promote smart charging of electric vehicles in places not accessible to the public. By way of derogation from the ordinary tariff system, the experimental framework provides for the possibility for consumers to recharge their EV during off-peak hours (i.e., night-time, Sundays, and holidays) without requesting a power increase from their electricity supplier (typically from 3 to 6 kW), therefore avoiding the additional fixed costs due to the increase in contracted power. Only customers using between 2 and 4.5 kW of power, already equipped with a first- or second-generation smart meter and with an advanced recharging device that complies with the technical specifications required by ARERA, can participate in the experimentation. The request for admission to the trial can be submitted from 3 May 2021 until 30 April 2023. The scheme, which runs from 1 July 2021 to 31 December 2023, sends a price signal to domestic consumers to charge their EVs at off peak hours, thus reducing the impact on the power system of domestic charging (usually occurring at 6–9 pm).

Table 14 summarises the main elements of the pilot regulation scheme for electromobility in Italy.

**Table 14.** Pilot regulation in Italy - Electromobility

ITALY – Pilot regulation   Electromobility	
<b>Legal basis</b>	ARERA decision 541/2020/R/eel, of 15 December 2020
<b>Brief description</b>	The scheme sends a price signal to domestic consumers to charge their EVs at off peak hours, thus reducing the impact on the power system of domestic charging
<b>Objectives</b>	To promote smart charging of electric vehicles in places not accessible to the public
<b>Derogations</b>	By way of derogation from the ordinary tariff system, the experimental framework provides for the possibility for consumers to recharge their EV during off-peak hours (ie, night-time, Sundays, and holidays) without requesting a power increase from their electricity supplier (typically from 3 to 6 kW)
<b>Length of derogations</b>	From 1 July 2021 to 31 December 2023
<b>Eligible project promoters/participants</b>	Customers using between 2 and 4.5 kW of power, already equipped with a first- or second-generation smart meter and with an advanced recharging device that complies with the technical specifications required by ARERA
<b>Knowledge sharing obligations</b>	-

Source: JRC, 2023

**Additional pilot regulations.** ARERA adopted two more pilot regulations between 2014 and 2017. The first one<sup>113</sup> tested the introduction of a new, non-progressive tariff for heat pumps installed in domestic premises, while the second one<sup>114</sup> tested the reliability of an open communication protocol between In-Home Devices (IHDS) and second-generation smart meters. More information on the pilot regulations is provided by (ARERA, 2015), (ARERA, 2016) and (ISGAN, 2019).

### **Regulatory sandboxes**

**Smart grids.** Following the recent deterioration of network reliability indicators, in 2019, ARERA introduced a large scale regulatory sandbox<sup>115</sup> targeted at DSOs, with the aim to promote the improvement of network reliability in critical areas. The scheme provides for the possibility for DSOs to propose an alternative and tailored incentive regulation for quality of supply (QoS), provided that innovative solutions to reduce the

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<sup>112</sup> ARERA decision 541/2020/R/eel, of 15 December 2020. Available at <https://www.arera.it/it/docs/20/541-20.htm>

<sup>113</sup> ARERA decision 541/2020/R/eel, of 15 December 2020. Available at <https://www.arera.it/it/docs/20/541-20.htm>

<sup>114</sup> ARERA decision 205/2014/R/eel, of 8 May 2014. Available at: <https://www.arera.it/allegati/docs/14/205-14.pdf>

<sup>115</sup> ARERA decision 566/2019/R/eel of 23 December 2019. Available at: [https://www.arera.it/allegati/docs/15/646-15alla\\_tiqe.pdf](https://www.arera.it/allegati/docs/15/646-15alla_tiqe.pdf)

duration and number of unplanned interruptions of supply are trialled and that some overall principles are ensured. Two windows of applications were foreseen for experiments starting in 2020 and 2021 (with a deadline on 30 April 2020 and 28 February 2021, respectively). All experiments must be completed by the end of 2023. In case of positive intermediate results, ARERA may decide on the large-scale application of some of the derogations granted already after two years of experimentation.

Decision 566/2019/R/eel defined the experiment eligibility criteria, the derogations that could be granted and DSOs reporting obligations. To be admitted to the scheme, projects need to:

- define a reliability improvement target (at 4-year horizon) that is not worse than the target defined by ARERA under the ordinary regulation of continuity of supply,
- present an innovative dimension, including the use of technological innovation,
- refer to limited geographical areas (where the actual level of QoS is unsatisfactory) and evaluate the potential for further deployment,
- clearly identify the regulatory obstacles that, in the DSO's view, hinder innovation and provide convincing evidence that the removal of such obstacle is necessary to improve network reliability over what would be achieved without the requested derogations,
- ensure an adequate level of consumer protection and compliance with the principle of non-discrimination between network users,
- set up a reporting system to evaluate the effects of the derogations granted and the results of the adopted innovative solutions.

By way of derogation from the otherwise applicable regulation, DSOs can propose an alternative path for improving reliability indicators over the regulatory period, as long as the last year's target is not worse than would have been under the ordinary regulation. They can also propose an alternative reward and penalty mechanism that applies in place of the standard mechanism. Performance against the target is only assessed in the final year of the regulatory period (differently from ordinary regulation, where performance is assessed every year). In practice, this allows DSOs to avoid penalties for the whole period, provided that they are really able to reach the 4-year target at the end of the period. In case the target is met, the overall reward cannot be greater than what the DSO would have obtained under the standard regulation. In case of failure to achieve the target, DSOs must pay the same penalty that would have applied under the ordinary regulation.

While the DSOs may request exemptions from any aspect of the reliability incentive, so far requests have focused on (CEER, 2022):

- using a less stringent measure of MAIFI – calculated for short interruptions lasting more than five seconds (instead of one second in the standard incentive),
- yearly targets on a less stringent path than under the standard incentive,
- euro/kWh not-served lower than in the standard incentive (used for both penalties and rewards) (CEER, 2022).

In the 2020-2023 regulatory period, the regulatory experiment has been taken up by the two largest DSOs and has covered approximately a quarter of total network users (9.6 million out of 37 million) (CEER, 2022). Table 15 summarises the main elements of the regulatory sandbox scheme for smart grid in Italy.

**Table 15.** Regulatory experiment in Italy - Smart grid

ITALY – Regulatory sandbox   Smart grid	
<b>Legal basis</b>	ARERA decision 566/2019/R/eel of 23 December 2019
<b>Brief description</b>	The scheme provides an incentive to DSOs to define a tailored innovative solution to reduce the duration and number of unplanned interruptions of supply
<b>Objectives</b>	To promote the improvement of network reliability in critical areas, following the deterioration of relevant indicators recorded in recent years.
<b>Derogations</b>	By way of derogation from the otherwise applicable regulation, DSOs can propose an alternative path for improving reliability indicators over the regulatory period. They can also propose an alternative reward and penalty mechanism, that applies in place of the standard mechanism
<b>Length of derogations</b>	All experiments must be completed by the end of 2023
<b>Eligible project promoters/participants</b>	DSOs
<b>Knowledge sharing obligations</b>	DSOs must set up a reporting system to evaluate the effects of the derogations granted and the results of the adopted innovative solutions

Source: JRC, 2023

**Gas networks.** In its strategy for 2022-2025<sup>116</sup>, ARERA envisaged the introduction of an experimental framework to promote system innovation for the development of renewable gases and hydrogen. Following wide stakeholder consultation, with Decision 404/2022/R/gas<sup>117</sup> ARERA adopted an incentive mechanism to support innovation in gas infrastructure<sup>118</sup>, which also targets innovative uses of the existing infrastructure to accommodate an increasing input of renewable gases and hydrogen. The scheme can be considered as a regulatory sandbox, substantially addressed to gas network operators, albeit in cooperation with market players.

Only infrastructure service operators of the natural gas supply chain, subject to tariff regulation, can apply for the incentive mechanism. To be eligible, projects need to show a technology readiness level (TRL) entry point between 5 and 6 and aim to achieve TRL 8 at the end of the trial. Project applicants can ask for any derogation from the applicable regulations, provided that such derogations are necessary for the feasibility or significance of the experiment. Applications may be submitted to ARERA between November 2022 and February 2023 and the maximum duration of the trial is three years. Table 16 summarises the main elements of the regulatory sandbox scheme for gas networks in Italy.

<sup>116</sup> ARERA decision 2/2022/A of 13 January 2022. Available at: <https://www.arera.it/it/docs/22/002-22.htm>

<sup>117</sup> ARERA decision 404/2022/R/gas of 2 August 2022. Available at: <https://www.arera.it/it/docs/22/404-22.htm>

<sup>118</sup> The incentive mechanism to support innovation in gas infrastructure applies to the following project areas: - methods and tools for optimised network management; - innovative uses of the existing infrastructure to accommodate an increasing input of renewable gases, including hydrogen, P2X applications and carbon capture, utilisation and storage (CCUS); - interventions to increase energy efficiency in regulated gas infrastructure (transport, distribution, storage and regasification).

**Table 16.** Regulatory sandbox in Italy – Gas networks

ITALY – Regulatory sandbox   Gas networks	
<b>Legal basis</b>	ARERA Decision 404/2022/R/gas of 2 August 2022
<b>Brief description</b>	Incentive mechanism supporting innovative uses of the existing infrastructure to accommodate an increasing input of renewable gases and hydrogen
<b>Objectives</b>	To promote system innovation for the development of renewable gases and hydrogen
<b>Derogations</b>	Project applicants can ask for any derogation from the applicable regulations, provided that such derogations are necessary for the feasibility or significance of the experiment
<b>Length of derogations</b>	Applications may be submitted to ARERA between November 2022 and February 2023 and the maximum duration of the trial is three years
<b>Eligible project promoters/participants</b>	Infrastructure service operators of the natural gas supply chain, subject to tariff regulation
<b>Knowledge sharing obligations</b>	Annual reports and a final report at the end of the demonstration period

Source: JRC, 2023

## LESSONS LEARNED

Desktop research and direct contacts with the NRA and experts from academy and research centres allowed us to collect the main lessons learned since the start of regulatory experiments back in 2010.

**Competence to adopt regulatory experimentation initiatives.** ARERA's governing law provides the Authority with wide competences to regulate the areas under its remit, including the competence to carry out regulatory experimentation initiatives aiming at energy system innovation. So far, all the adopted initiatives have been rooted in its regulatory mandate, apart from the collective self-consumption and energy community pilot regulation, where a change in legislation was necessary. This is not the case for many other NRAs, which lack the necessary powers to engage in regulatory experimentation and which may then struggle to keep up the pace of regulatory innovation. The disparity of approach between Member States opens up the debate for possible EU level solutions. One option could be the adoption of an EU provision that empowers NRAs to launch regulatory experiments and grant derogations from current regulation, e.g. through the amendment of art. 59 of Directive (EU) 2019/944<sup>119</sup>. Such provision could also be accompanied by the adoption of EU guidelines harmonising the national experimentation frameworks, but careful consideration should be given to the aspects to be included (e.g. principles and objectives of the experimentation, project participants, time limits).

**Choice of the regulatory innovation tool.** Over time, building on its own experience, ARERA trialled different forms of regulatory experimentation, tailoring them on country-specific circumstances and on the results that it wished to achieve. A clear example of this approach is offered by the way ARERA reinterpreted regulatory sandboxes. Regulatory experiments, recently adopted in Italy, are indeed a form of large-scale sandbox, targeted at regulated entities. ARERA used this experimentation tool, as well as pilot regulations, to avoid as much as possible the risk of discrimination among market players, risk that it considered to be a drawback of 'typical' regulatory sandboxes. To avoid this risk, ARERA did not include market operators as eligible project proponents in this kind of regulatory experimentation. Targeting regulated entities also allowed the set-up of large experiments, leading to improved generalizability of the results and enhanced regulatory learning.

<sup>119</sup> Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (recast).

**Monitoring and evaluation of project results.** The design of the experiments and the definition of project indicators is a complex task and NRAs don't always have enough internal resources and expertise to dedicate. Collaborating universities and research centres can play a pivotal role to assist NRAs in this task and they should be involved since the early design stage of the initiative. Indicators should enable the assessment of the experiment against the pre-defined objectives, while also taking into consideration other technological, economic, and social implications. Designing indicators implies defining the experiment's boundaries, distinguishing between main and side effects.

**Knowledge sharing.** Aware of the importance of knowledge sharing to disseminate good practices and support regulatory learning, in its regulatory innovation initiatives ARERA has defined clear monitoring, reporting and dissemination obligations for project participants. Knowledge sharing is also important between countries, particularly with regard to the design of the experiments and the way results can feed into the regulatory change process.

**EU support to regulatory innovation.** In the short term, NRAs could benefit from an EU advisory service to support them in the interpretation of relevant EU law and in granting derogations that are consistent with EU law provisions. Such a service - inspired by the fast, frank feedback (FFF) service provided to operators by OFGEM - could support NRAs, especially those most suffering from a lack of staff and expertise, to launch regulatory experimentation initiatives.

## LITHUANIA

Regulatory sandbox. In August 2020, the Lithuanian NRA (Valstybinė Energetikos Reguliacimo Taryba - VERT) introduced a regulatory sandbox scheme aimed at testing innovative products and business solutions in a real-life environment, promoting regulatory learning and informing regulatory reforms. VERT resolution 03E-699/2020<sup>120</sup> followed the approval, by the Lithuanian Parliament, of relevant amendments to the Energy Law supporting innovation and providing a legal basis for the enactment of regulatory experimentation<sup>121</sup>.

The regulatory sandbox is available for activities in the electricity, gas and district heating sectors and it is open to any interested party. The innovative solutions trialled under the sandbox shall have a clearly defined scope of application and may refer to technologies or services, products, ways of delivering such products and services, business solutions and business models.

Under the sandbox, VERT can adopt the following measures:

- provide bespoke guidance to project proponents, ensuring cooperation and the necessary exchange of information with other competent authorities,
- grant derogations from the rules setting licensing and permitting requirements, as well as from any other provision set by VERT, on a case-by case basis,
- change and apply the technical parameters set out in the legislation to other indicators that have the same impact on the operation of the energy system; reduce requirements and/-or exemptions without compromising security of supply, reliability and quality requirements,
- non-application of sanctions on the project owner, unless necessary,
- provide economic incentives for innovation and long-term investment decisions, in line with the same-size contribution rule. This rule requires project proponents to provide at least 50% of the funding for the innovative project.

VERT is responsible for assessing the applications, granting derogations and monitoring projects. To be admitted to the sandbox, projects shall meet the following eligibility criteria:

- benefits: the proposed innovation shall provide consumers and/or energy companies with more useful and/or convenient services,
- necessity of testing: testing of the innovative solution in a real environment is objectively necessary and can contribute to its deployment,
- applicability: the innovative solution has the potential to be deployed at large scale in Lithuania,
- novelty / substantial improvement: the innovative solution is not yet considered a normal business practice and is not commonly available in other countries' markets and /or in Lithuania. If the proposed solution is already available in other countries, but is considered a new business practice in Lithuania, it may still be eligible if it is not currently assessed by VERT in its normal tariff-setting process,
- readiness: the innovator is ready to test the energy innovation in a real-life environment
- exit strategy: the conditions for the end and / or extension of the project must be clearly defined,
- other specific criteria established by VERT to ensure adequate consumer protection safeguards and to maintain an adequate level of security and reliability of the energy sector.

