WASTE2H2

WASTE TO HYDROGEN

Sustainability Roadmap

Deliverable No.:	5.2
Project Acronym:	WASTE2H2
Full Title: Sustainability Roadmap	
Grant Agreement No.:	952593
Work package No.:	5
Work package Title: Sustainability beyond WASTE2H2 and exploitation	
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Date:	31/10/2023
Status:	Final
Dissemination level:	Public

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 952593

Abstract

Creating a sustainability roadmap for the European project WASTE2H2, as outlined in deliverable D5.2, is a critical step to ensure the long-term success and impact of the project. This sustainability roadmap charts a strategic course for IPP in its pursuit of excellence in waste-to-hydrogen technologies and sustainable energy practices. Collaborative networks and partnerships with like-minded organizations, both regionally and internationally, lie at the heart of IPP's strategy. These partnerships enable resource leverage, knowledge exchange, and innovation, positioning IPP as a key player in its chosen research field.

Continuous education and training empower IPP's team with the essential skills and expertise required for research excellence. This investment in knowledge and skills fosters long-term sustainability and a culture of adaptability. To secure the resources needed for research initiatives, IPP will actively seek grant opportunities and collaborate with project partners to enhance the competitiveness of its proposals.

Effective communication through a suite of tools and platforms facilitates seamless collaboration, ensuring that IPP's impact extends beyond its immediate projects. The roadmap also includes a proactive mechanism for monitoring and aligning with evolving EU policies, ensuring compliance and relevance.

This roadmap culminates in a vision where IPP leaves a legacy of research excellence, shared expertise, and practical solutions, contributing to the broader sustainability goals of both the organization and the European Union. Through resource allocation, knowledge sharing, and a focus on long-term sustainability, IPP stands poised for a sustainable and impactful future.

Document History

Date	Version	Author(s)	Changes made
19/09/2023	1	Paulo Brito	1st document draft
27/09/2023	2	Luiz Rodrigues, Pedro Romano, Luís Loures	Contributions in sustainability roadmap
09/10/2023	3	Catarina Dias, Catarina Nobre	Revisions and formatting
31/101/2023	4	Paulo Brito	Final version of the document

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1. Introduction

As the WASTE2H2 project draws to a close, we reflect on the remarkable journey that has led us to this moment. The project has been a testament to the transformative power of collaboration and innovation, as we've witnessed waste evolve into an abundant resource and hydrogen emerge as a clean, versatile energy carrier. Over the course of the project, we've witnessed the European energy market undergo rapid and impactful changes, driven by the imperative to decarbonize and adapt to a greener society.
The journey has been marked by the relentless pursuit of innovation, and it's within this innovation that we've uncovered new opportunities for companies to add value. Hydrogen and fuel cell technologies have emerged as central pillars in our collective effort to reduce greenhouse gas emissions and transform energy consumption in the European Union. Our exploration of 2nd and 3rd generation biofuels, electricity, and hydrogen has propelled us to the forefront of a technological revolution that's vital for our planet's survival.
Our project has recognized the distinctive advantages of hydrogen, particularly when produced from renewable sources like biomass or natural gas, due to its lower carbon footprint. As IPPortalegre, we brought our significant experience in residual biomass thermal gasification processes to the table, primarily focused on electricity production through internal combustion engines. However, we also identified gaps in our knowledge, particularly in syngas enhancements, including cleaning technologies, water gas shift reactors, and hydrogen separation techniques.
The WASTE2H2 project provided us with a unique opportunity to address these shortcomings, enhance our technological capabilities, and gain new technical knowledge, administration, and management skills. Our collaboration has not only expanded our international and national project submissions but also increased our contributions to international publications and patents.
Through our partnership with esteemed institutions like KTH, ENEA, and KIT, renowned for their expertise in chemical engineering processes, electrochemical energy transfer, and thermochemical conversion, we've been able to bridge our knowledge gaps in gas upgrade technologies, discover new research avenues, and strengthen our research profile.
As we conclude the WASTE2H2 project, we're filled with pride in our collective achievements and the impact we've made in a highly competitive field. Together, we've laid the foundation for hydrogen production from residual biomass and waste using thermal gasification processes. We've mastered the water gas shift process, reactors, and hydrogen separation operations, ultimately enhancing the scientific and technological capacity of IPPortalegre.
This twinning initiative has allowed us to be an integral part of an excellence-driven network, and our combined efforts promise to leave a lasting legacy in the world of sustainable energy and waste management.

