

# Output report

## WP 2 – Pilot H2 Regulatory Sandbox

### D.2.1.1 – Design plan

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## 1 ABSTRACT / POVZETEK / ZUSAMMENFASSUNG

### Abstract

*In the energy sector, regulatory sandboxes play a crucial role in fostering innovation by lowering entry barriers for breakthrough technologies, enhancing competitiveness, and enabling safe testing of new solutions in a controlled environment. As part of accelerating the transition to a hydrogen-based economy, we will establish the H2GreenFUTURE regulatory sandbox, which will involve all quadruple helix stakeholders: businesses, educational and research institutions, policymakers, and civil society. The aim of the sandbox is to address legislative and regulatory challenges related to hydrogen technologies through a structured process that includes identifying stakeholder challenges, conducting sandbox simulations, and holding a Policy Forum. Based on these activities, we will develop concrete legislative recommendations to support the rapid and safe deployment of hydrogen technologies.*

### Povzetek

*V energetskega sektorja imajo regulatorni peskovniki ključno vlogo pri spodbujanju inovacij, saj zmanjšujejo vstopne ovire za razvoj prebojnih tehnologij, povečujejo konkurenčnost in omogočajo varno testiranje novih rešitev v nadzorovanem okolju. V okviru pospeševanja prehoda na vodikovo gospodarstvo bomo vzpostavili regulatorni peskovnik H2GreenFUTURE, ki bo vključeval vse deležnike četverne vijačnice: podjetja, izobraževalne in raziskovalne institucije, zakonodajalce ter civilno družbo. Namen peskovnika je naslavljanje zakonodajnih in regulativnih izzivov na področju vodikovih tehnologij preko strukturiranega procesa, ki vključuje identifikacijo izzivov, izvedbo simulacije peskovnika in razpravo v okviru Policy Forum. Na podlagi teh aktivnosti bomo oblikovali konkretna zakonodajna priporočila za pospešeno in varno uvajanje vodikovih tehnologij.*

### Zusammenfassung

*Im Energiesektor spielen regulatorische Sandkästen eine entscheidende Rolle bei der Förderung von Innovationen. Sie senken Markteintrittsbarrieren für bahnbrechende Technologien, stärken die Wettbewerbsfähigkeit und ermöglichen das sichere Testen neuer Lösungen in einem kontrollierten Umfeld. Im Rahmen der Beschleunigung des Übergangs zu einer wasserstoffbasierten Wirtschaft werden wir den regulatorischen Sandkasten H2GreenFUTURE einrichten, der alle Akteure der Vierfachhelix einbezieht: Unternehmen, Bildungs- und Forschungseinrichtungen, Gesetzgeber sowie die Zivilgesellschaft. Ziel des Sandkastens ist es, gesetzgeberische und regulatorische Herausforderungen im Bereich der Wasserstofftechnologien durch einen strukturierten Prozess anzugehen, der die Identifikation von Herausforderungen, die Durchführung einer Sandkastensimulation und die Diskussion im Rahmen eines Policy Forums umfasst.*

*Auf Basis dieser Aktivitäten werden wir konkrete gesetzgeberische Empfehlungen für die schnelle und sichere Einführung von Wasserstofftechnologien entwickeln.*

## 2 Description of the output and content

Innovations today largely remain within the boundaries of operational improvements to networks and systems. It is increasingly evident that a truly meaningful step forward requires a more open and progressive regulatory approach. Only through such an approach can the development of new technologies be accelerated, the effective digitalization of the energy system enabled, and transparency improved — all of which are crucial to achieving the European goals for sustainable transformation.

The EU Agency for the Cooperation of Energy Regulators (ACER) highlights that it is precisely the regulatory environment that can unlock the potential for new solutions and approaches [1]. To make this possible, smart regulation must be developed — one that is based on real data and practical experience [2]. Citizens and companies alike need a supportive environment that facilitates a unified, competitive, and well-functioning EU energy market. The European Union and its Member States play a key role in this process, as they have the ability to introduce innovative regulatory tools that promote development within otherwise strictly regulated sectors [3].

One of the most effective tools of this kind are regulatory sandboxes. These allow new ideas, technologies, and business models to be tested in practice, within a controlled environment specifically designed for experimentation [4].