Project proponents shall also submit a test plan detailing, inter alia, the activities to be carried out, the derogations sought, the expected results, the timeline, the description of the trial participants, the consumer safeguards to be applied and the exit strategy. If the application and the test plan are submitted together, VERT shall adopt a decision on the admission to the sandbox within 4 months from the date of the application. The project proponent can also decide to follow a two-stage application procedure, submitting the test plan after an interim decision on the eligibility of the application has been taken. In this case, VERT

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<sup>120</sup> VERT Resolution 03E-699/2020 of 7 August 2020. Available at: <https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/0bacdd10d8e511ea8f4ce1816a470b26?fwid=-vs1qiem47>

<sup>121</sup> The so-called VERT Innovation toolkit includes 11 legislative acts on the regulatory response to energy innovation in the electricity, gas and district heating sectors. The provisions regarding the set-up of the regulatory sandbox can be found at: <https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/9f6a80a28acc11eaa51db668f0092944>

decides within 3 months on the eligibility of the application and, in case of a positive decision, the project proponent has 2 months to submit the test plan. VERT adopts the final decision on the admission to the sandbox within the following 2 months.

The duration of the projects varies according to the field of experimentation. For projects testing services, products, business solutions and business models, the maximum project duration is 1 year, with a possible extension for a further year. For projects testing innovative technologies for energy infrastructures, the maximum project duration is 3 years, with a possible extension of 2 more years.

Within 2 months of the submission of the final report, VERT assesses the results of the project. If the project is deemed to be successful, within the following 6 months VERT shall identify and propose the changes to the legislative and regulatory provisions that represent an obstacle to the implementation of the tested innovation. The project is considered to be successful if it has achieved the expected results, has demonstrated that it is applicable in Lithuania, brings benefits to consumers and/or energy companies and does not pose a threat to public interests and/or to the energy system.

Table 17 summarises the main elements of the regulatory sandbox scheme in Lithuania.

**Table 17.** Regulatory sandbox in Lithuania

LITHUANIA – Regulatory sandbox	
<b>Legal basis</b>	VERT decree no. O3E-699 of 7/08/2020
<b>Brief description</b>	The regulatory sandbox is available for activities in the electricity, gas and district heating sectors and it is open to any interested party. The innovative solution trialled under the sandbox shall have a clearly defined scope of application and may refer to technologies or services, products, ways of delivering such products and services, business solutions and business models
<b>Areas of experimentation</b>	Open
<b>Objectives</b>	Testing innovative products and business solutions in a real-life environment, promoting regulatory learning and informing regulatory reforms
<b>Derogations</b>	Derogations from the rules setting licensing and permitting requirements, as well as from any other provision set by VERT, on a case-by case basis.  Derogation from the technical parameters set out in the legislation to apply other indicators that have the same impact on the operation of the energy system; derogations from other requirements and/or exemptions without compromising security of supply, reliability and quality requirements
<b>Length of derogations</b>	Max 1 or 3 years depending on the area of experimentation. Possible extension of respectively 1 and 2 years
<b>Eligible project promoters</b>	Any interested party
<b>Knowledge sharing obligations</b>	Progress and final reports to be submitted to VERT

Source: JRC, 2023

## LESSONS LEARNED

**General assessment of the scheme.** Contacts with the NRA revealed that, despite the great interest raised by the sandbox scheme among innovators, as of May 2022 no project has formally been submitted for approval. A number of informal consultations have taken place between innovators and VERT to discuss the possible submission of project proposals. After careful consideration, however, VERT confirmed that the innovative solutions under discussion with regulated entities could already be carried out under the current regulatory framework without the need for derogations. Given the lack of project submissions, consideration is currently being given to how some factors, such as the requirement of the same size contribution, or the timing of the approval process, may be acting as deterrents

**Eligibility requirements.** The requirement that projects need to present an innovative character can prove controversial, as it is difficult to define when a new solution ceases to be innovative. Also, innovative solutions lack sufficient information for the credible and accurate estimation of their costs and regulators may find it challenging to set the rate of return on investment.

**EU support to regulatory innovation.** The EU could support Member States' efforts by providing a forum where regulatory innovation issues could be discussed to help regulators find solutions in line with EU law. Such a forum could also help share knowledge and best practices and inspire regulators to set up regulatory innovation initiatives tailored to their own national context.

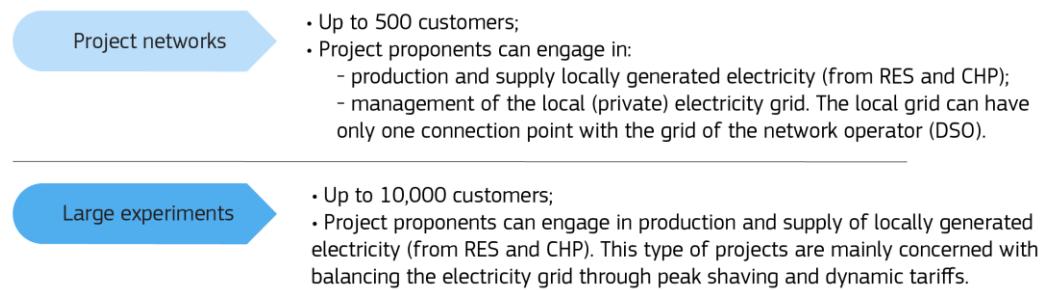
## NETHERLANDS

**Regulatory sandbox.** In 2015 the Netherlands had already adopted a sandbox scheme to support local renewable energy generation, consumer engagement with energy and the adoption of new services and business models. The scheme was adopted with an executive order<sup>122</sup> (i.e. the Experimentation Decree), based on article 7a of the Electricity Act 1998<sup>123</sup>, which provides an experimental clause to allow experiments that contribute to new developments in the field of production, transport and supply of locally generated renewable electricity, or electricity generated in combined heat and power plants.

The experimentation decree enables energy cooperatives and homeowner associations to take up the roles of grid operators and electricity suppliers asking for a derogation from some of the provisions of the Electricity act (for a period of 10 years). Such provisions refer to the prohibition of carrying out DSO tasks; the obligation to have a supply permit; the way to determine the tariffs; rules regarding data processing and transparency and liquidity of the energy market; rules regarding metering and invoicing (van der Waal, Das, & van der Schoor, 2020) (Broeckx, 2019).

Two different types of project are foreseen by the decree: project networks (where project proponents can take up the role of the DSO and of the electricity supplier) and large experiments (where project proponents can take up the role of the supplier only). The differences between the two types of projects are shown in Figure 27.

**Figure 27.** Types of regulatory sandbox projects in the Netherlands



*Source:* JRC, 2023

The application process involves different institutional actors. Applications are submitted to the Netherlands Enterprise Agency (Rijksdienst voor ondernemend Nederland, RVO), which also grants the derogations and evaluates the outcomes of the scheme (first evaluation after four years). The role of the regulator, the Netherlands Authority for Consumers and Markets (ACM), is limited to checking the calculation method for the energy and transport tariffs, in case the project takes over the tasks of the supplier and the DSO (van der Waal, Das, & van der Schoor, 2020). The Ministry of Economic Affairs and Climate Policy has a supervising role over the implementation of the scheme.

Applications started in 2015 and continued through 2018. 20 projects could be admitted each year, 10 project networks and 10 large experiments. Over the 4-year period, however, only 17 projects were eventually approved. According to the RVO's evaluation report<sup>124</sup>, out of 20 applications, 14 projects were granted derogations of which 5 projects are currently running and 9 are still under development. 3 projects were admitted to the sandbox but were later withdrawn, as the plans proved unfeasible before the exemptions became operational. 3 applications were rejected because they did not meet one or more eligibility criteria.

Figure 28 and Figure 29 show the time and geographical distribution of sandbox projects in the Netherlands.

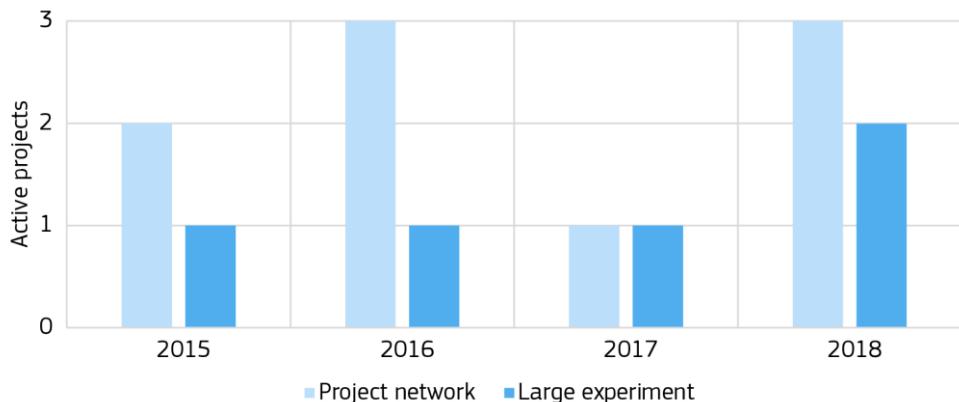
Table 18 summarises the main elements of the regulatory sandbox scheme in the Netherlands.

<sup>122</sup> Besluit van 28 Februari 2015, Houdende Het bij Wege van Experiment Afwijken van de Elektriciteitswet 1998 voor Decentrale Opwekking van Duurzame Elektriciteit. Available online: <https://wetten.overheid.nl/BWBR0036385/2015-04-01>

<sup>123</sup> Elektriciteitswet 1998. Available online: <https://wetten.overheid.nl/BWBR0009755/2022-08-01>. This article states that, through executive orders, in accordance with European Union legislation, the Electricity Act can be derogated from by the experiment.

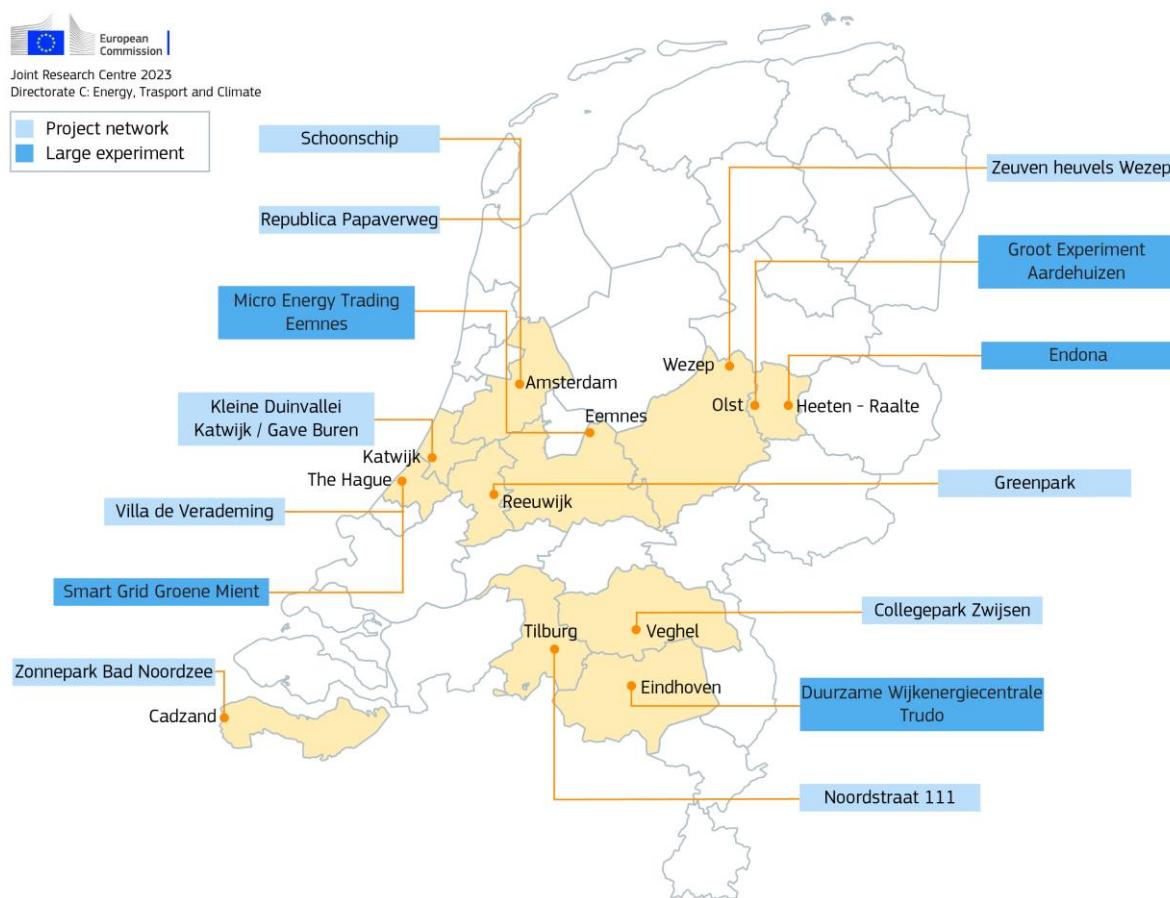
<sup>124</sup> <https://www.rvo.nl/subsidie-en-financieringswijzer/experimenten-elektriciteitswet-2015-2018/besluiten-ontheffingen>

**Figure 28.** Number of active regulatory sandbox projects in the Netherlands



Source: JRC, 2023

**Figure 29.** Location of regulatory sandbox projects in the Netherlands



Source: JRC, 2023

The low number of projects and the delays in project execution may be explained by the difficulty of non-professional stakeholders (i.e. energy communities and homeowner associations) had in navigating the complexity of the energy system. Project promoters had limited resources and it was challenging for them to meet all the eligibility criteria, such as demonstrating the necessary organisational, financial, and technical expertise to fulfil all the required goals of the experiment (Carlson, 2020). Van der Waal et al., also highlight the lack of collaboration and alignment between different actors and the low level of support for potential applicants and project proponents. A more holistic approach, inter-actor alignment, the availability of expert

support, and facilitation of a more close-knit learning community could have facilitated participation in the scheme (van der Waal, Das, & van der Schoor, 2020).

**Table 18.** Regulatory sandbox in the Netherlands

NETHERLANDS - Regulatory sandbox	
<b>Legal basis</b>	Experimentation Decree for Decentralised Renewable Electricity Generation of 28 February 2015
<b>Brief description</b>	The experimentation decree enables energy cooperatives and homeowner associations to take up the roles of the grid operator and of the electricity supplier asking for a derogation from some of the provisions of the Electricity act
<b>Areas of experimentation</b>	Collective self-consumption and community energy
<b>Objectives</b>	To support local renewable energy generation, consumer engagement with energy and the adoption of new services and business models
<b>Derogations / Exemption</b>	Predefined exemptions related to: - the prohibition to carry out DSO tasks; - the obligation to have a supply permit; - the way to determine the tariffs; - rules regarding data processing and transparency and liquidity of the energy market; - rules regarding metering and invoicing
<b>Length of derogations</b>	10 years
<b>Eligible project promoters</b>	Communities and homeowner associations
<b>Knowledge sharing obligations</b>	6-month or yearly meet-ups of experiments. Last progress report published by RVO in April 2021

*Source:* JRC, 2023

In 2019, a follow-up of the initiative was envisaged. Building on the experience gained from the 2015 Experimentation Decree and on the new provisions on regulatory experimentation of the Energy Transition Progress Act<sup>125</sup>, the Ministry of Economic Affairs and Climate Policy drafted a new decree containing further provisions on experimentation. The decision aimed to facilitate future developments to enable the energy transition, expanded the number of articles of the Electricity Act 1998 from which it was possible to derogate and also enabled experiments under the Gas Act. It also expanded the number and type of projects that could be granted a derogation and opened the scheme to market participants, particularly network operators and suppliers.

In February 2020 however, the Advisory Division of the Council of State<sup>126</sup> recommended abandoning the draft decree. In brief, the Council stated that the decree was neither in line with the legal requirements of a pilot regulation (e.g. definition of the content, scope, eligibility criteria and assessment of the results of the experiment) nor with the requirements of an exemption scheme (e.g. definition of the conditions, purpose and cases in which a particular legal provision can be disapplied). It allowed for an unlimited number of exemptions in both time and scope, which could lead to losing sight of the laws and legal safeguards and could make the performance of statutory duties or the compliance with the law by citizens and businesses problematic<sup>127</sup>. The draft decree could also lead to tension with binding EU regulations.

