



SYMSITES

Industrial-Urban Symbiosis and its social, economic and environmental impact on different European regions

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Responsible partner	AITEX
Authors	Elena Herrero, Jesús Yagüe, Belen Garcia, Luis Ripoll, Emma Pérez, María Blanes
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List of Abbreviations and Acronyms

Abbreviation	Definition
AnMBR	Anaerobic membrane bioreactor
HVNR	High Value New Resources
IT	Information Technology
I-US	Industrial-Urban Symbiosis
MMV	Magnetic Membrane Vibration
ROI	Return on investment
WWTP	Waste Water Treatment Plant





Table of Contents

List of Abbreviations and Acronyms	2
1. EXECUTIVE SUMMARY	4
2. INTRODUCTION & OBJECTIVES	4
3. DESCRIPTION OF THE WORK	5
1. Technical aspects	5
2. Policy and regulatory framework	9
3. Environmental aspects	14
4. Socioeconomic aspects and social acceptance	18
5. Economic viability	23
6. Cross-cutting question	27
4. CONCLUSIONS	28
ANNEX	30
1. Answers to open questions technological barriers	30
2. Answers to open questions Policy and regulatory framework	31
3. Answers to open questions Environmental aspects	33
4. Answers to open questions Socioeconomic aspects and social acceptance	34
5. Answers to open questions Economic viability	36
6. Answers to cross-cutting question	37



1. EXECUTIVE SUMMARY

This deliverable summarises the final feedback collected from partners involved in the four SYMSITES EcoSites, assessing technical, environmental, socioeconomic, regulatory and economic aspects. The results show an overall positive perception of the EcoSites, with all average scores above 3 out of 5, indicating that the initiative is generally seen as beneficial and aligned with circular-economy goals. Environmental aspects obtain the highest ratings, reflecting strong confidence in the EcoSites' ability to reduce waste, resource recovery and operate safely under different regional conditions. Socioeconomic results are also favourable, highlighting perceived benefits in terms of employment, collaboration and community acceptance. Economic viability is rated positively, though long-term sustainability will require stable funding and reduced investment risks.

Technical performance is considered good, with partners valuing innovation, infrastructure design and staff expertise, while also noting the need for further optimisation as pilots mature into full-scale operations. The policy and regulatory framework receives the lowest score, as existing rules and administrative procedures are often not fully adapted to new circular solutions, creating delays and uncertainty. Differences between countries in regulatory readiness, funding availability and public awareness strongly influence implementation and replication.

Overall, the feedback confirms that the EcoSites deliver clear environmental and social value and demonstrate the feasibility of industrial-urban symbiosis in real conditions. To enable broader deployment across Europe, improvements in regulatory clarity, financial support and stakeholder engagement will be essential.

2. INTRODUCTION & OBJECTIVES

This deliverable presents the consolidated feedback gathered from partners across the four SYMSITES EcoSites through dedicated questionnaires assessing technological, environmental, socio-economic, regulatory and economic-viability aspects. As real-scale pilot implementations of the Industrial-Urban Symbiosis (I-US) model, the EcoSites provide valuable insights into the practical performance of the technologies deployed, the level of stakeholder engagement achieved, and the contextual factors that influence implementation.

Overall, the feedback demonstrates that the EcoSites are positively perceived in terms of environmental impact, contribution to circular-economy goals, and potential for waste reduction and resource recovery. At the same time, partners highlighted several challenges related to regulatory complexity, technical scalability, investment requirements, and the varying social acceptance across regions. These perspectives allow a comprehensive understanding of the opportunities and limitations associated with the replication and long-term sustainability of the I-US concept.



The objectives of this deliverable are: (1) to summarise and analyse the final feedback obtained from all partners; (2) to evaluate the performance, maturity and perceived usefulness of the EcoSite technologies; (3) to examine the socio-economic, environmental and regulatory conditions that influence the feasibility and replicability of the model; (4) to extract key lessons learned to guide future scaling strategies; and (5) to support the final assessment of SYMSITES by providing evidence-based conclusions on the achievements and remaining barriers associated with the implementation of Industrial-Urban Symbiosis in Europe.

3. DESCRIPTION OF THE WORK

The survey was divided into five main categories: **technical**, **policy and regulatory**, **environmental**, **socioeconomic and social**, and **economic** aspects. The following sections present a detailed analysis of the results obtained for each category.

A uniform scoring scale was applied across all sections:

- 1 = totally disagree,**
- 2 = disagree,**
- 3 = neutral,**
- 4 = agree,**
- 5 = totally agree.**

All statements in the questionnaire were formulated positively, meaning that a score of **5** represents the **most favourable** scenario, while a score of **1** indicates the **least favourable** scenario.