2. Sustainability roadmap

The goal of creating a sustainability roadmap for IPP is to provide a structured and strategic plan for the organization to ensure its long-term sustainability and success in the context of the WASTE2H2 project. This roadmap serves several key purposes:

- **Strategic Planning**: The sustainability roadmap helps IPP define its strategic direction by outlining the actions and initiatives needed to achieve long-term sustainability. It sets clear objectives, identifies challenges, and aligns IPP's goals with the project's mission.

- **Resource Allocation**: It assists IPP in efficiently allocating its resources, whether they are financial, human, or technological. By identifying the specific knowledge and resource gaps, IPP can invest in the areas that will yield the most significant returns and contribute to the project's success.

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- **Capacity Building:** The roadmap allows IPP to identify where it lacks expertise, equipment, or resources and offers guidance on how to fill these gaps. This capacity building ensures that IPP can contribute effectively to the project and enhance its own capabilities.

- **Collaboration**: By outlining opportunities for collaboration with partners like KTH, ENEA, and KIT, the roadmap fosters cooperation and knowledge exchange. It positions IPP to become an active participant in a collaborative network, strengthening its presence in the field.

- **Impact and Legacy**: The roadmap provides a strategic framework for achieving the project's objectives and long-term impact. It aims to leave a legacy by positioning IPP as a key player in the advancement of waste-to-hydrogen technologies and sustainable energy practices.

- **Alignment with EU Policies**: Given the changing European energy landscape and decarbonization policies, the sustainability roadmap ensures that IPP aligns its activities and research with the overarching objectives and regulations of the European Union.

- **Risk Mitigation**: It helps identify and mitigate potential risks and challenges that could affect the project's sustainability, allowing IPP to proactively address issues and adapt to changing circumstances.

In summary, the sustainability roadmap for IPPortalegre is a strategic document that guides the organization in its efforts to contribute to the WASTE2H2 project and, by extension, to the broader goals of sustainable energy and waste management in Europe. It sets a clear path for IPP's continued growth, impact, and long-term viability within the project and the field of sustainable energy technology.

2.1 Strategic planning

For a smaller organization like IPPortalegre (IPP) with limited human resources, participating in the research area of using waste as a feedstock for hydrogen production can be a challenging yet achievable endeavor. Throughout this project, IPP was able to design a tailored approach to maximize its contributions in this research field, as shown in Figure 1.