Regulatory sandboxes are purpose-built frameworks that enable the real-world testing of innovative technologies, services, products, or approaches when appropriate. They are time-limited and content-specific testing environments within defined sectors or areas, conducted under the supervision of relevant regulatory authorities. This approach enables the controlled introduction of innovations while ensuring a sufficient level of participant protection and the prevention of systemic risks [5].

Participation in sandboxes is open to both regulated entities and other market actors. These participants may propose concrete projects and submit requests for temporary exemptions from existing regulations [6].

In the energy sector, regulatory sandboxes have particular significance. They lower entry barriers for companies developing breakthrough technologies, strengthen competitiveness, and enable faster testing of new solutions — all while safeguarding end-users by identifying and managing risks early in the process [7, 8, 9, 10].

To accelerate the transition to hydrogen technologies, we will create a regulatory sandbox, involving all stakeholders of the quadruple helix model — businesses, educational and research institutions, legislative bodies, and civil society (supporting organizations, students, and other interested parties).

The H2GreenFUTURE sandbox will address legal and regulatory challenges related to hydrogen technologies by first identifying stakeholder concerns and then tackling these through sandbox simulations and a Policy Forum, where the simulation outcomes will be discussed and used to develop legislative recommendations.

## 3 Output report

### 3.1 Context

In recent years, the energy transition has been rapidly shifting toward renewable sources, with hydrogen playing a key role as an energy carrier. However, the development of hydrogen technologies is often hindered by rigid regulatory frameworks, a lack of testing environments, and uncertainty regarding legislative approaches. Regulatory sandboxes present an innovative response to these challenges, enabling new solutions to be tested in a safe and controlled environment with minimal risk while providing valuable insight into necessary legal changes.

The H2GreenFUTURE project recognizes the need for a systemic approach and the establishment of interdisciplinary cooperation between stakeholders from Slovenia and Austria to accelerate the deployment of hydrogen technologies. The establishment of a regulatory sandbox within WP2 represents a breakthrough initiative in this field and lays the groundwork for future transnational regulatory instruments.

### 3.2 Brief description of the state of the art

Regulatory sandboxes are well-known tools worldwide, typically implemented as testing grounds for technical solutions without “regulators.” In our case, however, we will address legislative frameworks to accelerate research and development of technologies in a broader sense. The H2GreenFUTURE regulatory sandbox will not focus solely on technical challenges but will also address challenges related to business development, investments, and legislative barriers that prevent or hinder hydrogen technologies from reaching their full potential in the interregional area of Slovenia and Austria.

### 3.3 Results obtained – Design plan

A regulatory sandbox is a tool that enables controlled testing of innovative products, technologies, or business models in a real environment but with limited risks. The purpose of the sandbox is to obtain concrete evidence on how the innovation works, what results it delivers, and how it can be integrated into the existing market and regulatory framework.



Regulatory sandboxes are especially important in the financial and technological sectors, where new technologies and business models require adaptation or development of regulatory frameworks. The

sandbox allows testing how innovations affect the market and public from potential negative effects.




### 3.3.1 Key elements of designing a regulatory sandbox

A regulatory sandbox typically includes five basic elements that can be adapted depending on the project's goals and environment. These elements are:

- Eligibility
- Governance
- Timeframe
- Testing limitations
- Exit options

Design Element	Purpose	H2GreenFUTURE approach
<b>Eligibility</b> 	Define who is eligible to participate in the sandbox to ensure fairness, openness, and focus on relevant innovations.	<ul style="list-style-type: none"> <li>- The sandbox is open to all interested stakeholders who meet basic criteria such as technological relevance, regulatory compliance, and readiness to participate.</li> <li>- Participants must sign a cooperation statement outlining their rights and obligations within the sandbox.</li> <li>- Special attention is given to smaller companies and startups, which can be key drivers of innovation.</li> </ul>
<b>Governance</b> 	Ensure a clear structure regulating the sandbox process, roles, and responsibilities of all involved parties.	<ul style="list-style-type: none"> <li>- Leadership level: Project Director and Steering Committee responsible for strategy, monitoring implementation, and making key decisions.</li> <li>- Operational level: Project manager, legal experts, technical specialists, risk analysts, and communication team managing day-to-day operations.</li> <li>- External stakeholders: Regulators, industry partners, research</li> </ul>