<sup>125</sup> The Energy Transition Progress Act, which amends the Electricity Act 1998 and the Gas, provides for a broad experimentation clause to experiment with all relevant aspects of renewable energy, energy saving, reduction of CO2 emissions, efficient use of the system, new market models and tariff regulation. Another change is that the possibility to experiment is given shape by means of an exemption from the minister. The Energy Transition Progress act is available at: <https://zoek.officielebekendmakingen.nl/stb-2018-109.html>

<sup>126</sup> Advice by the Advisory Division of the Council of State (Raad van State), issued on 17 February 2020. Available online: <https://www.raadvanstate.nl/adviezen/@115910/w18-19-0145-iv/#highlight=Experiment>

<sup>127</sup> As highlighted by (Ranchordás, 2021), the Council of State has expressed on numerous occasions its apprehension regarding the potential tension between experimental legislation and the principle of legal certainty.

Following this advice, in December 2020, the Ministry of Economic Affairs and Climate decided that it would no longer allow new experiments under the 1998 Electricity Act. It is still unknown whether the upcoming new Energy Act will contain provisions regarding regulatory innovation.

### LESSONS LEARNED

Desktop research and direct contact with the NRA allowed us to collect the lessons learned during the operation of the regulatory sandbox.

**General assessment of the regulatory experimentation to date.** The evaluation report by RVO<sup>128</sup>, concluded that not enough experiments have been carried out so far to draw a definitive assessment about the added value of the experiments for better grid management. The low number of applications and the delays in project implementation are possibly explained by the fact that the eligible project proponents (i.e. energy communities and homeowner associations) are typically non-professional stakeholders and it is very difficult for them to navigate the complexity of the energy system. Their effective inclusion in regulatory experiments may require the adoption of supporting tools (e.g. expert advice) and mechanisms (e.g. stakeholder collaboration, knowledge sharing platforms, community engagement).

**Monitoring and evaluation of project results.** The definition of project indicators to measure the results of projects experimenting with innovative solutions and business models is a complex task. Indicators should enable the assessment of the experiment against pre-defined objectives, while taking into consideration other technological, economic, and social implications of the projects. The Dutch experience showed the importance of carefully defining the objectives of the initiative to be able to capture the results of the experimentation in terms of innovation. The project's endeavours to bring together different stakeholders and maximise the collective gains represents an important social innovation achievement of the projects, which could have been better supported and valued.

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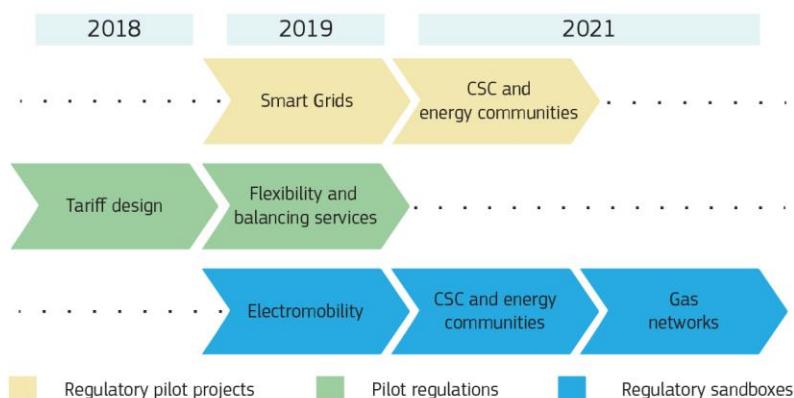
<sup>128</sup> See footnote 124

## PORUGAL

Since 2018, ERSE - the Portuguese NRA - has launched experimental initiatives to promote innovation in the energy sector and inform possible regulatory change (Figure 30). The choice of the regulatory innovation tool depended on the topic of the experimentation as well as on the objectives that ERSE intended to achieve. In some cases, the sectoral regulation provided interested parties with the possibility to ask for derogations from its own provisions to promote bottom-up innovation (regulatory sandboxes). In other cases, the sectoral regulation mandated network operators to come up with proposals to test different solutions and inform the regulatory innovation process (pilot projects). In other cases, finally, an experimental scheme, temporarily derogating from the otherwise applicable rules, was directly adopted by ERSE to promote regulatory learning and inform possible regulatory change (pilot regulations).

The experiments, which have all been rooted in ERSE's regulatory mandate, have addressed regulatory barriers to the development of new technologies, services and business models in a variety of sectors, including CSC and energy communities, flexibility and balancing services, electromobility, tariff design and storage. Further initiatives are currently under consideration in the integration of RES and flexibility and balancing services sectors.

**Figure 30.** Timeline regulatory experimentation initiatives in Portugal



Source: JRC, 2023

### Regulatory sandboxes

**CSC and energy communities.** In 2021, a regulatory sandbox scheme was set up for testing technological and business model solutions relating to self-consumption and renewable energy communities. Art. 55 of ERSE Regulation 373/2021<sup>129</sup> (also known as self-consumption regulation) provides for the possibility to carry out pilot projects where transitory derogations from its provisions may be granted. Applications to ERSE can be submitted by any entity and shall specify the rules of the self-consumption regulation that the project intends to derogate from. The projects are approved by ERSE, after consultation with the network operator of the area where the project is to be carried out. Their duration shall not exceed 1 year, but it may be extended by ERSE upon a justified request presented by the project promoter. Projects are monitored by ERSE and shall submit a final report containing the main conclusions of the project. No costs are recognised or funded through this scheme.

As of 23 May 2022, the following projects have been approved (Figure 31):

- Comunidade de Energia Renovável – Agra do Amial (neighbourhood in the city of Oporto). The project aims to fight energy poverty and to incorporate renewable energy in the city with public resources. It will be carried out in an area including a social public housing complex of 180 households and a public school. It sets up a renewable energy community, enabling energy sharing between participants. AdE Porto (the energy agency of Porto), as a project proponent, applied for a derogation to use dynamic energy sharing

<sup>129</sup> Regulation 373/2021 of 5 May 2021. Available at <https://files.dre.pt/2s/2021/05/087000000/0008500110.pdf>

- coefficients which are not currently foreseen in the regulation<sup>130</sup>. The project also seeks regulatory oversight and guidance during implementation,
- POCITYF (Évora municipality). The EU funded project includes the creation of 3 RECs, where individual self-consumers can participate with excess energy. It requested a derogation to use dynamic energy sharing coefficients and to implement a P2P case within the RECs,
  - industrial site at Maia. The project requested a derogation to use dynamic energy sharing coefficients between three industrial facilities in the same industrial site.

These projects will benefit from the work carried out under a regulatory pilot project on dynamic energy sharing in self-consumption promoted by ERSE and carried out by the operator of the MV and HV distribution networks (see below the regulatory pilot project on CSC and energy communities). Table 19 summarises the main elements of the regulatory sandbox scheme on CSC and energy communities in Portugal.

**Table 19.** Regulatory sandbox in Portugal – CSC and energy communities

<b>PORUGAL - Regulatory sandbox   CSC and energy communities</b>	
<b>Legal basis</b>	ERSE Regulation 373/2021
<b>Brief description</b>	The Regulation enables any interested party to carry out pilot projects where transitory derogations from its provisions may be granted
<b>Areas of experimentation</b>	CSC and energy communities
<b>Objectives</b>	Testing technological and business model solutions relating to self-consumption and RECs
<b>Derogations</b>	Applications shall specify which rules of the regulation the project intends to derogate.
<b>Length of derogations</b>	1 year, but the duration may be extended by ERSE upon a justified request presented by the project promoter
<b>Eligible project promoters</b>	Any interested party
<b>Knowledge sharing obligations</b>	A final report containing the main conclusions of the project shall be submitted to ERSE and made public by the project promoter

*Source:* JRC, 2023

**Electromobility.** The electric mobility regulation, approved by ERSE in 2019 and later amended in 2021<sup>131</sup>, provides project proponents with the possibility to derogate from its provisions when carrying out pilot projects that promote innovation in the electric mobility sector. Any entity may submit to ERSE a detailed project proposal, including the identification of the rules that it intends to derogate. The projects, approved by ERSE after consultation with EGME (i.e. the Electric Mobility Network Operator), shall have a maximum duration of three years. Information on the pilot-project and its results need to be made publicly available and reported to ERSE to inform possible regulatory change.

As of May 2022, only one project has been approved<sup>132</sup>. The project was proposed by GALP, an energy company, partnering with the regional DSO in the Azores islands, the local government, data management and energy technology providers. The project aimed to test the V2G technology, to evaluate the benefits for users and system operators, and the capacity of EVs to take part in balancing services. This project did not

<sup>130</sup> The regulation is currently under review to include dynamic sharing methods for collective self-consumption. The pilot project will however be continued to contribute to the regulatory learning process for the definition of the regulation implementation details.

<sup>131</sup> Regulation 854/2019 of 4 November 2019, as later amended by Regulation 103/2021 of 1 February 2021. Consolidated version available at [https://www.erne.pt/media/phqd2bpj/rme\\_consolidado\\_2021.pdf](https://www.erne.pt/media/phqd2bpj/rme_consolidado_2021.pdf)

<sup>132</sup> The project was approved by ERSE on 12 May 2020 and ended in 2021, <https://www.erne.pt/media/vsvdvnk/projetov2q.pdf>

require any derogation from the applicable rules and no costs where recognised or funded through this initiative.

Table 20 summarises of the main elements of the regulatory sandbox scheme on electromobility in Portugal.

**Table 20.** Regulatory sandbox in Portugal – Electromobility

PORTUGAL - Regulatory sandbox   Electromobility	
<b>Legal basis</b>	ERSE Regulation 854/2019, as amended
<b>Brief description</b>	The Regulation enables any interested party to carry out pilot projects where transitory derogations from its provisions may be granted
<b>Areas of experimentation</b>	Electromobility
<b>Objectives</b>	Promoting innovation in the electric mobility sector
<b>Derogations</b>	Applications shall specify which rules of the regulation the project intends to derogate.
<b>Length of derogations</b>	3 years
<b>Eligible project promoters</b>	Any interested party
<b>Knowledge sharing obligations</b>	A final report containing the main conclusions of the project shall be submitted to ERSE and made public by the project promoter

*Source:* JRC, 2023

**Gas networks.** The Regulation on Access to Networks, Infrastructure and Interconnections in the Gas Sector, approved in May 2021<sup>133</sup>, provided for a dedicated scheme to support innovation in the gas sector. Art. 56 of the Regulation enables project proponents to apply for derogations from its rules to carry out projects that aim to test the technical and economic feasibility and applicability of innovative practices and technologies, including proposals for legal and regulatory development. Project proposals must be submitted to ERSE, which approves the projects and the derogations, within its own competences, after consultation with the operator of the network where the project is to be carried out. Information on the pilot project and its results need to be made publicly available and reported to ERSE to inform possible regulatory change. No costs are recognised upfront through this initiative, but they can be evaluated in the annual revenue setting process.

This experimentation scheme was inspired by a pilot project proposed by a DSO and approved by ERSE in 2020 for the injection of H<sub>2</sub> into a local gas distribution network ('Green Pipeline Project'), at a built-for-purpose mixing station. The project proposed to experiment with different equipment fit for H<sub>2</sub>, with metering and billing adjustments to the new mixture of gases and with the control by the DSO of the mixing station. At the time of approval by ERSE, the possibility to inject H<sub>2</sub> in the gas network had to be granted by way of derogation, as it was still not foreseen in the legislation. Other minor adaptations to provisions on metering and energy conversion were also needed. No specific funding was granted by ERSE for this project, but the DSO may have access to public funds for the energy transition.

Table 21 summarises the main elements of the regulatory sandbox scheme on gas networks in Portugal.

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<sup>133</sup> ERSE Regulation 407/2021 of 12 May 2021. Available at <https://dre.pt/dre/detalhe/regulamento/407-2021-163158540>

**Table 21.** Regulatory sandbox in Portugal - Gas networks

PORTUGAL - Regulatory sandbox   gas networks	
<b>Legal basis</b>	ERSE Regulation 407/2021
<b>Brief description</b>	The Regulation enables any interested party to carry out pilot projects where transitory derogations from its provisions may be granted.
<b>Areas of experimentation</b>	Integration of renewables and low carbon gases in the gas networks
<b>Objectives</b>	Testing the technical and economic feasibility and applicability of innovative practices and technologies in the gas sector
<b>Derogations</b>	Applications shall specify which rules of the regulation the project intends to derogate.
<b>Length of derogations</b>	Not specified
<b>Eligible project promoters</b>	Any interested party
<b>Knowledge sharing obligations</b>	A final report containing the main conclusions of the project shall be submitted to ERSE and made public by the project promoter

Source: JRC, 2023

**General sandbox scheme.** Besides the regulatory sandboxes adopted by ERSE, Portugal has also recently adopted a framework to promote and support the testing of innovative sectoral, as well as cross-cutting<sup>134</sup> products, services, processes and models. Such a framework can be considered as a general sandbox scheme, open to all sectors of the economy, where research, demonstration and testing activities can be carried out in a real environment. The scheme provides for the set-up of so called Technological Free Zones (TFZs), defined as real or quasi-real test environments, intended for testing and experimenting with innovative technologies and technology-based products, services and processes, with direct and permanent support and monitoring by the competent authorities, which shall supervise the testing as well as provide information, guidelines and recommendations.

Resolution of the Council of Ministers no. 29/2020<sup>135</sup>, establishes the general principles for the creation and regulation of the TFZs, while Decree-Law No. 67/2021<sup>136</sup> establishes the regime and defines the governance model for the promotion of technology-based innovation through the creation of TFZs. Finally, Decree-Law 15/2022<sup>137</sup> establishes the specific framework for the creation of TFZs in the electricity sector.

According to art. 216 Decree-Law 15/2022, TFZs aim to promote innovation in the fields of electricity production, self-consumption and storage, as well as in the electric mobility field. The TFZ are managed directly by the Directorate-General for Energy and Geology (DGEG) or through a concession granted through a competitive procedure.

The management of TFZ in the electricity sector shall comply with the following principles:

- transparency and non-discrimination, both with regard to users, technologies and solutions subject to research, demonstration and testing,
- safety of people and goods, consumer protection, privacy, and personal data protection,
- publication of project results,

<sup>134</sup> Products, services, processes and models that cross more than one sector and may therefore be subject to different regulation and regulators.

<sup>135</sup> Resolution of the Council of Ministers no. 29/2020 of 21 April 2020. Available at: <https://dre.pt/dre/detalhe/resolucao-conselho-ministros/29-2020-132133787>

<sup>136</sup> Decree-Law No. 67/2021 of 30 June 2021. Available at: <https://dre.pt/dre/detalhe/decreto-lei/67-2021-168697990>

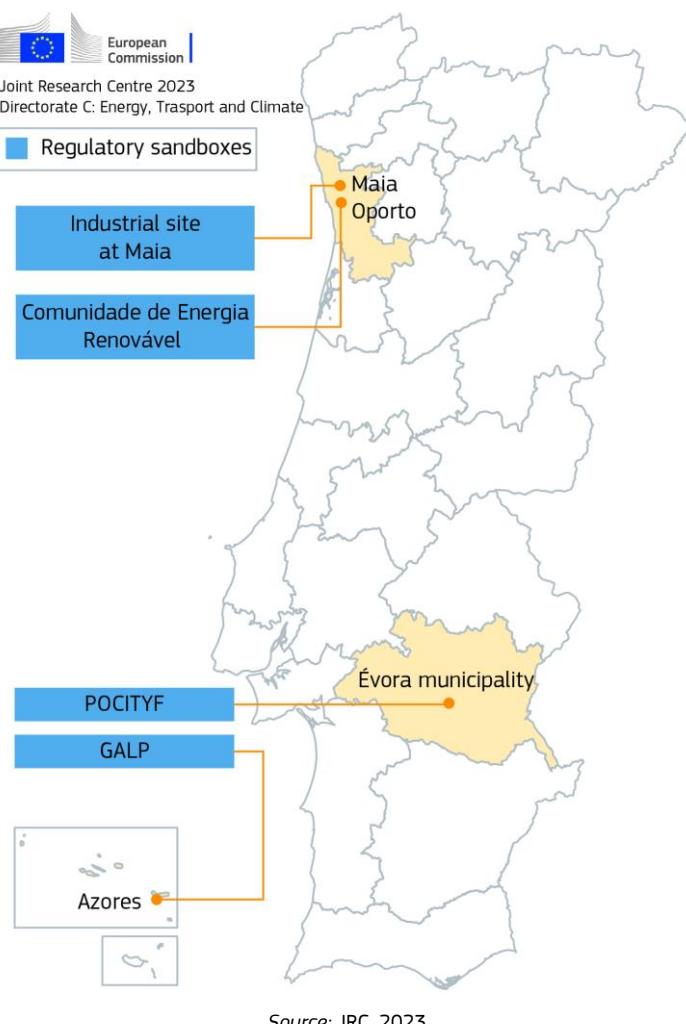
<sup>137</sup> Decree-Law 15/2022 of 14 January 2022. Available at <https://dre.pt/dre/detalhe/decreto-lei/15-2022-177634016>

- ethical and responsible use of technologies.