The partners' responses to the open questions are provided in the annex at the end of this deliverable.

1. Technical aspects

The following list outlines the technical aspects assessed within the survey:

- **The technologies required for ECOSITE are easy to implement.**
- **The necessary technologies are readily available in the region.**
- **The cost of ECOSITE technologies is affordable.**
- **ECOSITE has a high level of digitization (monitoring and control).**
- **Staff have the necessary technical training.**
- **There are no significant technical barriers to implementing ECOSITE.**
- **The ECOSITE infrastructure is well planned.**
- **ECOSITE is designed to be expandable or replicable in the future.**
- **ECOSITE incorporates innovative technological solutions.**
- **The expected waste supply for ECOSITE is realistic and stable.**

The table below presents the average score assigned by each partner in relation to the technical aspects, together with the overall average score for this category.



Table 1. Technical aspects: average score per partner

PARTNER	Average Score
AITEX	3.8
CSIC	3.4
BIU	3.3
ITG	3.7
UPC	4.1
KUL	3.2
FACSA	4.3
FOVASA	3
BOKU	3.2
NTUA	3.9
GRENEE	4
OSM	3.4
PRJ	3.5
ICLEI	2.9
AGRA	3.1
GERM	3.6
JOV	4.1
BER	3.4
AAT	3.4
BOFA	3.3
BEOF	3.2
GARD	3.2
DAVO	3.9
SP	3.6
KLINK	3.4
SIRMET	3.9
DTU	2.8
GENERAL	3.503

Figure 1 presents the scores reported by each partner.

The overall technical assessment of the ECOSITE is clearly positive, with an average score of 3.50, indicating that partners generally consider the technology to perform well and above neutral expectations. Important differences across partners are also evident: organisations such as FACSA, UPC, JOV and GREENE rate the technical performance highly (4.0–4.3), whereas DTU, with a score of 2.8, reports more significant challenges, likely linked to specific local conditions or operational constraints at their EcoSite.



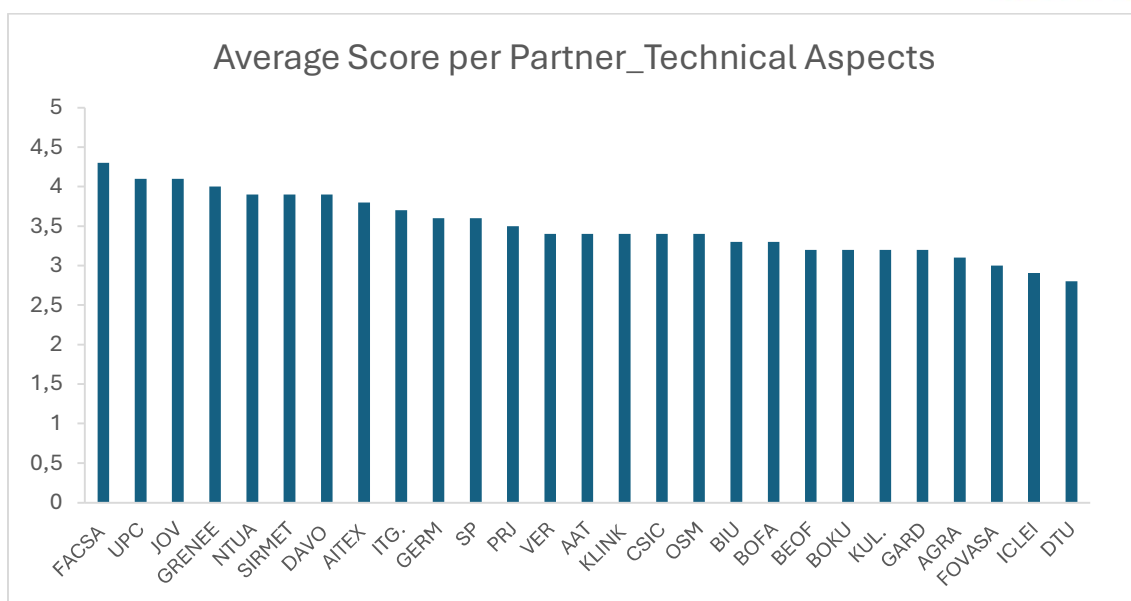


Figure 1. Average score per partner_Technical Aspects

To identify which technical aspects posed the greatest challenges for partners, the following table presents the average score obtained for each individual question.