		inst implementation and regulatory proposals.
<b>Timing</b> 	<p>Define milestones for sandbox phases to ensure effective management and clear progress tracking.</p>	<ul style="list-style-type: none"> <li>- Preparation and launch of the sandbox (November 2024)</li> <li>- Application submission and participant selection</li> <li>- Sandbox implementation: challenge assessment phase and challenge addressing phase</li> <li>- Results analysis and report preparation</li> <li>- Sandbox closure and proposals for further actions</li> </ul>
<b>Test restrictions</b> 	<p>Limit the scope, impact, and duration of testing to reduce risk for all stakeholders and ensure legal compliance.</p>	<ul style="list-style-type: none"> <li>- Clearly define limits on the number of participants, geographical area, and types of stakeholders.</li> <li>- Clearly define the process, timeline, and objectives of the regulatory sandbox.</li> </ul>
<b>Exit</b> 	<p>Define clear procedures for ending participation of individual participants or the entire sandbox.</p>	<ul style="list-style-type: none"> <li>- Participants may exit with prior notice and completion of exit procedures.</li> <li>- Testing may be terminated early in case of non-compliance or risks.</li> <li>- After closure, results are analyzed and recommendations for further actions are prepared.</li> </ul>

### 3.3.2 Operational Structure

#### Leadership Level:

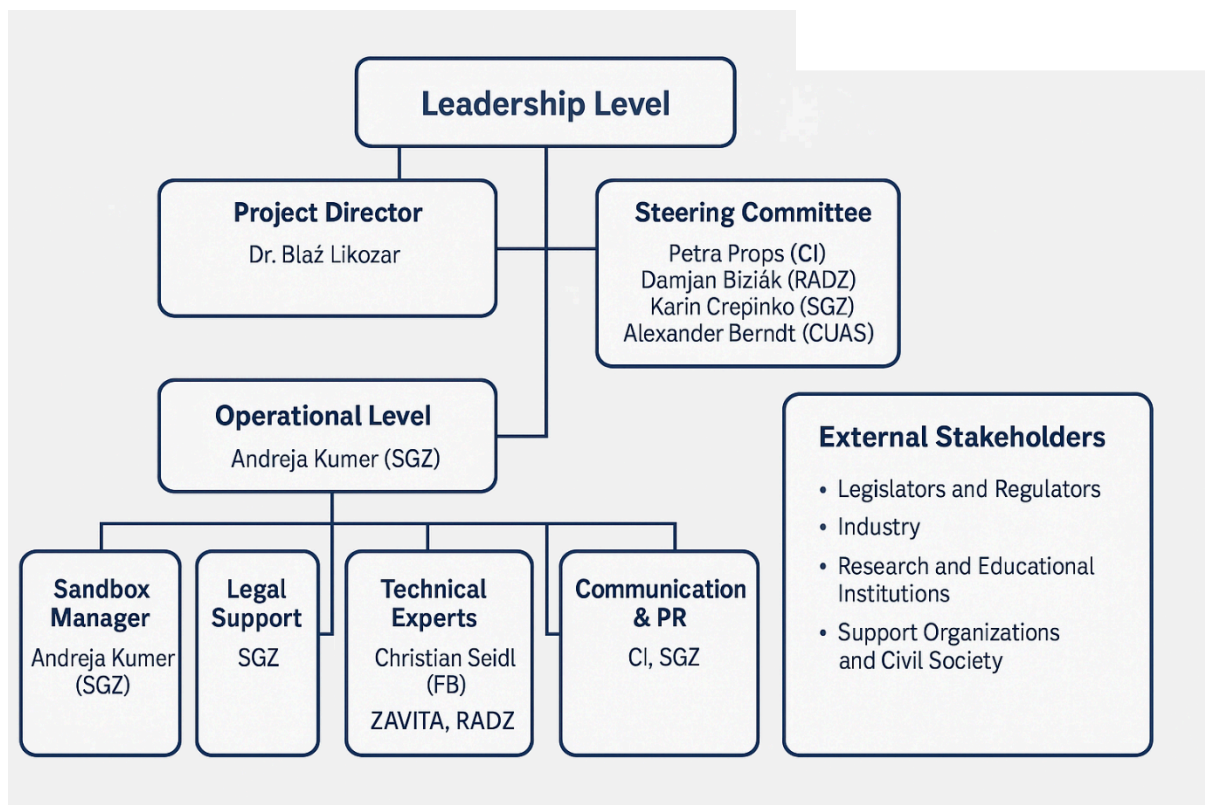
- Project Director: Responsible for the strategic management of the sandbox, overall direction, and liaising with external institutions (e.g., legislators, regulators, researchers, industry partners): Dr. Blaž Likozar
- H2GreenFUTURE Steering Committee: Composed of representatives from project partners. The committee sets guidelines, defines priorities, and monitors implementation: Petra Props (CI), Damjan Bizjak (RADZ), Karin Črepinko (SGZ), Alexander Berndt (CUAS), Christian Seidl (FB)