Articles 217-225 identified the first three TFZs in the electricity sector, and established supporting provisions, including the exemption from payment of network access fees, as well as other charges related to the participation in the networks, and a reserve of injection capacity in the public service electrical network. The identified TFZs are the following:

- Viana do Castelo: production of offshore or nearshore energy (wind and ocean),
- Abrantes: production, storage and self-consumption of electricity from renewable energies, to be developed within the scope of the decommissioning process of the local coal-fired power plant,
- Perimeter of Irrigation of the river Mira: establishment of innovation and development projects that generate synergies between agriculture and electricity production.

**Figure 31.** Location of regulatory sandbox projects in Portugal



### **Regulatory pilot projects**

**CSC and energy communities.** With the aim to provide an enabling framework for bottom-up initiatives relating to self-consumption and renewable energy communities, article 55 of ERSE Regulation 373/2021 also provides for the set-up of a regulatory pilot by the operator of the MV and HV distribution networks in mainland Portugal (i.e. E-Redes). Within 6 months from the entry into force of the regulation, E-Redes had to submit a project proposal to ERSE to test at least two alternative energy sharing rules, complementary to

those defined in Article 36 (i.e. fixed and proportional coefficients), based in particular on hierarchical algorithms and the dynamic setting of energy sharing. Participation in the pilot was open to other interested parties, under the terms defined by ERSE. As of May 2022, the project is still ongoing. Table 22 summarises the main elements of the pilot project scheme on CSC and energy communities in Portugal.

**Table 22.** Pilot projects in Portugal - CSC and energy communities

PORTUGAL – Pilot project   CSC and energy communities	
<b>Legal basis</b>	ERSE Regulation 373/2021
<b>Brief description</b>	The pilot required the network operator to test at least two alternative energy sharing rules, complementary to those defined by art. 36 of the electricity self-consumption regulation two alternative energy sharing rules, regulation on electricity self-consumption
<b>Areas of experimentation</b>	CSC and energy communities
<b>Objectives</b>	To provide an enabling framework for bottom-up initiatives relating to self-consumption and renewable energy communities
<b>Derogations</b>	The network operator was enabled to derogate from the energy sharing rules specified by the electricity self-consumption regulation
<b>Length of derogations</b>	Not specified
<b>Eligible project promoters</b>	The operator of the MV and HV distribution networks in mainland Portugal (i.e. E-Redes)
<b>Knowledge sharing obligations</b>	The DSO must submit a report on the project to the regulator, after the first year of implementation

*Source:* JRC, 2023

**Smart grids.** ERSE regulation 610/2019<sup>138</sup> introduced the obligation for DSOs operating at low voltage level to submit, within 120 days after its entry into force, the proposal for the execution of pilot projects experimenting with possible uses of smart meter data on technical quality of service<sup>139</sup>. The regulation aims to promote the development and testing of new network management solutions and new services for end customers. Project proposals are evaluated and approved by ERSE and the project's main findings must be shared and discussed with ERSE to inform regulatory learning. As of May 2022, only one project has been approved. It involves around 25,000 low voltage customers fed by the Marinha Grande substation. It was approved on 28 April 2020 and lasted for about one year. The project found that offline and real time smart meter data can be used by DSOs to investigate voltage level complaints by customers.

Table 23 summarises the main elements of the pilot project scheme on smart grids in Portugal.

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<sup>138</sup> ERSE Regulation 610/2019 of 2 August 2019. Available at <https://dre.pt/dre/detalhe/regulamento/610-2019-123675698>

<sup>139</sup> To support the implementation of smart grid development plans by DSOs, the Regulation provides that DSOs offering smart grid services to users are awarded with an incentive. The incentive ensures the sharing of costs and benefits with consumers, based on the actual availability of the services.

**Table 23.** Pilot projects in Portugal – Smart grids

PORTUGAL – Pilot project   Smart Grids	
<b>Legal basis</b>	ERSE regulation 610/2019
<b>Brief description</b>	The Regulation required low voltage grid operators to submit to ERSE a project proposal to experiment with possible uses of smart meter data on technical quality of service
<b>Areas of experimentation</b>	Smart grids
<b>Objectives</b>	To promote the development and testing of new services for end customers
<b>Derogations</b>	The pilot did not imply the granting of derogations
<b>Length of derogations</b>	-
<b>Eligible project promoters</b>	DSOs operating at low voltage level
<b>Knowledge sharing obligations</b>	Projects main findings must be shared and discussed with ERSE to inform regulatory learning

Source: JRC, 2023

### **Pilot regulations**

**Tariff design.** To improve demand response by customers connected at very high, high and medium voltage, Regulation 6/2018<sup>140</sup> introduced an experimental scheme where network tariffs were used to encourage industrial customers to shift their consumption.

The experimentation was carried out in collaboration with the DSO responsible for the high voltage and medium voltage grid (i.e. EDP Distribuição, now E-Redes). The NRA defined the rules of the experimentation, as well as the changes to the tariff design subject to experimentation. The DSO was responsible for the selection of the participants, signing of the participation contracts with customers and energy suppliers, carrying out of a cost-benefit analysis<sup>141</sup> and billing according to the new tariff design. The costs incurred by the network operator for the implementation of the project were included in the operator's allowed revenues and recovered through network tariffs.

The pilot regulation tested the introduction of a new dynamic network access tariff, giving the participants at least 48 hours' notice (24 of which on business days) prior to the occurrence of critical periods on the grids, to which higher prices were applied.

The experimentation ran between June 2018 and May 2019, and it involved 82 industrial customers at high and medium voltage. 52 out of the 82 participants observed a reduction in the network tariffs during the duration of the project as a consequence of the new tariff design (2.2% in the super peak period and 1.4% in the peak period)<sup>142</sup>.

The results of the pilot informed the regulatory process for the adoption of an optional network access tariff for high, high and medium voltage networks<sup>143</sup>. The new tariff option is characterised by time periods for three different geographic groups on the mainland (North, Centre, South) and by differentiating the price of power-based network charges in peak hours for three seasons (high, medium, low).

<sup>140</sup> ERSE Regulation 6/2018 of 27 February 2018. Available at: <https://www.erne.pt/media/kefjgll/0630006321.pdf>

<sup>141</sup> The cost-benefit analysis reported net benefits of 50 million EUR over a 23-year period.

<sup>142</sup> More information on the pilot can be found at: <https://www.erne.pt/atividade/consultas-publicas/consulta-p%C3%A3BAblica-n%C2%BA-101/abertura/>

<sup>143</sup> Following the pilot, the DSO submitted to ERSE its final report, prepared in collaboration with the Centre for Energy Systems (INESC TEC). ERSE's analysis of the pilot's results led to the proposal for a new tariff option for access to networks. ERSE's analysis report is available at: <https://www.erne.pt/media/l5plp5td/anexo-1-relat%C3%B3rio-erne.pdf>

Table 24 summarises the main elements of the pilot regulation scheme on tariff design in Portugal.

**Table 24.** Pilot regulation in Portugal - Tariff design

PORTUGAL – Pilot regulation   Tariff design	
<b>Legal basis</b>	ERSE Regulation 6/2018
<b>Brief description</b>	The Regulation introduced an experimental scheme testing the introduction of a new dynamic network access tariff for customers connected at very high, high and medium voltage
<b>Areas of experimentation</b>	Tariff design
<b>Objectives</b>	To encourage customers connected at very high, high and medium voltage to shift their consumption
<b>Derogations</b>	By way of derogation from the ordinary tariff system, the experimental framework provided for the possibility for customers connected at very high, high and medium voltage to apply for a new dynamic network access tariff
<b>Length of derogations</b>	1 year
<b>Eligible project participants</b>	Customers connected at very high, high and medium voltage
<b>Knowledge sharing obligations</b>	A final report containing the main conclusions of the project to be submitted to ERSE

*Source:* JRC, 2023

**Flexibility and balancing services.** Following a public consultation procedure, in January 2019 ERSE adopted a regulation<sup>144</sup> that set the rules of an experimental scheme for the participation of demand response in the balancing service market, on an equal footing with energy generators. The aim of the scheme is to improve competition in the balancing market and to get real-life data about the impact of demand participation in the functioning of the market. The results of the project are meant to promote regulatory learning and inform regulatory change.

All consumers licensed by the TSO with a capacity of at least 1 MW can participate in the pilot, providing that they demonstrate to the TSO that they have the technical and operational skills to supply this service and that they are connected to a network of at least medium voltage level (ERSE, 2020). In particular, the participants have to meet specific technical requirements relating to metering devices and to the connection to the market platform. Costs for implementing the tasks assigned to the TSO are included in regulated revenues. Demand participation in the balancing service market gets the value of the matched bids.

More than granting derogations, the pilot regulation created ad-hoc rules to allow equal treatment of demand participation in the existent balancing service market and defined all other conditions for its participation, such as billing and balancing, control and information transactions.

The project was meant to last for one year. At the end of this period, following the encouraging results documented in the TSO and in ERSE's assessment report<sup>145</sup>, the duration of the experimentation scheme was extended till the adoption of the permanent regulatory framework<sup>146</sup>. Such a framework is currently under consideration by ERSE, which is also considering the inclusion of other consumers and stakeholders in the framework.

Table 25 summarises the main elements of the pilot regulation scheme on flexibility and balancing services in Portugal.

<sup>144</sup> ERSE Regulation 4/2019 of 15 January 2019. Available at <https://files.dre.pt/2s/2019/01/010000000/0192001922.pdf>

<sup>145</sup> The report by ERSE is available at <https://www.erne.pt/media/zwfhzifs/relat%C3%B3rio-erne.pdf>

<sup>146</sup> ERSE Regulation 6/2020 of 20 April 2020. Available at <https://files.dre.pt/2s/2020/04/077000000/0015000150.pdf>

**Table 25.** Pilot regulation in Portugal - Flexibility and balancing services

PORTUGAL – Pilot regulation   Flexibility and balancing services	
<b>Legal basis</b>	ERSE Regulation 4/2019
<b>Brief description</b>	The Regulation set the rules of an experimental scheme for the participation of demand response in the balancing service market, on an equal footing with energy generators
<b>Areas of experimentation</b>	Flexibility and balancing services
<b>Objectives</b>	To improve competition in the balancing service market; to get real-life data about the impact of demand participation in the functioning of the market; to promote regulatory learning and inform regulatory change
<b>Derogations</b>	More than granting derogations, the pilot regulation created ad-hoc rules to allow equal treatment of demand participation in the existent balancing service market and defined all other conditions for its participation, such as billing and balancing, control and information transactions
<b>Length of derogations</b>	1 year, later extended till the adoption of the permanent regulatory framework
<b>Eligible project promoters</b>	All consumers licensed by the TSO with a capacity of at least 1 MW, assuming they demonstrate to the TSO that they have the technical and operational skills to supply this service and that they are connected to a network of at least medium voltage level
<b>Knowledge sharing obligations</b>	The TSO reports to ERSE every three months. ERSE publishes a final report within 70 days after the conclusion of the project

Source: JRC, 2023

## LESSONS LEARNED

Desktop research and direct contacts with the NRA revealed the existence of a dynamic regulatory innovation framework in Portugal. Several measures have been adopted over the last few years, and further initiatives are currently at the planning stage.

**Competence to adopt regulatory experimentation initiatives.** ERSE is competent for the adoption of regulatory experimentation initiatives falling within its remit and can grant derogations only from the rules it has adopted. For experimentation initiatives requiring derogations from the rules falling under the competence of different authorities, a one-stop-shop approach would encourage innovators and help to speed up the project approval process.

**Monitoring and evaluation of project results.** Monitoring and evaluation of project results is particularly relevant in the case of pilot regulations, as they are tools to assess the functioning of the temporary experimental scheme and to decide on the possibility of permanently changing the regulation. Indicators are therefore set by the regulator, possibly in collaboration with universities and research institutes. In the case of regulatory sandboxes and pilot projects, where the focus is more on testing innovative solutions, it is usually the project promoter that sets the project goals and reports the findings to the regulatory authority at the end of the project. Monitoring and evaluation are challenging tasks for regulators, as they don't always have enough internal resources and expertise to dedicate.

**Knowledge sharing.** Project reporting and dissemination of the results are of pivotal importance to support the take-up of the innovative solutions tested in the framework of experimental initiatives. Furthermore, knowledge sharing is important between countries as, despite the differences in the national contexts, it can shed light on the challenges, risks and benefits related to the implementation of innovative solutions. The EU could play a role in supporting knowledge sharing between Member States by promoting the adoption of a common terminology and by providing a dedicated forum for the exchange of best practices and lessons learned.

## SPAIN

The Ministry for the Ecological Transition and Demographic Challenge holds the basic competencies on energy and leads on energy policy formulation. The national regulatory authority is the National Commission of Markets and Competition (CNMC), whose competence includes supervising and controlling the proper operation of energy markets and calculating network access tariffs according to transmission and distribution costs (IEA, 2021).

**Regulatory sandbox (CNMC).** In 2019, the CNMC adopted a decision<sup>147</sup> drafting the framework for the set-up of regulatory experiments. Art. 24 of the decision refers to the adoption by a subsequent CNMC resolution of the conditions and requirements for the implementation of demonstration projects that may contribute to the improvement of the functioning of the wholesale electricity market and the operation of the system. To be eligible, projects need to meet the following criteria:

- innovation - the tested product or service is innovative, not currently being offered on the market or different from the model currently in use,
- benefits for consumers,
- safety - the TSO or, where appropriate, the DSO, can warrant the absence of risks for the operation of the system or for the distribution network concerned, respectively,
- clearly identified legislative or regulatory obstacle exists,
- well-developed plan for testing the innovation. The plan shall include clear objectives, criteria and indicators of success and a specific timeframe for implementation, which shall not exceed 36 months.

At the time of writing, no further act has been adopted by CNMC.

**Regulatory sandbox (Government).** In parallel, in 2020, a royal decree<sup>148</sup> (Royal decree 23/2020) was adopted that enabled the Government to establish a regulatory sandbox programme for the implementation of innovative projects in the electricity sector. The sandbox scheme was meant to stimulate innovation, promote regulatory learning and facilitate the dialogue between the administration and the regulator. Improved interinstitutional collaboration is expected to speed up and facilitate the revision of the current regulatory framework, with a view to accommodate and support the entry of new actors in the electricity market, giving them the opportunity to test their business model.