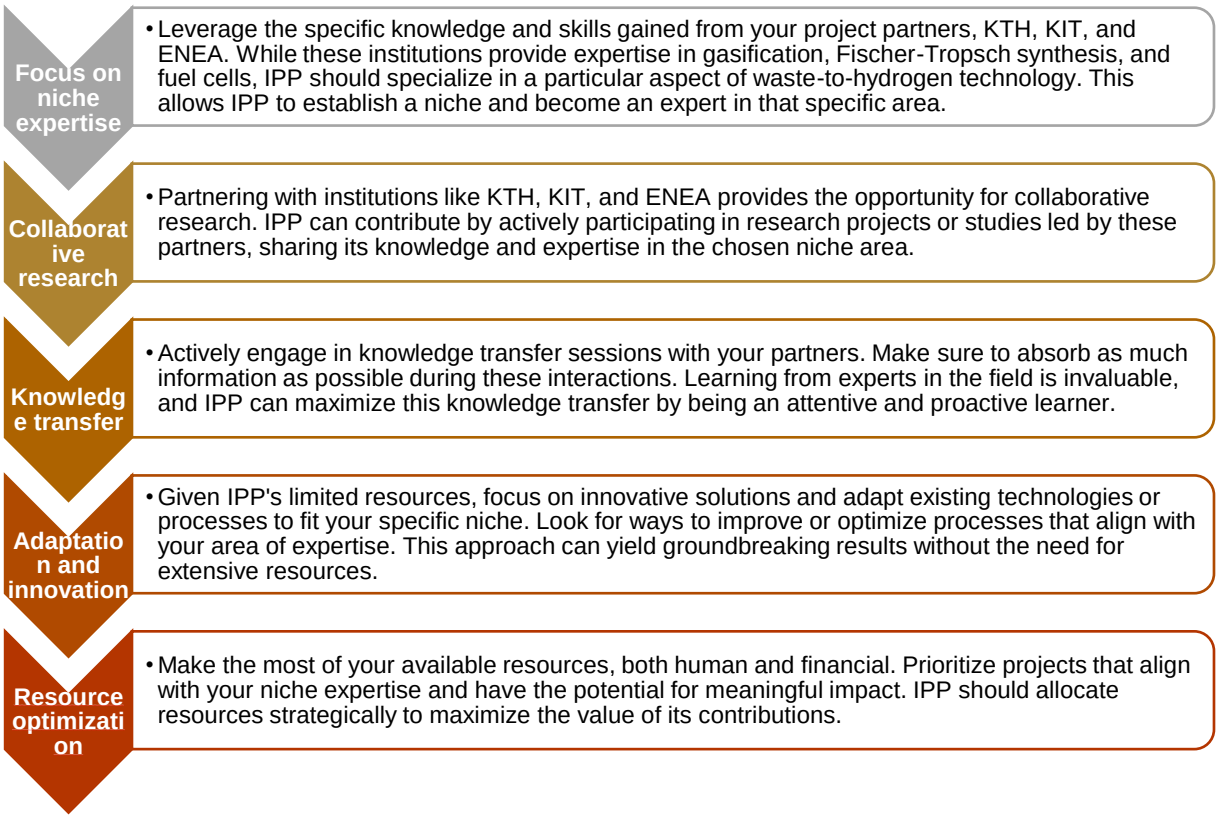

Figure 1. IPP's approach to maximize contribution in the field of project WASTE2H2.

Furthermore, with the lessons learned in WASTE2H2, IPPortalegre (IPP) will consider actively engaging in collaborative networks and partnerships with organizations that share similar research interests, both within its region and on an international scale. These partnerships can offer opportunities to leverage additional expertise and resources without requiring direct financial investments. By working together with like-minded institutions, IPP can tap into a collective pool of knowledge and support each other's research goals.

The project also had significant benefits from a training and educational point-of-view, namely that it's worthwhile to invest in the continuous education and training of your staff. As with the STSEs from WASTE2H2, IPP will continue to explore options such as online courses, workshops, and webinars, which provide cost-effective means to build expertise and stay up to date with the latest developments in this research field. Empowering IPP's team with the necessary knowledge and skills will not only enhance IPP's capabilities but also contribute to the success of the chosen niche area.

From the funding perspective, WASTE2H2 allowed IPP to team-up with the consortium partners for a European project proposal (which will be resubmitted beyond the duration of the project), and to be part of an approved project (as coordinator) with KTH. To secure the necessary resources for projects, IPP will actively seek out grant opportunities and research funding that align with its niche expertise. Collaborating with the project partners will for sure strengthen IPP's grant proposals, making them more competitive and increasing IPP's chances of obtaining financial support. Funding is essential to sustain IPP's research efforts and drive innovation in its area of specialization.

Finally, IPP will enhance its participation in academic and industry conferences, publishing of research findings, and sharing knowledge through white papers and online platforms. These activities will raise IPP's profile within the research community and the wider industry. By contributing to the collective knowledge pool, IPP will not only establish its authority in its field but also foster collaboration and innovation through the dissemination of its findings.

2.2. Resource allocation

Within this sustainability roadmpa, "Resource Allocation" refers to the strategic distribution and management of an organization's resources to achieve its long-term sustainability goals and objectives. This involves careful planning, prioritization, and optimization of various resources, including financial, human, technological, and knowledge assets:

- **Financial Resources:** Effective resource allocation involves determining how financial resources are budgeted and spent. In the context of the sustainability roadmap, IPPortalegre (IPP) will need to allocate funds for specific activities, such as research projects, participation in collaborative networks, educational programs, and demonstration projects. Financial resources should be allocated to activities that align with IPP's long-term sustainability strategy and objectives.