Table 2. Average Score for each of the technical aspects assessed

TECHNICAL ASPECTS	Average Score
The technologies required are simple to implement	3.04
The necessary technologies are readily available in the region	3.22
The cost of the ECOSITE technologies is acceptable	3.19
The ECOSITE has a high level of digitalisation (monitoring and control)	3.48
Staff have the necessary technical training	3.81
There are no technical barriers to implementing the ECOSITE	3.00
The ECOSITE infrastructure is well planned	3.78
The ECOSITE is designed to be expandable/replicable in the future	3.78
The ECOSITE incorporates innovative technological solutions	4.11
The expected waste supply planned for the ECOSITE is realistic and stable	3.63

The results show that the ECOSITE technologies are viewed very positively by the project partners. The strongest point is the high level of innovation, which receives the best score of all. This means that the solutions being developed are seen as advanced and different from what usually exists in the sector. Partners also feel confident about the skills of the technical staff and agree that the infrastructure has been well designed, which helps ensure that the system can operate safely and efficiently.

At the same time, the feedback makes it clear that putting these technologies into practice is not always easy. Some processes still require adjustments, extra work on site, or further optimisation before they can run smoothly everywhere. Access to the necessary technologies and their costs are



rated as moderate, suggesting that, although everything is technically possible, improvements are still needed to make the solutions more accessible and affordable for wider use.

The following table presents the average score recorded for each specific question across the different EcoSites.

Table 3. Score obtained for each of the technical aspects analysed per EcoSite.

TECHNICAL ASPECTS	Spanish	Greek	Danish	Austrian	Transversal partners
The technologies required are simple to implement	3.13	3.75	3.33	2.67	2.71
The necessary technologies are readily available in the region	3.13	3.50	3.67	3.67	2.86
The cost of the ECOSITE technologies is acceptable	3.50	3.50	2.67	4.00	2.71
The ECOSITE has a high level of digitalisation (monitoring and control)	3.75	3.50	3.33	3.00	3.29
Staff have the necessary technical training	4.25	3.75	2.67	3.00	4.14
There are no technical barriers to implementing the ECOSITE	3.38	3.00	2.67	2.33	3.14
The ECOSITE infrastructure is well planned	3.75	4.00	3.00	3.67	4.00
The ECOSITE is designed to be expandable/replicable in the future	4.13	4.25	3.00	3.33	3.57
The ECOSITE incorporates innovative technological solutions	4.13	4.25	3.67	3.33	4.57
The expected waste supply planned for the ECOSITE is realistic and stable	3.63	4.00	3.00	4.33	3.43
Average Score	3.68	3.75	3.10	3.33	3.44

When comparing the four EcoSites, there are noticeable differences in how easily the technologies can be put into practice. The Greek EcoSite receives the highest score (3.75), which suggests that the technologies were easier to install and operate there, and that the overall setup worked smoothly. The Spanish EcoSite also performs very well (3.68), showing strong planning, innovation and well-prepared teams, although some practical challenges still needed to be solved.

The Austrian EcoSite receives a mid-range score (3.33). This means that the technologies work, but partners faced several difficulties, either because the processes are more complicated or because some technologies are not as accessible in that region. The Danish EcoSite, with the lowest score (3.10), encountered the greatest number of technical challenges. This is in line with the lower ratings from its partners, and suggests that local conditions—such as the type of waste, space limitations or stricter operating requirements—made it harder to run the system effectively.



Open question

Main technical barriers of ECOSITE and how they are being addressed:

The feedback provided by partners shows that, although the ECOSITE technologies work and have great potential, their installation and day-to-day operation still present several practical challenges. These difficulties vary from one EcoSite to another, depending on the type of waste they receive, the local conditions, and how new or complex the technologies are.

One of the most common issues reported is related to waste quality and pre-treatment. In many cases, food waste is not sorted properly or arrives mixed with materials that should not be there. This can cause blockages in the equipment and forces partners to redesign parts of the system or train users and local businesses to separate waste correctly. In other sites, the composition of the wastewater changes a lot from day to day—sometimes with more salt, sometimes with more solids—which makes it harder to keep the treatment process stable.

Partners also mentioned challenges linked to the more advanced treatment steps, such as the use of special filters and new materials designed to remove pollutants. Producing these materials at larger scale and ensuring they work reliably outside the lab requires time and adjustment. To overcome this, partners have already increased production capacity and developed more robust materials that can be reused safely.

Some EcoSites faced infrastructure limitations, for example needing to adapt existing wastewater treatment plants before installing the pilot, dealing with limited space, or organising how to store or distribute the treated water or recovered products. In a few cases, technical issues like pump failures, membrane clogging, or incorrectly placed sensors caused interruptions but were fixed through equipment adjustments and better monitoring.