Building on Royal decree 23/2020 and on the results of a public consultation procedure, in July 2022 the Government adopted a decree<sup>149</sup> (Royal decree 568/2022) setting up a regulatory sandbox to support innovation in the electricity sector. The decree attributed the administration of the sandbox to the Secretary of State for energy, within the Ministry for the Ecological Transition and Demographic Challenge. Applications can be submitted only following the opening of an application window. Both regulated and market operators, including energy communities, can participate. Participants can be granted temporary derogations from any provision within the scope of the electricity sector legislation, including the possibility of operating in the absence of a specific enabling provision. Derogations from the provisions set by regulatory decisions, on the other hand, are out of the scope of the sandbox.

The project proposal must detail the objectives, the timeline of the project, the proposed regulatory improvements, the derogations needed, and the execution plan. Projects must contribute to the achievement of the objectives of the Electricity Act and of the national and European energy, sustainability and climate objectives. In addition, to be eligible, projects must comply with the following requirements:

- technical feasibility,
- safety (i.e. absence of risks for the electrical system),
- consumer protection,
- economic and financial sustainability of the electrical system,
- time limitation (when required by the corresponding call),

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<sup>147</sup> CNMC decision 3/2019 of 20 November 2019, art. 24. Available at: <https://www.boe.es/buscar/doc.php?id=BOE-A-2019-17287>

<sup>148</sup> Royal decree 23/2020 of 23 June 2020. Available at: <https://www.boe.es/buscar/act.php?id=BOE-A-2020-6621>

<sup>149</sup> Royal decree 568/2022 of 11 July 2022. Available at: <https://www.boe.es/eli/es/rd/2022/07/11/568/con>

- regulatory innovation, which will be assessed against the project's: - aptitude to contribute to regulatory improvement and learning; - usefulness to guide the transposition of European legislation; - aptitude to generate potential benefits for consumers,
- any other requirement established by the call for proposals.

The application is subject to a preliminary evaluation on the admissibility to the sandbox by the Secretary of State for Energy and the CNMC, depending on the nature of the regulatory exemption to be granted. The results of this evaluation are transmitted to the Coordination Commission, made up of representatives of several relevant authorities. After hearing the interested parties, the Committee prepares a proposal for a resolution to be adopted by the Secretary of State for Energy. The final decision on the admissibility to the scheme must be taken within 6 months from the date of publication of the call.

Projects admitted to the sandbox shall sign an agreement which specifies the rules and conditions for the development of the experimentation. Project execution is monitored by the Secretary of State for Energy, with the collaboration of the CNMC, depending on the nature of the derogations granted. Within 3 months from the completion of the project, the proponent shall send an evaluation report to the Secretary of State for Energy. The Secretary of State for Energy, together with the National Markets and Competition Commission, where appropriate, prepares a document with its conclusions on the development of the pilot and its results, which is then sent to the Coordination Commission and published with the necessary reservations in terms of industrial or intellectual property.

The lessons learned from the implementation of the projects will be taken into account in the procedure for preparing future legislation and regulations. The Secretary of State for Energy prepares an annual report on regulatory innovation in the electricity sector, to be published in the second quarter of each year.

Table 26 summarises the main elements of the regulatory sandbox scheme in Spain.

**Table 26.** Regulatory sandbox in Spain

SPAIN – Regulatory sandbox	
<b>Legal basis</b>	Royal decree 23/2020 and Royal decree 568/2022
<b>Brief description</b>	The sandbox supports the implementation of innovative projects in the electricity sector
<b>Area of experimentation</b>	Not specified
<b>Objectives</b>	To stimulate innovation, promote regulatory learning and facilitate the dialogue between the administration and the regulator
<b>Derogations</b>	Participants can be granted temporary derogations from any provision within the scope of the electricity sector legislation, including the possibility of operating in the absence of a specific enabling provision
<b>Length of derogations</b>	Not specified
<b>Eligible project promoters</b>	Both regulated and market operators, including energy communities, can participate in the scheme
<b>Knowledge sharing obligations</b>	Within 3 months from the completion of the project, the proponent shall send an evaluation report to the Secretary of State for Energy. The Secretary of State for Energy, together with the National Markets and Competition Commission, where appropriate, prepares a document with its conclusions on the development of the pilot and its results, which is then sent to the Coordination Commission and published with the necessary reservations in terms of industrial or intellectual property.  The Secretary of State for Energy also prepares an annual report on regulatory innovation in the electricity sector

Source: JRC, 2023

## SWEDEN

**Regulatory sandbox.** In March 2022, the Swedish Energy Markets Inspectorate (Ei) launched a project to investigate the conditions for the set-up of a regulatory sandbox scheme in the energy sector in Sweden and to develop a model for its implementation. The project will focus on the necessary legal framework, the identification of eligibility and selection criteria for participation, the possibility of funding, the regulatory learning and development framework. The project will end in February 2023 and will result in a report with a proposal for a model for regulatory sandboxes in the Swedish energy market. Stakeholder consultation is already underway.

**Pilot regulation.** In 2018, with an amendment to the 1997 Electricity Act<sup>150</sup> the Government introduced the possibility for electricity network operators to test new tariffs on a limited group of electricity users within a customer category. The objective of the experimental regime is to promote the efficient use of the electricity network. With this aim, network operators are enabled to develop and test innovative tariffs that can stimulate the type of demand flexibility required within their own network area.

The provision constitutes a derogation from the general requirement of uniform network tariffs. To safeguard the principle of equal treatment however, the experimental tariffs need to be objective, non-discriminatory and compatible with the efficient use of the electricity networks. The test can run for a maximum period of three years without the need of authorization by Ei. Only in cases where an extension is sought, the network company needs to file an application with Ei that shall grant permission if the tariff fulfils the above-mentioned criteria.

Network operators are also obliged to provide information to customers on how they can influence their electricity network fee.

Table 27 summarises the main elements of the pilot regulation on tariff design in Sweden.

**Table 27.** Pilot regulation in Sweden

SWEDEN – Pilot regulation   Tariff design	
<b>Legal basis</b>	Chapter 4, Sections 4 a - 4 b of the Electricity Act (1997:857)
<b>Brief description</b>	Network operators are enabled to test new tariffs on limited groups of electricity users within a customer category
<b>Areas of experimentation</b>	Tariff design
<b>Objectives</b>	To promote the efficient use of the electricity network
<b>Derogations</b>	By way of derogation from the general requirement of uniform network tariffs, network companies are enabled to develop and test innovative tariffs that can stimulate the type of demand flexibility required within their own network area
<b>Length of derogations</b>	Maximum three years. An extension can only be granted following an authorisation by Ei
<b>Eligible project promoters</b>	Network operators
<b>Knowledge sharing obligations</b>	Network operators are also obliged to provide information to customers on how they can influence their electricity network fee

Source: JRC, 2023

<sup>150</sup> Chapter 4, Sections 4 a - 4 b of the Electricity Act (1997:857). Available at: [https://www.riksdagen.se/sv/dokument-lagar/dokument/svensk-forfatningssamling/ellaq-1997857\\_sfs-1997-857](https://www.riksdagen.se/sv/dokument-lagar/dokument/svensk-forfatningssamling/ellaq-1997857_sfs-1997-857)

## B. Member States with no initiative in place or under development

### BULGARIA

Contacts with the Energy and Water Regulatory Commission (EWRC) in November 2022 confirmed that there are no regulatory experimentation initiatives currently in place or under development in Bulgaria.

### CZECH REPUBLIC

Contacts with the Energy Regulatory Office of the Czech Republic (ERU) in April 2022 confirmed that there are no regulatory experimentation initiatives currently in place in the Czech Republic. The possible introduction of a regulatory sandbox scheme is however under consideration and there is great attention for the initiatives already carried out in other Member States. The current legislative framework does not allow for the set-up of regulatory experiments, which would need the adoption of an ad-hoc legal basis.

### GERMANY

Contacts with the Federal Ministry for Economic Affairs and Climate Action in September 2022 revealed that although Germany is very active in promoting regulatory experimentation as a tool to support innovation, no initiative has been set up to date in the energy sector. A brief overview of the general context might however help to understand the current and future developments in the field.

Since 2018, Germany has been implementing a national strategy<sup>151</sup> to support the set-up of regulatory sandboxes in those sectors of the economy where modern technologies can result in new products and services and contribute to the digital and sustainable transformation. The strategy pursues three main goals:

- creating better legal provisions to test and implement innovative solutions. The strategy has explored the design of a model experimentation clause to help the set-up of experimentation frameworks in a wide range of sectors, providing flexibility, clarity and legal certainty for all parties involved. On this basis, new experimentation clauses were created e.g. for the testing of autonomous driving and digital identities,
- networking and knowledge sharing. To reduce uncertainties, improve networking and facilitate the exchange of information between industry, science and public administration, the Ministry for Economic Affairs and Climate Action has set up a Network for Regulatory Sandboxes, as well as an interministerial working group on regulatory sandboxes. It also issued several key documents, such as a handbook for regulatory sandboxes<sup>152</sup>, a guide for formulating experimentation clauses<sup>153</sup>, and a guide to data protection in regulatory sandboxes<sup>154</sup>,
- launching and supporting bottom-up regulatory sandboxes. The Federal Ministry for Economic Affairs and Climate Action regularly awards the Regulatory Sandboxes Innovation Prize, to which companies, public administrations and research institutions can apply. The aim of the competition is to show that regulatory sandboxes can make a valuable contribution to innovation in Germany.

Several regulatory sandboxes have been set up in Germany in recent years (e.g. in the passenger transport and autonomous driving sectors), showing their potential to support innovation and help advancing regulation through regulatory learning. To strengthen further regulatory sandboxes as a tool to drive digitalisation forward, in June 2021 the Conference of Economics Ministers of the federal States asked the federal

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<sup>151</sup> Bundesministerium für Wirtschaft und Energie – Strategie Reallabore als Testräume für Innovation und Regulierung, adopted on 10 December 2018. Available at: [https://www.bmwk.de/Redaktion/DE/Downloads/S-T/Strategiepapier-reallabore.pdf?\\_\\_blob=publicationFile&v=10](https://www.bmwk.de/Redaktion/DE/Downloads/S-T/Strategiepapier-reallabore.pdf?__blob=publicationFile&v=10)

<sup>152</sup> Making space for innovation – The handbook for regulatory sandboxes, published in 2019 by the Federal Ministry for Economic Affairs and Energy (BMWi). Available at: <https://documents.net/making-space-for-innovation-bmwii.html?page=1>

<sup>153</sup> New flexibility for innovation - Guide for formulating experimentation clauses, published in December 2020 by the Federal Ministry for Economic Affairs and Energy (BMWi). Available at: [https://www.bmwk.de/Redaktion/EN/Publikationen/Digitale-Welt/guide-new-flexibility-for-innovation-en-web-bf.pdf?\\_\\_blob=publicationFile&v=2](https://www.bmwk.de/Redaktion/EN/Publikationen/Digitale-Welt/guide-new-flexibility-for-innovation-en-web-bf.pdf?__blob=publicationFile&v=2)

<sup>154</sup> Praxishilfe zum Datenschutz in Reallaboren, published in March 2021 by the Federal Ministry for Economic Affairs and Energy (BMWi). Available at: [https://www.bmwk.de/Redaktion/DE/Publikationen/Digitale-Welt/praxishilfe-zum-datenschutz-in-reallaboren.pdf?\\_\\_blob=publicationFile&v=4](https://www.bmwk.de/Redaktion/DE/Publikationen/Digitale-Welt/praxishilfe-zum-datenschutz-in-reallaboren.pdf?__blob=publicationFile&v=4)

Government to draft an experimentation law that creates a uniform legal framework for the set-up of regulatory sandboxes across all areas of experimentation. In September 2021, the Federal Ministry for Economic Affairs and Climate Action published a concept paper for the adoption of a regulatory sandbox act<sup>155</sup>, which focuses on the following key points:

- adopting overarching standards for experimentation clauses (e.g. equal access, time limits and possible extensions, evaluation of the results, scaling up and regulatory learning),
- introducing experimentation clauses in the sectoral legislation of key innovation areas,
- creating a one-stop shop for regulatory sandboxes that could serve as a central advisory and knowledge hub for companies, research and municipalities,
- setting down a binding check in the legislative process to assess the opportunity of inserting an experimentation clause in new or revised sectoral legislation.

The German federal government announced in its coalition agreement of December 2021 its intention to adopt a general regulatory sandbox law.

In the energy sector, no regulatory sandbox has been set up to date. Innovation has been promoted through the funding programme 'Smart Energy Showcases – Digital Agenda for the Energy Transition' (SINTEG), set up in 2015. The programme aimed to support the development and demonstration of innovative solutions for a secure, efficient and environmentally friendly energy system relying on a high proportion of fluctuating electricity generation from wind and solar energy. Such solutions were to be demonstrated in five large pilot regions, addressing technical, economic and regulatory challenges.

The SINTEG programme did not provide for the possibility of asking derogations from the applicable regulatory framework. In 2017 however, an ordinance by the Federal Government<sup>156</sup> introduced the possibility for SINTEG programme participants to apply for a reimbursement of the economic disadvantage suffered as a result of the project activity. The aim was to enable testing of innovative solutions that are not economically viable under the existing legal framework and to generate insights on how the future legal framework needs to be developed. Such economic disadvantages<sup>157</sup> were reimbursed by the network operator responsible for collecting the respective network fees, network fee surcharges and surcharges. The ordinance was only temporary and expired on 30 June 2022.

According to (Widl, et al., 2022)<sup>158</sup>, although no derogations were granted under the SINTEG programme, the funded projects have provided important insights on the need to innovate the regulatory framework, especially in relation to the set-up of new business models (Widl, et al., 2022). A cross-cutting working group on legal issues, which involved representatives from all the funded projects, collected these insights and prepared recommendations on the legal adjustments needed to support the development and uptake of innovative solutions<sup>159</sup>.

## GREECE

Contacts with the Regulatory Authority for Energy (RAE) in April 2022, confirmed that there are no regulatory experimentation initiatives ongoing in Greece. There is however great attention for the initiatives already carried out in other Member States.

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<sup>155</sup> Neue Räume, um Innovationen zu erproben Konzept für ein Reallabore-Gesetz, adopted by the Federal Ministry for Economic Affairs and Climate Action on 1 September 2021. Available at: [https://www.bmwk.de/Redaktion/DE/Publikationen/Digitale-Welt/konzept-für-ein-reallabore-gesetz.pdf?\\_\\_blob=publicationFile&v=6](https://www.bmwk.de/Redaktion/DE/Publikationen/Digitale-Welt/konzept-für-ein-reallabore-gesetz.pdf?__blob=publicationFile&v=6)

<sup>156</sup> Federal Government Ordinance 'Creating a legal framework for the collection of practical experience in the SINTEG programme', of 10 May 2017. Available at: <https://www.bmwk.de/Redaktion/DE/Downloads/E/entwurf-sinteg.html>.

<sup>157</sup> According to §6 of the SINTEG Ordinance, the economic disadvantages that can be reimbursed are only those that arise in periods in which: 1) the network operator must take measures to avoid a network bottleneck or any other risk to the safety and reliability of the electricity supply system; 2) the value of the hourly contracts on the spot market in the day ahead or intraday auctions is zero or negative.

<sup>158</sup> Widl, E. et al., 2022. Pionier für Reallabore. Synthesebericht 4 des SINTEG Förderprogramms, Berlin: Study commissioned by the Federal Ministry for Economic Affairs and Climate Action (BMWK).

<sup>159</sup> The report, published by the Ecologic Institute in October 2021, is available at: <https://www.ecologic.eu/sites/default/files/publication/2022/2135-Handlungsempfehlungen-SINTEG-Schaufenster-Anpassung-Rechtsrahmen.pdf>

## **ESTONIA**

Contacts with the Estonian Competition Authority (Konkurentsiamet) in July 2022, confirmed that there are no regulatory experimentation initiatives currently in place or under development in Estonia.