#### Operational Level:

- H2GreenFUTURE Sandbox Manager: Responsible for daily management and coordination of activities within the sandbox and reporting to the leadership level: Andreja Kumer (SGZ)
- Legal Support: A team of legal experts providing support on legislative research and addressing operational legal challenges: SGZ
- Technical Experts on Hydrogen Technologies: A group of specialists working on the development and testing of hydrogen technologies within the sandbox: JURE (CI), Christian Seidl (FB)
- Risk and Compliance Analysts: A team analyzing potential risks and ensuring that tests comply with applicable legal and safety guidelines: ZAVITA, RADZ
- Communication and PR: A group responsible for communicating achievements, insights, and plans, as well as engaging with the public and other stakeholders: CI, SGZ

#### External Stakeholders – Categorized into Four Groups Based on the Quadruple Helix Model:

- Legislators and Regulators
- Industry
- Research and Educational Institutions
- Support Organizations and Civil Society



Slika 1: Operational structure

### 3.3.3 H2GF Stakeholder Committee (WP2)

#### Composition

The H2GreenFUTURE project stakeholder committee is composed of stakeholders from the hydrogen ecosystem in Slovenia and Austria. Stakeholders are categorized into: industry, research and development institutions or academia, educational institutions, legislative or regulatory bodies, and other relevant stakeholders.

Participating stakeholders choose the area(s) in which they wish to collaborate, i.e., in pilot implementation, legislation and regulations, education, or all three areas.

#### Purpose

The stakeholder committee is intended to establish a functional hydrogen technology ecosystem. We recognize that fostering development and innovation in this field requires a supportive legislative and regulatory environment. Therefore, the stakeholder committee will participate in the regulatory sandbox, where we will gather stakeholder challenges related to legislation and test proposed

solutions in practice. The collected results will then be presented to Austria.

### Meeting Frequency

At least twice a year.

### Approach

Stakeholders join by signing an electronic accession statement, available at: [https://docs.google.com/forms/d/1i5GeqbAEtR9Md-2vJ\\_GQdw2RDCUR4Cn9rGlo9XH2atl/edit](https://docs.google.com/forms/d/1i5GeqbAEtR9Md-2vJ_GQdw2RDCUR4Cn9rGlo9XH2atl/edit).

Withdrawal is possible by submitting a written resignation statement.

### Communication

Participating stakeholders will receive meeting invitations by email, along with other relevant information on hydrogen technologies. Additionally, we will utilize the communication channels of H2GreenFUTURE and the Hydrogen Center platform (hydrogen-center.eu).

#### 3.3.4 Process

Step	Activity Description	Timeframe
<b>1. Definition of areas and objectives</b>	Identification of key technological and regulatory challenges and priorities for testing. Collaboration with the committee.	December 2024 – February 2025
<b>2. Stakeholder engagement</b>	Establishment of mechanisms for involving partners from industry, legislation, research, and the public.	Ongoing
<b>3. Preparation of rules and guidelines</b>	The regulatory sandbox leadership develops guidelines and implements methods for identifying and addressing detected challenges.	April – June 2025
<b>4. Planning of testing or simulation</b>	Planning the execution of the H2GreenFUTURE regulatory sandbox simulation.	August – September 2025
<b>5. Testing execution</b>	Implementation of the sandbox simulation within the framework of the Interregional Congress and Policy Forum.	September 2025 – January 2026