- **Human Resources:** Human resources are a critical component of resource allocation. IPP needs to consider how its limited staff and expertise are deployed to maximize their impact. This includes assigning staff to specific tasks, projects, or collaborations that align with IPP's niche expertise. It's important to ensure that the workforce is trained and equipped with the skills and knowledge required to contribute effectively to the chosen niche area.

- **Technological Resources**: IPPortalegre may have access to certain technological resources and equipment. Resource allocation in this context would involve deciding how these assets are utilized. For example, if IPP has specific equipment related to waste-to-hydrogen research, it should be allocated to projects or initiatives that best leverage its capabilities.

- **Knowledge Assets**: Knowledge is a valuable resource, and IPP can allocate resources to continuously build and disseminate knowledge. This involves investing in training and education, as mentioned in the sustainability roadmap, to empower staff with the skills and expertise required for research activities. Knowledge sharing and dissemination through publications and conferences should also be considered as part of this allocation.

- **Prioritization:** Resource allocation also includes prioritizing activities based on their importance and impact. IPP should identify key initiatives and projects within its niche area and prioritize them based on their alignment with long-term sustainability objectives. Priority should be given to projects that have the potential to make a significant contribution to IPP's research field.

- **Optimization:** Resource allocation involves optimizing the utilization of available resources. IPP should assess how efficiently its resources are being used, identify areas where improvements can be made, and reallocate resources if necessary to ensure they are used effectively.

- **Balancing Short-term and Long-term Goals:** IPP must find a balance between allocating resources to immediate needs and long-term sustainability. Some resources may be allocated to ongoing projects that provide immediate benefits, while others may be invested in activities that position IPP for long-term success.

2.3. Capacity building

Capacity building involves enhancing the knowledge, skills, and capabilities IPP to ensure its long-term sustainability and effectiveness within the thematic areas of WASTE2H2. This includes:

1. Identifying knowledge gaps and areas where IPP's team may lack expertise.
2. Providing training and skill development through courses, workshops, and webinars.
3. Encouraging cross-training and knowledge sharing among team members.
4. Adapting to technological advancements in the chosen research field.
5. Improving resource management skills for efficient resource allocation.
6. Developing problem-solving and innovation capabilities.
7. Building networking and collaboration skills for effective partnerships.
8. Establishing knowledge management processes for collecting and sharing research findings.
9. Fostering a sustainability culture within the organization.

2.4. Collaboration

Collaboration is a key strategy for IPP to enhance its long-term sustainability. This involves actively engaging with like-minded organizations, both regionally and internationally, to leverage additional expertise and resources without making direct financial investments. Collaborative partnerships enable IPP to tap into a collective pool of knowledge, share research goals, and pool resources. It opens the door to shared projects, shared funding opportunities, and a wider network of experts. These collaborations not only strengthen IPP's position within its niche area but also contribute to its growth, learning, and innovation, ultimately ensuring its sustained impact in the research field.
Collaboration in the sustainability roadmap goes hand in hand with the effective use of communication tools and platforms. By embracing these tools, IPP can facilitate seamless and efficient communication with its partners and stakeholders. Whether it's sharing research findings, coordinating activities, or fostering knowledge exchange, communication tools like project management software, video conferencing platforms, and collaborative document sharing are essential. They help bridge geographical distances, ensure timely updates, and enhance the flow of information, ultimately strengthening collaborative efforts and contributing to IPP's long-term sustainability in its research area. Specific communication tools and platforms that IPP can use to enhance collaboration in its sustainability roadmap include:

- **Video conferencing tools:** Platforms like Zoom, Microsoft Teams, or Skype enable real-time, face-to-face communication with partners and collaborators, fostering a more personal and interactive connection.
- **Collaborative document sharing**: Services such as Google Workspace (formerly G Suite) and Microsoft 365 offer shared document editing, making it easy to collaborate on reports, research papers, and project documents.
- **Project management software:** Tools like Trello, Asana, or Jira help manage and track project progress, assign tasks, and communicate within project teams.

- **Instant messaging apps:** Apps like Slack, Microsoft Teams chat, or WhatsApp provide quick and efficient communication for day-to-day interactions, questions, and updates.

- **Email and mailing lists**: Traditional email remains a valuable tool for official communication and updates. Mailing lists can help distribute information to a larger audience.