## **IRELAND**

Contacts with the Commission for Regulation of Utilities (CRU) in July 2022, confirmed that there are no regulatory experimentation initiatives currently in place or under development in Ireland. CRU revealed that in the last years it has not focused on the adoption of regulatory experimentation initiatives but rather on the acceleration of the implementation of the Clean Energy Package, on the basis that the EU Directives already provide a very coherent and open regime for innovation.

## **LATVIA**

Contacts with the Public Utilities Commission (PUC) in June 2022, confirmed that the set-up of regulatory experimentation initiatives would need the adoption of an ad-hoc legal basis. The introduction of regulatory experimentation initiatives to promote innovation in the electricity sector is however currently under consideration.

## **LUXEMBOURG**

Contacts with the Institut Luxembourgeois de Régulation (ILR) in May 2022 confirmed that there is no regulatory experimentation initiative ongoing in Luxembourg. There is great interest in the initiatives underway in other Member States, and a lively debate on the possibility of setting up a regulatory sandbox scheme, especially in the fields of battery storage, electric mobility and smart relay devices.

## **MALTA**

Contacts with the regulator for energy and water services (REWS) in November 2022, confirmed that there is no regulatory experimentation initiative currently ongoing in Malta.

## **SLOVAKIA**

Contacts with the Regulatory Office for Network Industries (URSO) in November 2022 clarified that there is no regulatory experimentation initiative currently ongoing in Slovakia. The NRA does not have the necessary powers to engage in regulatory experimentation and the only way it has to support innovation is through tariff regulation.

## **Annex 2. Regulatory experimentation outside the EU**

### **EUROPE**

#### **UNITED KINGDOM**

**Regulatory sandbox.** In 2016, the British regulator OFGEM launched a new regulatory sandbox service called Innovation Link<sup>160</sup> to support innovators to trial new products, services and business models without the constraints of certain rules.

As a first phase, interested parties can submit expressions of interest and make use of the '*fast, frank feedback*' consulting service to clarify the regulatory issues. The second phase involves, depending on the situation, confirming the legality of experiments, providing more detailed legal advice or granting explicit exceptions. OFGEM has not set out a limit on the activities that could be granted a sandbox. Instead, the limits are a function of OFGEM's own legislative scope – i.e. the energy sector activities to which OFGEM provides licenses.

OFGEM uses sandboxes to enable greater experimentation, testing, and trialling to stimulate innovation under regulatory supervision. The innovation or new product must have the potential to benefit current and future consumers. OFGEM approve sandboxes that they consider have the potential for positive outcomes and desirable innovation features.

OFGEM assess applications against a number of eligibility criteria, which include:

- innovative: is it a new product, service, business model or methodology that is not readily available in the market?
- consumer benefits: benefits could be higher standard of service, lower bills, increased efficiency or benefiting consumers' interests in net zero,
- need: there is a clear regulatory barrier that needs a response,
- support ability: the sandbox can deliver what the innovator needs,
- readiness: the innovator is ready to make use of sandbox support,
- exit strategy: the innovator must have a sandbox exit strategy. This may mean reverting to business as usual, accepting risks of continuation or sponsoring a code modification leading to permanent change.

Once sandboxes have been granted, participants are expected to fulfil monitoring and evaluation requirements. This facilitates learning from sandbox experience.

Two application windows were open in 2017. In total, OFGEM received 67 expressions of interest with only seven sandboxes being allowed to carry out trials (three during the first window and four in the second one).

The number of approved sandboxes was limited since in some cases the regulatory barrier didn't exist. In these cases, the regulator provided support in better understanding the regulatory context. In some other cases, the regulatory barriers were in the process of being relieved. Project promoters varied from local energy communities to international players. In a co-creative process, OFGEM did not pre-define articles for which derogations would apply, but rather applicants proposed the derogations themselves. However, the derogations only applied to rules under the responsibility of OFGEM, and these mostly related to licenses.

#### **First window**

The first application round lasted from February to March 2017 and 30 expressions of interest were received.

The regulator provided the *fast, frank feedback* service to 22 innovators to help them better understand how their business model could operate within existing regulatory arrangements.

Three projects were granted a regulatory sandbox (Figure 32):

- EDF – (Collective self-consumption and community energy) developing a peer-to-peer local energy trading platform allowing urban residents to source their energy from local renewable sources, and to

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<sup>160</sup> <https://www.ofgem.gov.uk/energy-policy-and-regulation/policy-and-regulatory-programmes/innovation-link-share-your-energy-ideas>

- trade with their neighbours, increasing self-consumption of low-carbon energy and reducing overall energy costs,
- Empowered – (Collective self-consumption and community energy) developing a local peer-to-peer energy trading scheme that allows consumers to trade electricity directly with each other,
- OVO Energy – (Flexibility and balancing services) testing a smart tariff that uses smart devices and smart heating to provide grid balancing services.

### **Second window**

The second application round lasted from 2 to 27 October 2017. Through the sandbox process OFGEM collaborated with innovators to create viable trial arrangements. Out of the 37 expression of interests only 4 were granted a sandbox (Figure 32):

- Chase Community Solar – a community benefit society using fitted PV solar panels to homes in Channock Chase. The project tests a new arrangement that maximises the benefit from local PV generation, new battery storage and digital control technologies. By prioritizing power imports and exports, the project automates time-of-use (ToU) tariff selection, balancing community solar and storage, and lowering costs,
- Trent Basin – the project aims to generate and supply locally generated heat and electricity homes and buildings through the use of PV solar panels and a community battery,
- Repowering London – the project aims to maximise the benefits of local generation while testing peer electricity trading across a distributed ledger platform,
- BP – the project aims to develop a marketplace platform where consumers can sell excess electricity they generate.

The 2017 sandbox led to the following insights (OFGEM, 2018):

- innovators commonly need advice, not a sandbox. It is not always clear to the innovators what they can and cannot do,
- for propositions that did not go ahead, it was usually due to a complex combination of factors blocking the idea, such as industry norms, system charging arrangements or codes and licenses – i.e. things that were outside of OFGEM's control,
- innovators want to launch enduring businesses rather than trials. They require some certainty that after the trial they can continue to operate,
- start-ups seek to signal low investment risk to investors and want OFGEM to confirm that their business idea has no regulatory issues,
- innovators that have to work with consumers, need to be a licensed supplier or partner with one, which is a lengthy process not facilitated by OFGEM, and discouraging to applicants,
- innovation was sector-wide with a strong focus on local energy, e.g. benefit sharing of community owned generation, or delivering other services to local consumers, often the most vulnerable.

### **Sandbox 2.0**

Based on insights gained from running the first two sandbox calls, the OFGEM Sandbox 2.0 was launched in 2020 accepting applications on an ongoing basis. Four tools are available as part of the sandbox:

- bespoke guidance: the sandbox can provide individual guidance and clarity on specific rules for specific situations,
- comfort (shared risk): get reassurance about what is considered to be compliant,
- confirmation (of permissible activities): confirming if an activity is permissible,
- time-limited derogations (relief) from specific rules – permission to not comply with a rule.

The sandbox is limited to activities that have to do with the regulated energy markets, generally, those related to the generation, trading, transmission, distribution, shipping and supply of energy to domestic and non-domestic consumers, and associated tasks related to system management and data communications.

This sandbox supports schemes in the regulated gas and electricity markets, enabling pilots or demonstrators that must be done in live energy environments, involving consumers or interacting with market rules or the physical system. Each sandbox granted could be considered as bespoke, due to the range of activities that may be supported using the variety of tools.

So far four projects were granted a sandbox (Figure 32):

- F&S Energy Ltd – providing peer-to-peer electricity matching service, enabling generators and customers to enter into direct bilateral contracts. The applicant (F&S Energy Ltd) received a confirmation support for its application,
- Emergent Energy Systems Ltd – delivering the right to switch suppliers for residential customers on microgrids using a new industry methodology. The applicant (Emergent Energy Systems Ltd.) received a temporary derogation<sup>161</sup> from the Balancing and Settlement Code (BSC),
- UK Power Networks - trial a new price-discovery methodology to facilitate the installation of on-street EV charge points. The applicant (London Power Networks plc/ Eastern Power Networks plc) received a derogation<sup>162</sup> to not comply with Licence Condition 13.1 of the Electricity Distribution Licence,
- Centrica Business Solutions UK Optimisation Ltd – testing new methodologies that will enable flexibility from storage heaters to be traded in the Balancing Mechanism in situations where the supply to the premises is not half-hourly settled. The applicant (Centrica Business Solutions UK Optimisation Ltd) received a temporary derogation<sup>163</sup> from the Balancing and Settlement Code (BSC).

After approval, trials must be completed within two years. OFGEM requires the innovators to provide them with regular updates during the trial. Innovators are required to maintain a risk management plan and provide regular updates to OFGEM throughout the trial process. At the end of each trial, the innovators must submit a feedback report.

OFGEM takes a cautious approach to granting derogations. Usually, generation, distribution or supply licenses with conditions originating from national legislation, or outside of OFGEM duties or functions cannot be derogated from.

OFGEM is also expanding the scope of the sandbox by adding two codes that can potentially be derogated from: the Balancing and Settlement Code (BSC) and the Distribution Connection Code (DCUSA). The Retail Energy Code (REC) will also build in sandbox flexibility and there may also be an extension in the number of rules in the supplier license which it can provide relief from. Trials will continue to be time limited but market entry sandboxes can receive support once an innovation is confirmed as permissible, and for as long as regulation continues to allow for it ( Schittekatte, Meeus, Jamasb, & Llorca, 2021). Table 28 summarises the main elements of the regulatory sandbox scheme in the UK.

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<sup>161</sup> [https://www.ofgem.gov.uk/sites/default/files/docs/2021/05/emergent - bsc sandbox derogation - 260521\\_002.pdf](https://www.ofgem.gov.uk/sites/default/files/docs/2021/05/emergent - bsc sandbox derogation - 260521_002.pdf)

<sup>162</sup> <https://www.ofgem.gov.uk/sites/default/files/2021-06/UKPN%20Confirmation%20of%20Consent.pdf>

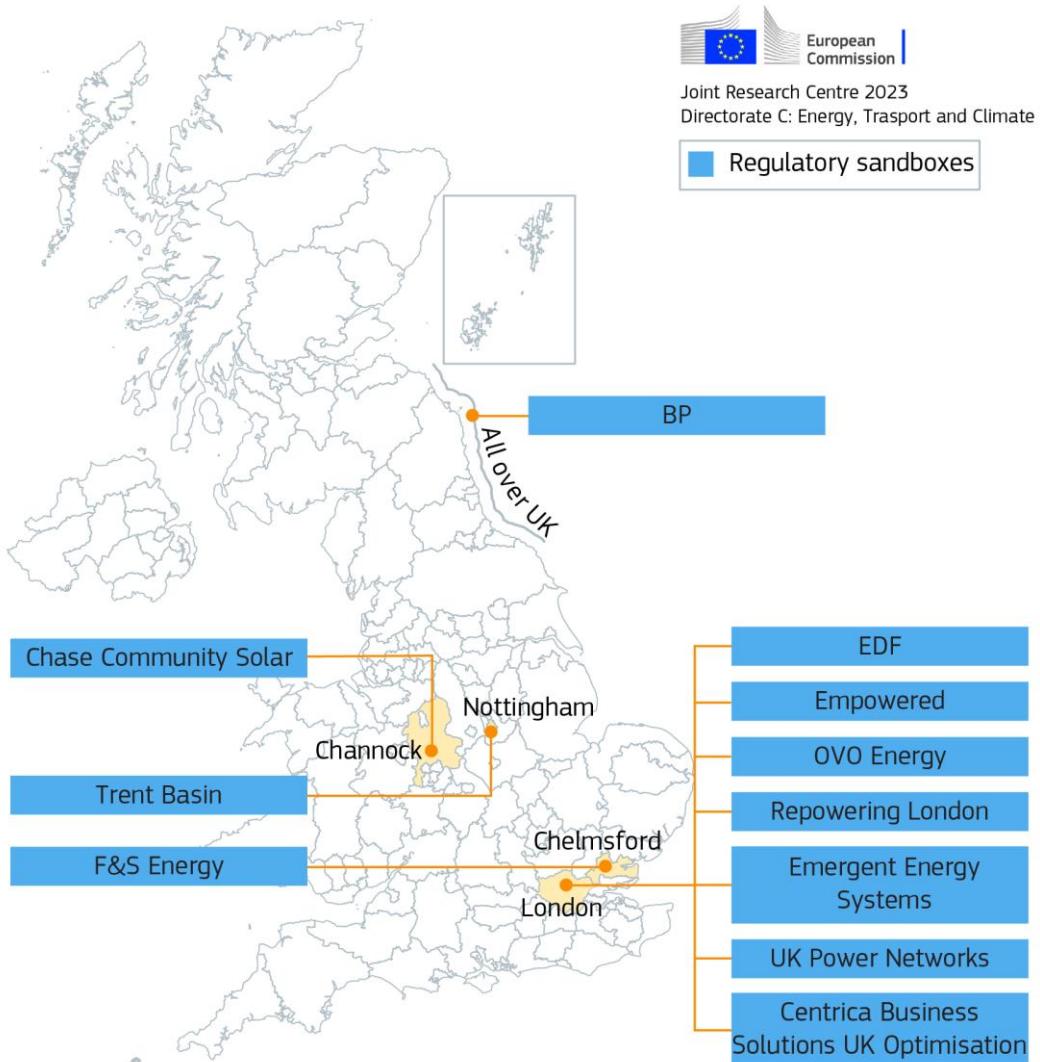
<sup>163</sup> <https://www.ofgem.gov.uk/sites/default/files/2022-02/Centrica%20Business%20Solutions%20UK%20Ltd%20-Sandbox%20derogation%20from%20the%20Balancing%20and%20Settlement%20Code.pdf>

**Table 28.** Regulatory sandbox in the United Kingdom

UNITED KINGDOM - Regulatory sandbox	
<b>Legal basis</b>	Innovation Link Program
<b>Brief description</b>	The sandbox is intended as a means of experimenting with ways of mitigating barriers innovators may face when implementing innovative solutions
<b>Areas of experimentation</b>	OFGEM has not set out a limit on the activities that could be granted a sandbox. Instead, the limits are a function of OFGEM's own legislative scope – i.e. energy sector activities to which OFGEM provides licenses
<b>Objectives</b>	To support innovators looking to trial or launch new products, services, methodologies or business models without the usual rules applying
<b>Derogations</b>	Open
<b>Length of derogations</b>	2 years, extensions are not possible
<b>Eligible project promoters</b>	Only open to licensed company (or collaboration with a licensed party)
<b>Knowledge sharing and obligations</b>	Regular updates and report.

*Source:* JRC, 2023

**Figure 32.** Location of regulatory sandbox projects in UK



## NORWAY

**Regulatory sandbox.** In 2019, the national regulatory authority NVE-RME, set up a regulatory sandbox scheme<sup>164</sup> to support the development of innovative projects that may lead to a more efficient power system. Such projects concern the testing of new solutions - including products, services, and processes – at small and large scale (pilot and demonstration projects, respectively).

The sandbox scheme provides two main services to project developers:

- information about rules and regulations applicable to innovative projects. Many innovative solutions can be tested within the existing legal framework, without the need to apply for a derogation. NVE-RME provides an enquiry service for project developers where the rules and regulations that apply in a specific case are clarified. Advice is provided through email and phone contacts with NVE-RME regulatory experts and during meetings where innovative projects can be presented and discussed,
- the possibility to apply for derogations. In case the extent of the trading license and/or the current regulatory framework do not allow the implementation of an innovative project, project coordinators can apply for derogations. NVE-RME has the authority to grant time-limited derogations from laws and regulations that fall within its regulatory mandate. In case an application is submitted for a derogation from a provision which is not under its regulatory mandate, NVE-RME can refer the project coordinators to the competent authority. There is no set list of provisions that can be temporarily derogated. All applications are evaluated on a case-by-case basis and derogations are granted if the proposed innovative solution can help the regulator to gain valuable knowledge and assess the need for regulatory change.