<b>6. Results analysis</b>	Evaluation of collected data and preparation of recommendations for improving the regulatory framework.	2026
<b>7. Preparation of final reports</b>	Compilation of detailed reports for legislators and the public, presentation of proposals for legislative changes.	May – July 2026
<b>8. Monitoring and adjustments</b>	Ongoing monitoring of the effects of implemented changes, regular updating of sandbox guidelines and strategies.	As needed, continuous
<b>9. Communication and PR</b>	Active informing of the public and stakeholders about progress, achievements, and results to strengthen transparency.	Ongoing

### 3.4 Impact of the results

The developed Design Plan of the regulatory sandbox will play a crucial role in ensuring the high quality of results by precisely defining the methodology, activity flow, and criteria for evaluating success. This will enable the acquisition of a realistic and comprehensive insight into the field under consideration, which is essential for developing effective and practical solutions. Additionally, the Design Plan will serve as a guide for all participating stakeholders, contributing to coordinated and efficient collaboration.

The interdisciplinary approach, based on the quadruple helix model, will facilitate a broad and multi-layered examination of the problematic area. Collaboration among researchers, industry, regulators, and civil society will contribute to better identification of challenges while enabling the development of innovative solutions that consider various aspects of technology, legislation, societal needs, and economic possibilities. Such a holistic approach will support the sustainable and successful development and implementation of the technologies addressed by the sandbox.

### 3.5 Deviation from the objective and corrective actions

The goal is to actively involve key stakeholders from both Slovenia and Austria to ensure a comprehensive and balanced approach to the development and implementation of the H2GreenFUTURE initiative. Due to observed lower interest and engagement regarding legislation and regulatory matters on the Austrian side, during the challenge collection phase we decided to also gather data related to Austria through Slovenian stakeholders who are active in the Austrian market.

These stakeholders include companies, research institutions, and educational organizations that either operate, conduct research, or provide education within Austria. This approach allows us to gain a better understanding of the specific challenges and needs within the Austrian context, while also establishing a bridge between the two countries for more effective exchange of knowledge, experience, and best practices. With this in mind, we aim to increase Austrian stakeholder engagement in the subsequent phases of the project and ensure that their perspectives and challenges are adequately addressed.

### 3.6 Innovation brought and progress

Special Features and Innovations of the H2GreenFUTURE Sandbox:

- **Interdisciplinary Approach:** The sandbox brings together technological, legal, and regulatory experts as well as civil society for a comprehensive approach to challenges.
- **Focus on Hydrogen Technologies:** The sandbox aims to accelerate the development of environmentally friendly hydrogen solutions with an emphasis on sustainable development.
- **Involvement of Regional Stakeholders from Slovenia and Austria:** Connecting stakeholders from Slovenia and Austria represents a holistic approach to addressing challenges. Collaboration with local institutions, research centers, and industry ensures greater efficiency and practicality of tests.
- **Flexibility:** The design plan allows for rapid adaptation to new technological trends and changes in the regulatory environment.
- **Sandbox Implementation Without Testing Infrastructure:** The H2GreenFUTURE regulatory sandbox is a novelty in Slovenia and Austria, so infrastructure for conventional testing facilities is not established. The sandbox will be conducted through consultations, interactive

workshops, and roundtables to identify stakeholder challenges and addressing them.

- **Addresses Comprehensive Challenges:** The H2GreenFUTURE regulatory sandbox focuses on a holistic approach to challenges related to the introduction and expansion of the technology — not only technical, but also regulatory, legal, organizational, and systemic aspects.

## 4 Conclusion

The Design Plan for the H2GreenFUTURE regulatory sandbox is a strategic document that outlines the methodology, structure, and timeline for the implementation of the first hydrogen technology sandbox in Slovenia and Austria. With an approach based on the quadruple helix collaboration model (industry, academia, public authorities, and civil society), the document enables testing activities, collection of stakeholder challenges, preparation of concrete legislative proposals, and long-term regulatory support for innovation.

The involvement of stakeholders, clear division of responsibilities, transparent timeline, and focus on open communication are key elements for successful implementation. The regulatory sandbox will contribute to the removal of existing barriers and support the accelerated development of the hydrogen technology market.



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