Another barrier highlighted by several partners is the difficulty of moving from small laboratory tests to real-life operation. Treating a wide variety of waste streams—from household wastewater to industrial residues—requires constant optimisation to ensure the system remains efficient and stable.

Despite all these challenges, partners agree that the situation is improving steadily. Many solutions are already in place: better automation and control systems, awareness campaigns, upgraded equipment, improved maintenance routines, and continuous monitoring of the pilots. Thanks to these efforts, the ECOSITE technologies are becoming increasingly reliable, bringing the project closer to its goal of creating practical, circular, and sustainable solutions for waste and water management.

2. Policy and regulatory framework

The following list outlines the policy and regulatory aspects assessed within the survey:





- The current political framework favours the development of the ECOSITE.
- The ECOSITE has political support at the local level.
- The ECOSITE has political support at the regional and/or national level.
- Current regulations are aligned with the circular economy and the IUS.
- There are relevant incentives or public subsidies for the ECOSITE.
- Legal requirements have been taken into account since the design of the ECOSITE.

The table below provides the average score assigned by each partner to the Policy and Regulatory Framework, together with the overall average value for this assessment category.

Table 4. Policy and Regulatory: average score per partner

PARTNER	Average Score
AITEX	4.0
CSIC	3.2
BIU	3.0
ITG	2.5
UPC	3.5
KUL	3.0
FACSA	3.7
FOVASA	2.8
BOKU	2.8
NTUA	3.0
GRENEE	4.0
OSM	4.0
PRJ	3.3
ICLEI	3.5
AGRA	3.7
GERM	4.0
JOV	3.5
BER	3.0
AAT	3.3
BOFA	3.2
BEOF	2.5
GARD	2.2
DAVO	3.0
SP	3.5
KLINK	3.3
SIRMET	3.2
DTU	3.2
GENERAL	3.25

The results show that policy and regulatory conditions remain the least favourable area for the development of the EcoSites, with an overall average score of 3.25 out of 5. This means that, although the situation is not negative, it is less supportive than in other fields such as environmental



performance or socio-economic benefits. The findings indicate that existing rules and administrative procedures are often not fully adapted to innovative circular-economy solutions, which makes it more difficult and slower for EcoSites to operate and expand. In practical terms, this highlights the need for clearer legislation, more agile administrative processes and stronger institutional support, so that these sustainable initiatives can be implemented more effectively across European regions.

The graph below presents the scores reported by each partner, ordered from the highest values (AITEK and GREENE, both scoring 4.0) to the lowest (GARD, 2.2).