Over time, the regulator has defined an internal case handling guidance document to streamline and speed up the derogation process. To be granted a derogation from the existing regulatory framework, projects need to:

- provide valuable knowledge that can be used to inform regulatory change,
- bring benefits for network operators or for customers,
- demonstrate the project's usefulness,
- publish the results of the experimentation.

The scheme is open to all parties and the exemption can be granted for a maximum of 5 years. Funding is not provided under the sandbox scheme, but network companies can obtain cost coverage for certain R&D projects through the revenue regulation<sup>165</sup>, while funding is possible for all parties through different funding institutions (e.g. the Research Council of Norway, ENOVA<sup>166</sup>, SkatteFUNN and Innovation Norway).

So far (August 2022), the following 8 projects have benefited from the sandbox scheme (Figure 33), with a total of 11 exemptions granted. Applicants included DSOs, the TSO and 1 market operator.

- Vassinghaugen housing association project, application submitted by the DSO NTE Nett AS (collective self-consumption and community energy)<sup>167</sup>. The project will be carried out in a housing complex made of ten energy-efficient apartments. NTE Nett applied for a derogation to test a new solution for sharing surplus production from self-produced electricity between residents in the same building, and to test a new power tariff model (ToU). The exemption period began in 2019 and will last for five years,
- MikroFlex project, application submitted by the DSO Norgesnett AS<sup>168</sup> (collective self-consumption and community energy). The project aims to test various solutions for energy and power optimization in a district integrating residential, commercial and industrial buildings. It includes solutions like V2G, home smart management, storage, and the set-up of a local micro market for flexibility trading where available flexibility is bought and sold. Norgesnett applied for a derogation to test a new solution for sharing

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<sup>164</sup> NVE-RME, Framework for pilot and demonstration projects, <https://www.nve.no/reguleringsmyndigheten/bransje/bransjeoppgaver/pilot-og-demonstrasjonsprosjekter/>

<sup>165</sup> More information on the scheme is available at: <https://www.nve.no/reguleringsmyndigheten/bransje/bransjeoppgaver/finansieringsordning-for-fou/>

<sup>166</sup> ENOVA has already provided funding to 2 projects admitted to the sandbox, i.e. MikroFlex and NorFlex.

<sup>167</sup> NVE decision of 31 October 2019. Available at [https://www.nve.no/media/8679/201842836-3-dispensasjon-fra-plusskundebestemmelser-og-kravet-om-at-tariffene-skal-refereres-2872803\\_14\\_1.pdf](https://www.nve.no/media/8679/201842836-3-dispensasjon-fra-plusskundebestemmelser-og-kravet-om-at-tariffene-skal-refereres-2872803_14_1.pdf)

<sup>168</sup> NVE decision of MikroFlex: [https://www.nve.no/media/8678/dispensasjon-fra-plusskundebestemmelser-og-kravet-om-at-tariffene-skal-refereres-tilknytningsp-2954346\\_1\\_1.pdf](https://www.nve.no/media/8678/dispensasjon-fra-plusskundebestemmelser-og-kravet-om-at-tariffene-skal-refereres-tilknytningsp-2954346_1_1.pdf)

surplus self-produced electricity between residents. The derogation was granted in 2019 and will last for five years,

- eFleks project<sup>169</sup> (development of flexibility and balancing services), application submitted by the TSO Statnett. By way of derogation from current rules, the minimum bid size requirement for the capacity market for manual frequency restoration reserves (mFRR) was decreased from 5 MW to 1 MW. The aim of the project was to reduce the overall entry barrier for flexibility. The exemption period began in 2020 and lasted for 10 weeks,
- NorFlex project<sup>170</sup> (development of flexibility and balancing services). The goal of the project is to enable grid companies and Statnett as system administrator to gain access to the same distributed flexibility through a flexibility market without creating challenges for each other. By way of derogation from current rules, such flexibility can be offered with bid size down to 1 MW. Several applications for exemptions were submitted for this project: by Agder Energi (DSO) and Nett AS (DSO) for the period 2019–2021, by Statnett SF (TSO) for the period 2021–2022, and by Nodes AS, an independent market operator, for the period 2021–2022. The project is expected to increase liquidity and make participation in the market more attractive to new flexibility providers. Participation in the regulating power market takes place through NODES, an independent market operator offering local marketplaces for trading flexibility<sup>171</sup>,
- SmartNettleie project<sup>172</sup>, application submitted by the DSO Glitter Energy Net (electric vehicles). The pilot project will test a new tariff structure (ToU) to promote smart charging of electric vehicles during off-peak hours. As a derogation from the ordinary tariff system, household customers benefited from lower grid rent at night-time in winter. The exemption period began in 2020 and lasted for one year. The aim of the project was to increase the usage time in the network, by getting customers to add new consumption to low-load periods,
- Peak Load Pricing project<sup>173</sup> application submitted by the DSO Ringeriksraft Nett (tariff design). During the project, dynamic peak load pricing was offered to around 4000 household customers to test their reaction to price signals announced the day before by Short Message Service (SMS). The exemption period began in 2019 and lasted for one year,
- Active homes project<sup>174</sup>, application submitted by the DSO Elvia (tariff design). The project tested a new tariff structure for household customers, as well as different communication and engagement approaches, to promote consumption during off-peak periods. The project covered more than 10,000 household customers. The exemption period began in 2020 and lasted for one year,
- Fast Frequency Reserves project<sup>175</sup>, application submitted by the TSO Statnett SF (development of flexibility and balancing services). The project aimed to test the introduction of Fast Frequency Reserve (FFR), as a complement to the primary reserve for disturbances (FCR-D) to increase frequency stability in the national grid. By way of derogation from the existing rules, Statnett was enabled to start the experimentation without updating the guidelines that regulate the exercise of its tasks and responsibilities (its update would also require approval by NVE). The exemption period began in 2021 and lasted one year (with an additional requested dispensation extension for 3 months).

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<sup>169</sup> NVE decision of eFleks [https://www.nve.no/media/12603/202006825-1-dispensasjon-fra-systemansvarsforskriften-28a-for-pilot-i-regulerkraftmarkedet-3250547\\_7\\_1.pdf](https://www.nve.no/media/12603/202006825-1-dispensasjon-fra-systemansvarsforskriften-28a-for-pilot-i-regulerkraftmarkedet-3250547_7_1.pdf)

<sup>170</sup> NVE decision of 27 April 2021, available at [https://www.nve.no/media/12602/202104665-2-dispensasjon-fra-systemansvarsforskriften-28a-for-demonstrasjonsprosjektet-norfl-3564166\\_7\\_1.pdf](https://www.nve.no/media/12602/202104665-2-dispensasjon-fra-systemansvarsforskriften-28a-for-demonstrasjonsprosjektet-norfl-3564166_7_1.pdf); NVE decision of 17 December 2019, available at <https://www.nve.no/media/8969/godkjennung-av-utvidet-fou-ramme-for-prosjektet-norflex.pdf> and NVE decision on sales license and exemption from requirements for technical and financial reporting.

<sup>171</sup> NODES AS asked for a time limited trading license to sell balancing services in the market.

<sup>172</sup> NVE decision of 10 February 2020, available at [https://www.nve.no/media/9186/202000750-4-dispensasjon-fra-krav-i-forskrift-om-kontroll-av-nettvirkoshet-14-2-3058916\\_9\\_1.pdf](https://www.nve.no/media/9186/202000750-4-dispensasjon-fra-krav-i-forskrift-om-kontroll-av-nettvirkoshet-14-2-3058916_9_1.pdf)

<sup>173</sup> NVE decision of 13 November 2019, available at [https://www.nve.no/media/9958/201912295-2-dispensasjon-fra-forskrift-om-kontroll-av-nettvirkoshet-for-om-om-effektbasert-ne-2966528\\_5\\_1.pdf](https://www.nve.no/media/9958/201912295-2-dispensasjon-fra-forskrift-om-kontroll-av-nettvirkoshet-for-om-om-effektbasert-ne-2966528_5_1.pdf)

<sup>174</sup> NVE decision of 2 October 2020, available at [https://www.nve.no/media/11045/202009952-3-dispensasjon-fra-krav-i-forskrift-om-kontroll-av-nettvirkoshet-13-1-og-14-2-3300078\\_15\\_1.pdf](https://www.nve.no/media/11045/202009952-3-dispensasjon-fra-krav-i-forskrift-om-kontroll-av-nettvirkoshet-13-1-og-14-2-3300078_15_1.pdf)

<sup>175</sup> Fast Frequency Reserves [https://www.nve.no/media/12601/202001030-4-svar-p%C3%A5-s%C3%B8knad-om-%C3%A5-gjennomf%C3%B8re-demonstrasjonsprosjekt-for-fast-frequency-reserve-3466133\\_14\\_1.pdf](https://www.nve.no/media/12601/202001030-4-svar-p%C3%A5-s%C3%B8knad-om-%C3%A5-gjennomf%C3%B8re-demonstrasjonsprosjekt-for-fast-frequency-reserve-3466133_14_1.pdf)

The majority of projects involved the testing of flexibility solutions, new tariff models to improve pricing signals and solutions to support collective self-consumption by enabling consumers to share surplus electricity among themselves.

Table 29 summarises the main elements of the regulatory sandbox scheme in Norway.

**Table 29.** Regulatory sandbox in Norway

<b>NORWAY - Regulatory sandbox</b>	
<b>Legal basis</b>	-
<b>Brief description</b>	The scheme enables any party to carry out projects testing out new solutions – including products, services, and processes – at small and large scale. It provides two main services to project developers: – information about rules and regulations applicable to innovative projects; – the possibility to apply for derogations to provisions under the regulatory mandate of the NRA
<b>Areas of experimentation</b>	Not specified
<b>Objectives</b>	To support the development of innovative projects that may lead to a more efficient power system
<b>Derogations</b>	There is no set list of provisions that can be temporarily derogated. All applications are evaluated on a case-by-case basis and derogations are granted if the proposed innovative solution can help the regulator to gain valuable knowledge and assess the need for regulatory change
<b>Length of derogations</b>	5 years
<b>Eligible project promoters</b>	Any party
<b>Knowledge sharing obligations</b>	Final report with the results of the experimentation

*Source:* JRC, 2023

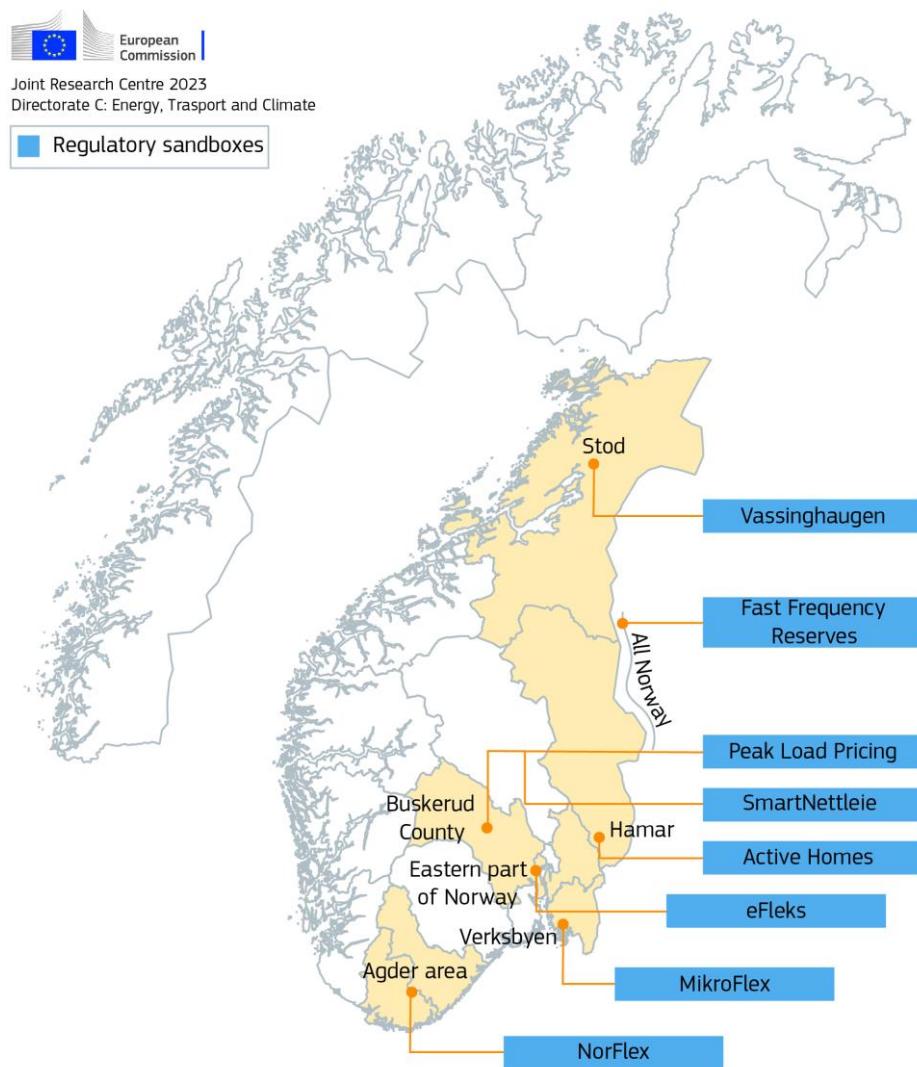
### **LESSONS LEARNED**

Contacts with the NRA revealed that the regulatory sandbox scheme has proven to be a valuable tool to foster innovation. The main challenge experienced so far is the lack of dedicated resources for the management and monitoring of the experimentations. The development of an internal case handling guidance document and the planned expansion of the team are expected to help to address this problem in the future.

A related challenge concerns the evaluation of the results of the experimentations. NVE-RME believes that an important step in this direction would be the identification of suitable indicators that would help to monitor the progress of the experimentations, to assess their contribution to the achievement of the project objectives and to inform the regulator on needed changes in existing rules and regulations. In this respect, progress and final reports could be an important tool in the hands of regulators as well as a way to ensure transparency and public support.

Based on the experience gained so far, NVE/RME believes that many projects can test innovative solutions within the existing legal framework, without the need to apply for derogations. The dialogue between the regulator and the project proponents can clarify many of the issues perceived as barriers to the development of innovative solutions.

**Figure 33.** Location of regulatory sandbox projects in Norway



Source: JRC, 2023

## **OUTSIDE EUROPE**

### **AUSTRALIA**

Australia is currently working on implementing its regulatory sandbox program. In March 2019 the Australian Energy Market Commission (AEMC) published an interim advice<sup>176</sup> recommending the introduction of a regulatory sandbox toolkit in the national energy market to enable businesses to develop and trial innovative energy technologies and business models. A final report<sup>177</sup> was published in September 2019. In November 2021, the Australian Energy Regulator (AER) released an issues paper<sup>178</sup>, seeking feedback on the proposed regulatory sandbox toolkit. A deadline of January 2022 was set for stakeholders, energy consumers and other interested parties to submit their suggestions.

According to the guidelines, the sandbox toolbox includes three components:

- an Innovation Enquiry Service (IES) that will provide innovators with guidance from the AER and other market bodies on how their new technologies or business models can be delivered under the current regulatory framework,
- a trial waiver that allows the AER to grant a time limited trial waiver for eligible trial projects, exempting an innovator from having to comply with specified rules for a period of time to allow a trial to proceed,
- a trial rule change process that allows the AEMC to temporarily change existing rules or introduce a new rule to allow a trial to proceed.

The IES service is referred to a 'first-stop-shop' as opposite to the 'one-stop-shop' approach implemented by OFGEM in the UK, to avoid the need for one market body to provide service on behalf of other market bodies. The tool will be open to all innovators and can provide a first step towards access to the other regulatory sandbox tools.