- **Collaboration platforms**: Collaboration platforms like SharePoint or Confluence facilitate document management, knowledge sharing, and collaboration within teams and organizations.

- **Social media for professional networking**: Platforms like LinkedIn can be used for networking, sharing research insights, and staying informed about industry developments.

- **Webinars and web conferencing**: Hosting webinars and web conferences through platforms like GoToWebinar or Webex allows IPP to share research findings and engage with a broader audience.

2.5. Impact and legacy

The roadmap's strategic planning sets clear objectives to ensure IPP's research has a significant and lasting impact in the waste-to-hydrogen and sustainable energy field. By emphasizing long-term sustainability, it ensures that IPP's contributions extend beyond the project's duration, leaving a legacy of research and innovation. Collaboration, knowledge sharing, and resource allocation prioritize high-impact activities, positioning IPP as a key player in advancing waste-to-hydrogen technologies and sustainable energy practices, and fostering a legacy of expertise, relationships, and practical solutions.

2.6. Alignment with EU policies

This roadmap ensures alignment with European Union (EU) policies by:

- **Monitoring regulatory changes:** The roadmap includes a mechanism (Figure 2) to keep track of evolving EU policies and regulations related to waste management and sustainable energy. This proactive approach ensures that IPP remains compliant with EU directives and adjusts its strategies accordingly.

Regular policy surveillance	IPP establishes a routine process for monitoring and staying informed about changes and updates in EU policies and regulations relevant to its research field. This includes tracking official EU publications, policy announcements, and legislative amendments.
Information dissemination	Once changes are identified, the mechanism ensures that this information is disseminated within IPP's organization to relevant stakeholders, researchers, and decision-makers. This dissemination facilitates a common understanding of the policy updates.
Compliance assessment	IPP conducts an assessment to determine the impact of these policy changes on its ongoing and future projects. This includes evaluating whether IPP's current activities align with the new policies or require adjustments to ensure compliance.
Strategic adjustment	If necessary, IPPortalegre adjusts its research strategies, objectives, and activities to align with the updated EU policies. This could involve reprioritizing projects, revising research focus, or adapting practices and procedures.
Proactive engagement	In cases where policy changes provide new opportunities, IPP proactively engages with relevant EU initiatives and collaborations to maximize the benefits of these policy shifts and contribute to EU sustainability goals.

Figure 2. Structured process within IPP's operational framework for actively monitoring and staying informed about evolving EU policies and regulations related to waste management and sustainable energy.

- **Adapting research focus**: As EU policies shift towards decarbonization and sustainable energy, the roadmap guides IPP to adapt its research focus to align with these priorities. This alignment ensures that IPP's work is not only relevant but also contributes to EU sustainability goals.

- **Promoting sustainability practices**: The roadmap encourages IPP to incorporate EU sustainability practices and standards into its projects and initiatives. By embracing EU-endorsed practices, IPP demonstrates its commitment to supporting and upholding the broader EU policy framework.

- **Engaging with EU initiatives**: IPP actively engages with EU-funded initiatives and collaborations, leveraging opportunities provided by the EU to further its research and impact. This engagement positions IPP as a participant in EU-driven efforts toward waste-to-hydrogen and sustainable energy advancements.

3. Conclusions

In summary, this sustainability roadmap outlines a comprehensive strategy for IPP to excel in the field of waste-to-hydrogen technologies and sustainable energy practices. Through active engagement in collaborative networks and partnerships, IPP will leverage additional expertise and resources, fostering innovation and knowledge exchange. Continuous education and training will empower IPP's team, ensuring that they possess the skills and expertise needed for research excellence. By actively seeking out grant opportunities, IPP will secure the resources necessary for ongoing research initiatives. The roadmap also emphasizes communication tools and platforms to facilitate seamless collaboration. Furthermore, IPP will adapt to evolving EU policies, ensuring alignment with EU directives, and contributing to broader sustainability objectives. This proactive approach positions IPP as a key player in the field, and its impact and legacy are assured through strategic resource allocation, knowledge sharing, and a focus on long-term sustainability. Together, these components of the roadmap form a robust framework for IPP's journey toward a sustainable and impactful future.