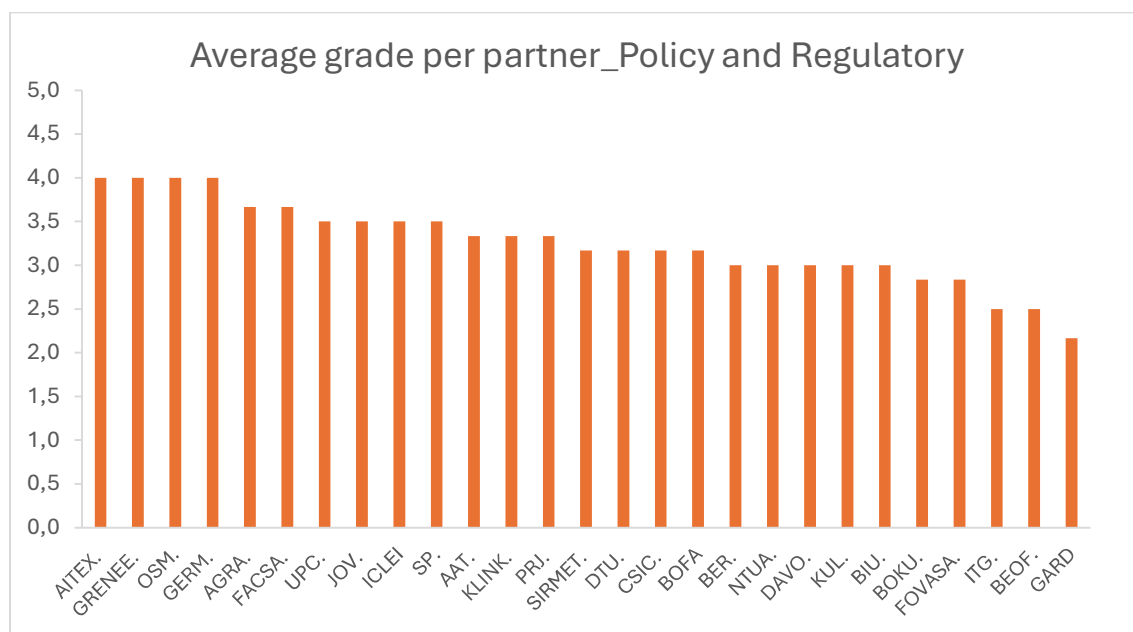


Figure 2. Average score per partner_Policy and Regulatory

A clear disparity between partners is observed. Several organisations—such as AITEK, GREENE, OSM, and GERM—report relatively favourable conditions, each scoring 4.0, which suggests that in some regions the regulatory framework is either supportive or at least adequately aligned with ECOSITE activities. In contrast, other partners experience significant regulatory obstacles, with the lowest ratings provided by GARD (2.2), BEOF (2.5), ITG (2.5), and FOVASA (2.8). These values below 3.0 indicate that these partners are encountering tangible regulatory or administrative constraints that hinder the effective operation of their EcoSites.

To determine which policy and regulatory aspects presented the greatest challenges for the partners, the following tables provide the average score recorded for each specific question.

Table 5. Average Score for each of the Policy and Regulatory aspects assessed

POLICY AND REGULATORY FRAMEWORK	Average Score
The current political framework favours the development of the ECOSITE	3.15
The ECOSITE has political support at local level	3.37





POLICY AND REGULATORY FRAMEWORK	Average Score
The ECOSITE has political support at the regional and/or national level	3.15
Current regulations are aligned with the circular economy and the IUS	3.26
There are relevant incentives or public subsidies for the ECOSITE	3.11
Legal requirements have been taken into account since the design of the ECOSITE	3.48

The results show that the policy and regulatory environment offers only limited support for the development of the EcoSites. Although many partners recognise that legal requirements were considered from the very beginning and that some local authorities show interest, the overall situation is still not ideal.

In general, partners agree that current regulations are not fully adapted to innovative circular-economy solutions like ECOSITE, and that financial incentives or public subsidies are still scarce. This makes it harder for organisations to invest in new technologies and slows down the introduction of more sustainable waste- and water-management practices.

The conclusions are clear: while the project benefits from some supportive elements, a stronger regulatory push and more active political engagement are needed to help EcoSites grow, expand, and be replicated in other regions. Improving these conditions would greatly facilitate the transition toward more circular and environmentally friendly systems.

Finally, Table 6 provides the average score reported for each EcoSite.

Table 6. Score obtained for each of the Policy and Regulatory aspects analysed per EcoSite.

POLICY AND REGULATORY	Spanish	Greek	Danish	Austrian	Transversal partners
The current political framework favours the development of the ECOSITE	3.25	3.00	2.67	2.67	3.71
The ECOSITE has political support at local level	3.63	2.75	3.33	3.67	3.43
The ECOSITE has political support at the regional and/or national level	3.63	3.00	2.67	3.00	3.00
Current regulations are aligned with the circular economy and the IUS	3.75	3.00	2.00	2.67	3.86
There are relevant incentives or public subsidies for the ECOSITE	3.25	3.00	3.00	3.00	3.14
Legal requirements have been taken into account since the design of the ECOSITE	3.63	3.50	4.00	3.33	3.29
Average Score	3.52	3.04	2.94	3.06	3.40

The results show that the policy and regulatory situation is quite different from one EcoSite to another, and this strongly affects how easily each site can move forward with its activities. Overall,



the Spanish EcoSite receives the most positive assessment (3.52), suggesting that local and regional rules, political support, and legal requirements are generally more favourable there. The Austrian EcoSite also performs reasonably well (3.06), showing that, although challenges exist, the regulatory environment does not prevent progress.

In contrast, the Greek EcoSite (3.04) and especially the Danish EcoSite (2.94) face more difficulties. The lower scores reflect issues such as limited political backing, stricter or less flexible regulations, fewer incentives or subsidies, and administrative processes that may slow down implementation. The Danish case stands out as the most challenging, indicating that the regulatory framework there is not yet fully supportive of circular-economy initiatives like SYMSITES.

Open questions

Main regulatory and administrative barriers identified

The partners report that the main difficulties they face are due to regulations that are not yet adapted to new circular-economy solutions like SYMSITES. In some countries, water reuse is still restricted, approvals take a long time, or the rules for using treated water are unclear.

There are also large differences between regions, which creates confusion and slows down progress. Some partners mention heavy bureaucracy, lengthy certification processes or regulations that even conflict with EcoSite activities. Others point out that there are no incentives or official support to help organisations adopt these innovations.