To be granted a trial waiver, a project must meet the following requirements: - be genuinely innovative; - have the potential to lead to better services and outcomes for consumers; - be unable to be conducted without a trial waiver; - be appropriately limited in time, scope and scale; - maintain adequate consumer protections; - meet any other requirements specified in the trial projects guidelines.

For a trial rule to be granted, the AEMC must agree that: - the trial rule will or is likely to contribute to the achievement of the relevant energy objective(s); - the trial project is genuinely innovative; - the trial project has the potential to lead to better services and outcomes for consumers.

In April 2022, the AER published a draft Trial Projects Guideline and explanatory statement<sup>179</sup> for consultation. Submissions were due in June 2022.

The IES can be implemented without deviations to the regular framework, being scheduled to launch in Q2 2022. The other two tools, which require changes to the 'Energy Laws' as well as more detailed provisions to be made under the 'Energy Rules', will be open once the legislation is passed.

Trial waivers and trial rules have a maximum duration of 5 years with extensions likely to be suitable in very limited circumstances.

The innovators will be required to share the learnings from their trials, with regular progress reports, and a final report will need to be submitted to the AER at the end of the trial.

The sandbox toolkit resembles the approaches adopted by OFGEM in the UK and OEB in Canada, both offering two types of services: an information service and a trial project support.

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<sup>176</sup> AEMC, Regulatory sandbox arrangements, Interim Advice, 7 March 2019 <https://www.aemc.gov.au/sites/default/files/2019-03/Interim%20Advice%20-%20REGULATORY%20SANDBOXES%20-%20for%20publication.pdf>

<sup>177</sup> AEMC, Regulatory sandbox arrangements to support proof-of-concept trials, Final report, 26 September 2019 <https://www.aemc.gov.au/sites/default/files/2019-09/Regulatory%20sandbox%20toolkit%20-%20Final%20Report.pdf>

<sup>178</sup> AER, Regulatory Sandboxing Issues Paper, November 2021, <https://www.aer.gov.au/system/files/AER%20-%20Regulatory%20Sandboxing%20-%20Issues%20Paper%20-%20Final.pdf>

<sup>179</sup> Trial projects guidelines - Regulatory sandboxing, <https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/trial-projects-guidelines-regulatory-sandboxing/draft>

## CANADA

In January 2019 the Ontario Energy Board (OEB), launched its Innovation Sandbox<sup>180</sup>. The program aimed to engage and assist innovators interested in testing new energy-related ideas, services and business models that would benefit and bring value to consumers and the grid.

The initiative was open to regulated and unregulated businesses, but unregulated applicants are encouraged to partner with a regulated company. Interested companies can apply any time; no fixed deadlines being set.

The sandbox program provides two services:

- an information service where innovators can get in contact with the OEB staff and address their questions regarding the regulatory framework and how it applies to their idea or concept,
- a project-specific support where the innovators wish to move forward with a specific innovation project. During this process, the OEB staff can provide written guidance on the regulatory requirements or assistance in requesting a temporary relief from a regulatory requirement.

To be eligible for a project-specific support, a project must meet the following criteria<sup>181</sup>: - support consumer value and protection; - maintain or enhance the resilience/ reliability of the grid; - recognise carbon pricing and net zero mandates; - relate to a regulatory barrier for which OEB can provide support; - have the potential for scalability and economic viability.

Since the start of the program, OEB has receive over 50 inquiries (ISGAN, 2021).

Lessons learned<sup>182</sup>:

- twenty applicants approached the sandbox in the first 6 months of its launch, majority of these were non-utility businesses,
- most of the applicants contacted the OEB staff for information and guidance about whether their project was already permitted by the current regulatory framework. Discussions with the OEB staff helped to clarify what is permitted and what not,
- themes for inquiry included: - licensing and OEB code for various activities, - questions related to distributed energy resources and what services and activities are within the purview of a licensed distributor to provide, - customer billing,
- some applications were related to requirements that the regulator could not provide relief from.

In January 2022, the OEB published a report called 'Innovation Sandbox 2.0'<sup>183</sup> to support new ideas and technologies.

The new sandbox program will look for strategies to improve transparency, communication and information sharing. The OEB will explore funding and government partnership opportunities.

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<sup>180</sup> <https://www.oeb.ca/newsroom/2019/oeb-innovation-sandbox-seeks-ideas-benefit-consumers>

<sup>181</sup> [https://www.oeb.ca/\\_html/sandbox/process.php](https://www.oeb.ca/_html/sandbox/process.php)

<sup>182</sup> [https://www.oeb.ca/\\_html/sandbox/reporting-1.php](https://www.oeb.ca/_html/sandbox/reporting-1.php)

<sup>183</sup> OEB Innovation Sandbox 2.0, January 2022, <https://www.oeb.ca/sites/default/files/report-innovation-sandbox-2.0-20220131.pdf>

## SINGAPORE

The Energy Market Authority (EMA) of Singapore launched a regulatory sandbox scheme<sup>184</sup> to encourage energy innovation for the benefit of consumers already in 2017. The sandbox program complements the Energy R&D initiatives, providing a platform for R&D projects to be tested on a wider scale.

For a proposal to be accepted for the regulatory sandbox it needs to fulfil the evaluation criteria. The application should demonstrate that it: - uses technologies/ products in an innovative way; - addresses a problem or brings benefits to consumers and/or the energy sector; - requires some changes to existing rules; - is ready to be tested; - has defined boundary conditions; - has defined monitoring and evaluation procedure; - has assessed and mitigated foreseeable risks; - has a defined exit/ or transition strategy. Each application will be reviewed and approved on a case-by-case basis.

The program is open for, but not limited to, technology firms, stakeholders and licensees in the energy and gas sectors.

The EMA has the ability to create regulations and apply exemptions related to codes of practice, electricity market rules and licensing conditions for electricity and gas licensees.

All applicants must submit, in a pre-determined format, progress reports to EMA in agreed intervals.

Following a review<sup>185</sup> of the initiative in 2018, the EMA introduced thematic sandboxes, where applicants are expected to address challenge statements provided by EMA. For ideas unrelated to the challenge statements, companies can still apply via the generic sandbox. The number of projects implemented is unknown.

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<sup>184</sup> Framework for a regulatory sandbox for the energy sector in Singapore, 23 October 2017, [https://www.ema.gov.sg/cmsmedia/EMA%20Regulatory%20sandbox%20-%20Final%20Determination%20Paper\\_Final.pdf](https://www.ema.gov.sg/cmsmedia/EMA%20Regulatory%20sandbox%20-%20Final%20Determination%20Paper_Final.pdf)

<sup>185</sup> Framework for a regulatory sandbox for the energy sector in Singapore, Version 2.0, 3 December 2019, <https://www.ema.gov.sg/cmsmedia/Consultations/Electricity/2019/PD/Regulatory%20Sandbox%20Framework%20-%20Version%202.0.pdf>

### **Annex 3. Questionnaire**

#### **Q.1 - Current and foreseeable regulatory experimentation initiatives in the energy sector**

1. Does your jurisdiction provide a legal basis (i.e. an experimental clause) to set up regulatory experimentation initiatives?

Yes       No

If yes, please specify.....

2. If you answered yes to the previous question, which is/are the competent authority/ies for the set-up and implementation of regulatory experimentation initiatives?

.....

3. Mark the fields where your jurisdiction has adopted/is considering the adoption of regulatory experimentation initiatives:

- Flexibility and balancing services.
- Collective self-consumption & community energy.
- Electromobility.
- Storage.
- Power-to-X.
- Smart grids.
- RES connection to electricity networks.
- Tariff design.
- Other (please specify) .....

4. What type of regulatory experimentation is in place/under consideration?

- Pilot projects.
- Regulatory sandboxes.
- Pilot regulation.
- Other (please specify) .....

5. What are the main regulatory impediments that require(d) the set-up of a regulatory experimentation initiative?

.....

6. Why regulatory experimentation has been deemed necessary, instead of setting directly new regulation? What are the potential risks requiring containment?

.....

7. What form of support and/or guidance at EU level would you find more relevant (please select max 2 options)?

- Setting fora / platforms / communities of practice for the sharing of knowledge and best practices.

- EU guidelines on regulatory experimentation.
- Sectoral legislation providing for the set-up of national regulatory experimentation initiatives.
- Pan-EU regulatory experimentation (if yes, please specify the topic): .....
- Other (please specify) .....

8. What are, in your opinion, the main benefits of an EU-wide framework for regulatory experimentation (please select max 2 options)?

- Promoting knowledge sharing and leverage on the results of testing already undertaken in other jurisdictions.
- Avoiding jeopardizing the EU climate and energy goals.
- Avoiding fragmentation of the EU single market.
- Preventing the creation of unlevelled playing fields or regulatory arbitrages.
- Ensuring a uniform level of consumer protection throughout Europe.
- Other (please specify) .....

## **Q. 2 - Perceived obstacles, difficulties, limitations, risks and benefits relating to the set-up and/or implementation of national regulatory experimentation initiatives**

1. Main obstacles (please select max 2 options)

- Absence of a legal basis (i.e. an experimental clause) to set up regulatory experimentation initiatives.
- The competence to set up and/or manage a regulatory experimentation initiative is spread among different administrations.
- Lack of resources and/or competencies required by the management and/or monitoring of the experimentation.
- Some provisions (e.g. deriving from EU law) cannot be derogated.
- Other (please specify) .....

Please add more details: .....

2. Main difficulties (please select max 2 options)

- Timing – The set-up of regulatory experiments requires timely and scrupulous planning to make sure that the experimentation leads to effective and fruitful changes in current regulation.
- Regulatory learning - Difficulty in defining suitable indicators/a rigorous methodology to measure the experimentation results.
- Orchestration - Need to coordinate between different stakeholders and administrations in the implementation, management and regulatory learning phases.
- Transparency - Ensuring transparency while protecting innovators' confidentiality.
- Other (please specify) .....

Please add more details: .....

3. Main limitations (please select max 2 options)

- Limited validity of the experimentation results.
- Unsatisfactory distribution of benefits.
- Regulatory experimentation alone may not suffice – Need for public funding.
- Other (please specify) .....

Please add more details: .....

4. Main potential risks (please select max 2 options)

- Risk of the tests causing harm to consumers.
- Risk of disrupting competition.
- Technological non-neutrality.
- Other (please specify) .....

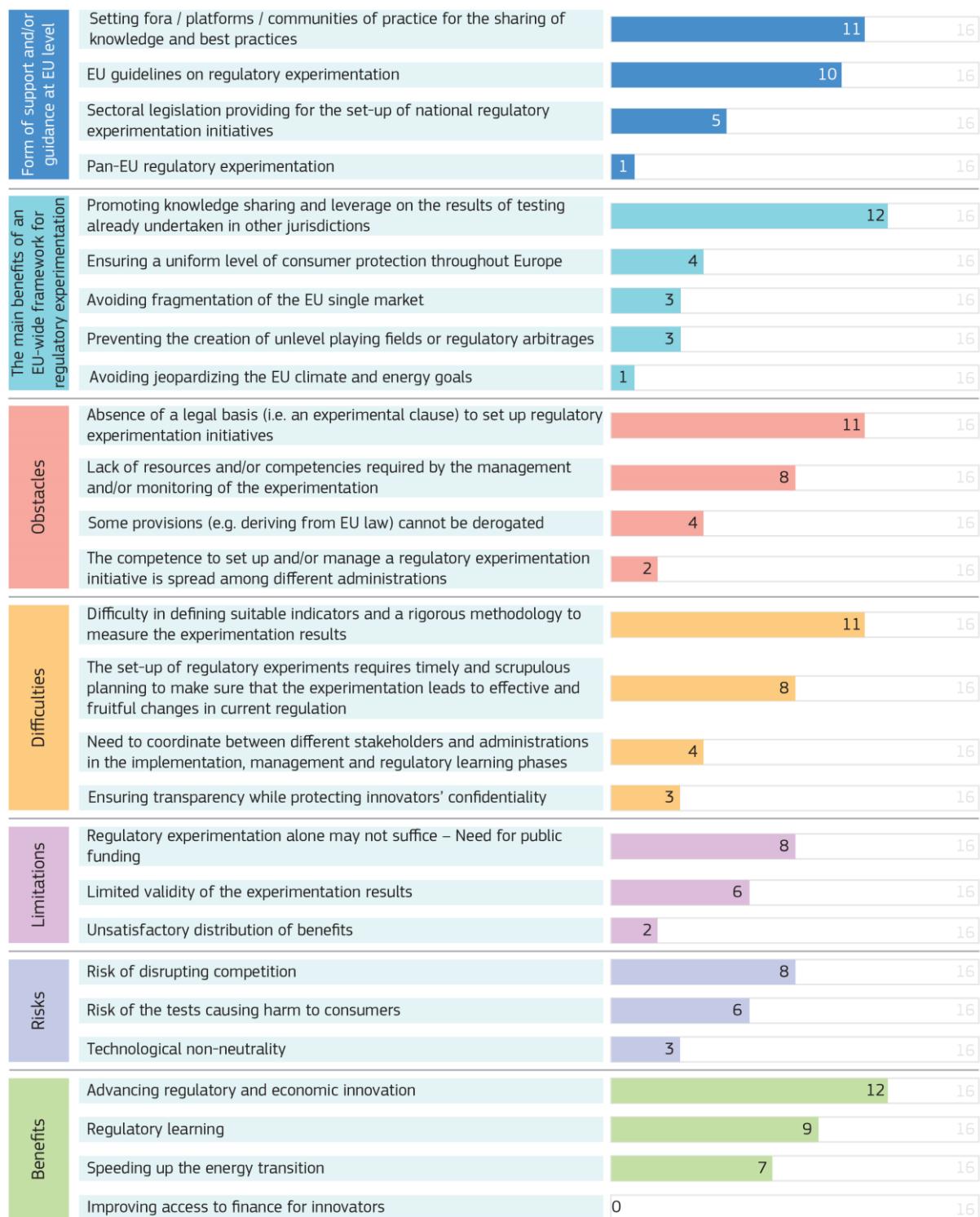
Please add more details: .....

5. Main expected benefits (please select max 2 options)

- Advancing regulatory and economic innovation.
- Speeding up the energy transition.
- Regulatory learning.
- Improving access to finance for innovators.
- Other (please specify) .....

Please add more details: .....

#### Annex 4. Questionnaire answers



## **GETTING IN TOUCH WITH THE EU**

### **In person**

All over the European Union there are hundreds of Europe Direct centres. You can find the address of the centre nearest you online ([european-union.europa.eu/contact-eu/meet-us\\_en](http://european-union.europa.eu/contact-eu/meet-us_en)).

### **On the phone or in writing**

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- at the following standard number: +32 22999696,
- via the following form: [european-union.europa.eu/contact-eu/write-us\\_en](http://european-union.europa.eu/contact-eu/write-us_en).

## **FINDING INFORMATION ABOUT THE EU**

### **Online**

Information about the European Union in all the official languages of the EU is available on the Europa website ([european-union.europa.eu](http://european-union.europa.eu)).

### **EU publications**

You can view or order EU publications at [op.europa.eu/en/publications](http://op.europa.eu/en/publications). Multiple copies of free publications can be obtained by contacting Europe Direct or your local documentation centre ([european-union.europa.eu/contact-eu/meet-us\\_en](http://european-union.europa.eu/contact-eu/meet-us_en)).

### **EU law and related documents**

For access to legal information from the EU, including all EU law since 1951 in all the official language versions, go to EUR-Lex ([eur-lex.europa.eu](http://eur-lex.europa.eu)).

### **Open data from the EU**

The portal [data.europa.eu](http://data.europa.eu) provides access to open datasets from the EU institutions, bodies and agencies. These can be downloaded and reused for free, for both commercial and non-commercial purposes. The portal also provides access to a wealth of datasets from European countries.



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EU Science Hub



EU Science



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