Overall, these barriers show that, although the technology is ready, the regulatory framework still needs to improve for EcoSites to be implemented and expanded more easily across Europe.

What public measures would facilitate the replicability and scaling up of ECOSITE?

The partners agree that, although the ECOSITE model has great potential, its expansion to other regions will only be possible if public authorities play a more active role. The suggestions they provide point to a few key needs.

First, many partners emphasise the importance of financial support, such as grants, subsidies, or incentives that make it easier for companies and municipalities to adopt these new technologies. Without this support, investing in circular-economy solutions can be too costly, especially in sectors where margins are low.

Second, there is a strong call for clearer and more flexible regulations. Partners explain that existing laws are often not adapted to innovative practices like water reuse, biogas production, or the recovery of materials from waste. Tools such as *regulatory sandboxes*—special zones where new solutions can be tested under controlled conditions—would help accelerate progress and reduce uncertainty for operators.



Communication and awareness also play a major role. Several partners highlight that informing citizens, farmers, companies and local authorities about the benefits of ECOSITE technologies would encourage broader acceptance and adoption. Demonstration activities, public events and better visibility of successful results would make the concept easier to understand and trust.

Another recurring idea is the need for better coordination between public entities. This includes support for planning, resource mapping, eco-industrial parks, and shared infrastructure for things like biogas upgrading or water storage. Such coordination would help ensure that all actors—from waste producers to utilities and industries—work together efficiently.

3. Environmental aspects

The following list outlines the environmental aspects assessed within the survey:

- **Waste has a significant environmental impact in the region.**
- **ECOSITE effectively contributes to reducing waste and dumping.**
- **ECOSITE is highly relevant to the environment within the circular economy.**
- **ECOSITE's technological solutions are sufficiently mature.**
- **The risk of negative environmental impacts from ECOSITE is low.**
- **ECOSITE is well integrated into its natural and social environment.**
- **There are clear plans for environmental monitoring and evaluation.**
- **Impacts on biodiversity and ecosystems have been adequately considered**

The table below presents the average score assigned by each partner for the environmental aspects, together with the overall average score for this category.

Table 7. Environmental aspects: average score per partner

PARTNER	AVERAGE
AITEX	3.875
CSIC	3.625
BIU	4
ITG	3.5
UPC	4.375
KUL	3.875
FACSA	4.25
FOVASA	3.625
BOKU	2.75
NTUA	4.625
GRENEE	4
OSM	3.625
PRJ	3.625
ICLEI	3.5



PARTNER	AVERAGE
AGRA	4
GERM	3.625
JOV	4
BER	4.375
AAT	4
BOFA	3.125
BEOF	3.5
GARD	3.25
DAVO	3.875
SP	3.875
KLINK	3.75
SIRMET	3.75
DTU	4
AVERAGE	3.79

The graph below presents all partner scores, ordered from the highest (NTUA, 4.625) to the lowest (BOKU, 2.75).

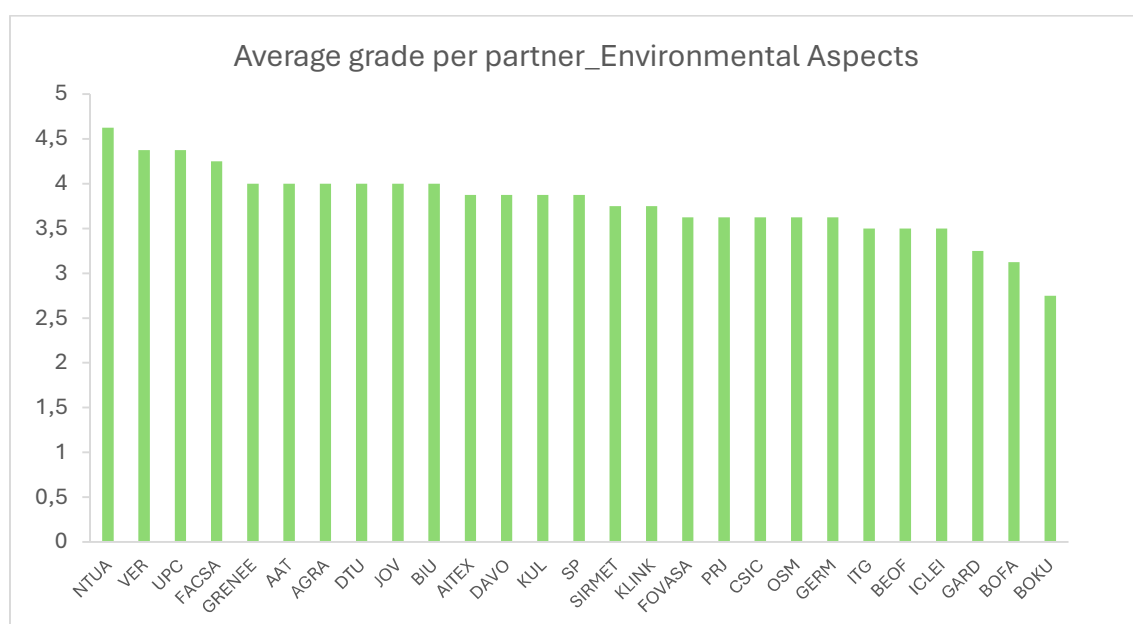


Figure 3. Average score per partner_Environmental Aspects

The environmental assessment of the EcoSites shows a consistently positive performance, with an overall average score of 3.79 out of 5, indicating broad agreement among partners that the initiative delivers clear environmental benefits. The aspects evaluated—such as waste reduction, circular-economy relevance, technological maturity, low environmental risk, and appropriate monitoring—received favourable ratings, reflecting confidence in the project's contribution to sustainable resource management.



The chart further illustrates this positive trend: most partners report scores close to or above 4.0, with the highest rating (4.625) given by NTUA, while the lowest (2.75) corresponds to BOKU. This distribution shows that, across diverse regional contexts, EcoSites are generally perceived as environmentally valuable, well-integrated and effective in supporting circular practices.

To determine which environmental aspects posed the greatest challenges for the partners, the following table presents the average score recorded for each of the questions assessed.

Table 8. Average Score for each of the Environmental aspects assessed

ENVIRONMENTAL ASPECTS	Average Score
Wastes have a significant environmental impact in the region	3.81
The ECOSITE contributes effectively to reducing waste and dumping	4.04
The ECOSITE is highly relevant to the environment within the circular economy	4.15
The ECOSITE's technological solutions are sufficiently mature	3.63
The risk of negative environmental impacts from the ECOSITE is low	3.78
The ECOSITE is well integrated into its natural and social environment	3.81
There are clear plans for environmental monitoring and evaluation	3.70
Impacts on biodiversity and ecosystems have been adequately considered	3.41

The results indicate a broadly positive environmental assessment of the EcoSites. Partners consider that the initiative makes a significant contribution to reducing waste and dumping and is highly relevant to the circular economy, which receives the highest score among all aspects evaluated. They also show confidence in the maturity of the technological solutions and assess the risk of negative environmental impacts as low, suggesting that the technologies are performing reliably.

Furthermore, the EcoSites are viewed as well integrated into their natural and social environments and supported by clear environmental monitoring and evaluation plans, reinforcing trust in their operational soundness. Although the consideration of biodiversity and ecosystem impacts receives a slightly lower—yet still positive—score, partners generally agree that these aspects are being addressed appropriately. Overall, the findings reflect a strong consensus that EcoSites deliver tangible environmental benefits and support more sustainable resource management in the participating regions.

Finally, Table 9 provides the average score reported for each EcoSite.



Table 9. Score obtained for each of the environmental aspects analysed per Ecosite.

Environmental Aspects	Spanish	Greek	Danish	Austrian	Transversal partners
Wastes have a significant environmental impact in the region	4.00	4.25	3.25	3.25	4.00
The ECOSITE contributes effectively to reducing waste and dumping	4.00	4.00	3.25	4.25	4.43
The ECOSITE is highly relevant to the environment within the circular economy	3.88	4.25	4.50	4.25	4.14
The ECOSITE's technological solutions are sufficiently mature	3.13	4.50	4.00	3.50	3.57
The risk of negative environmental impacts from the ECOSITE is low	4.00	4.25	3.25	4.00	3.43
The ECOSITE is well integrated into its natural and social environment	4.00	4.00	3.25	3.75	3.86
There are clear plans for environmental monitoring and evaluation	4.13	3.50	3.50	3.50	3.57
Impacts on biodiversity and ecosystems have been adequately considered	3.75	3.75	2.75	3.50	3.14
Average Score	3.86	4.06	3.47	3.75	3.77

The table shows that all EcoSites receive positive environmental scores, though with clear differences between regions. The Greek EcoSite achieves the highest average (4.06), reflecting strong performance across most environmental aspects. The Spanish EcoSite also scores well (3.86), particularly in monitoring and integration into the local environment. The Austrian EcoSite follows with 3.75, showing good results overall and high confidence in technological maturity. In contrast, the Danish EcoSite records the lowest average (3.47), with more variability across aspects, including lower values for biodiversity and integration, despite assigning one of the highest scores to circular-economy relevance. The transversal partners provide a balanced perspective with an average of 3.77, highlighting strong waste-reduction performance. Overall, the table indicates that while each EcoSite faces different environmental conditions, all are perceived as contributing positively to environmental sustainability.

Open question

Main environmental challenges facing the ECOSITE and possible improvements

The responses from the partners show that, although the EcoSites provide clear environmental benefits, they also face a number of practical and technological challenges that need to be addressed to ensure long-term sustainability. A common concern across several partners relates to the variability and quality of waste and wastewater, which can affect the stability of the treatment processes. This includes issues such as inconsistent waste composition, high salt or nitrogen levels, and the presence of emerging pollutants.



Several partners also highlight challenges linked to the technological maturity and scale of operation. At pilot scale, some systems require higher energy consumption or additional raw materials, and certain components—such as membranes, filters or nanoparticles—need further optimisation to work efficiently under real operating conditions. Partners emphasise that progressing to larger-scale operation will help reduce these impacts through improved efficiency and “economy of scale.”

Another set of challenges concerns environmental risks associated with advanced treatment technologies, such as the potential release of nanoparticles, methane emissions from digestion processes, or risks linked to reclaimed water used for irrigation. While these are being addressed through improved monitoring, immobilisation of materials, or additional treatment steps, partners agree that maintaining strict environmental controls is essential.

Some EcoSites also face context-specific constraints, such as energy consumption (BOKU), nitrogen-rich irrigation water in winter (BEOF), or local concerns related to odour, chemicals or noise. Others point out that not all waste streams are yet being treated simultaneously, and that the full closed-loop environmental performance will only be reached once all planned processes are fully implemented.

Despite these challenges, partners report that improvements are already underway, including enhanced monitoring systems, better pre-treatment, optimisation of energy use, upgraded materials, biological post-treatments, and more efficient integration of waste streams. Taken together, the responses reflect a shared view: while the EcoSites still face environmental hurdles typical of innovative pilot-scale systems, they are progressively becoming more robust, efficient and environmentally safe as the project advances

4. Socioeconomic aspects and social acceptance

The following list outlines the socioeconomic and social aspects assessed within the survey.

- **ECOSITE contributes to social inclusion and equity.**
- **ECOSITE has the potential to generate local employment.**
- **The actors involved are well acquainted with the principles of the circular economy and IUS.**
- **The local community largely accepts ECOSITE.**
- **Regional companies show interest in participating.**
- **There is good collaboration between companies, government, and citizens.**
- **It is easy to involve all relevant stakeholders.**
- **ECOSITE is well integrated into the local community.**
- **ECOSITE improves the reputation of participating entities.**
- **ECOSITE promotes competitiveness and business innovation.**



The table below presents the average score assigned by each partner for the socioeconomic and social aspects, together with the overall average score for this category.

Table 10. Socioeconomic and Social: average score per partner

PARTNER	AVERAGE
AITEX	4.2
CSIC	3.4
BIU	3.5
ITG	3
UPC	3.8
KUL	2.9
FACSA	3.4
FOVASA	3.5
BOKU	2.9
NTUA	3.5
GRENEE	4
OSM	3.1
PRJ	3.9
ICLEI	4.7
AGRA	3.8
GERM	3.8
JOV	3.9
BER	3.2
AAT	4.4
BOFA	3.8
BEOF	4.1
GARD	3.9
DAVO	3.8
SP	4
KLINK	3.6
SIRMET	3.7
DTU	3.7
AVERAGE	3.69

Figure 4 presents all partner scores, ordered from the highest (ICLEI, 4.7) to the lowest (KUL, 2.9).

The information shown in the table and the graph indicates that the EcoSites receive a generally positive evaluation in terms of their socioeconomic and social contribution, with an overall average score of 3.69 out of 5. Partners consider that EcoSites can support local employment, improve the reputation of participating organisations, and promote competitiveness and innovation, all of which are reflected across the listed aspects.



The graph highlights the differences between partners. Some organisations, such as ICLEI, AAT and AITEX, assign the highest values, showing strong confidence in the social and economic benefits of EcoSites. Others, including KUL and BOKU, give lower but still positive scores, suggesting that while the benefits are recognised, the perceived impact may vary across regions or stakeholder groups.

Overall, based solely on the data presented, the results suggest a shared perception that EcoSites can strengthen collaboration between companies, public authorities and citizens, encourage community acceptance, and help local actors engage with circular-economy principles. Although some partners express more modest levels of confidence, the general trend remains clearly favourable across the consortium.

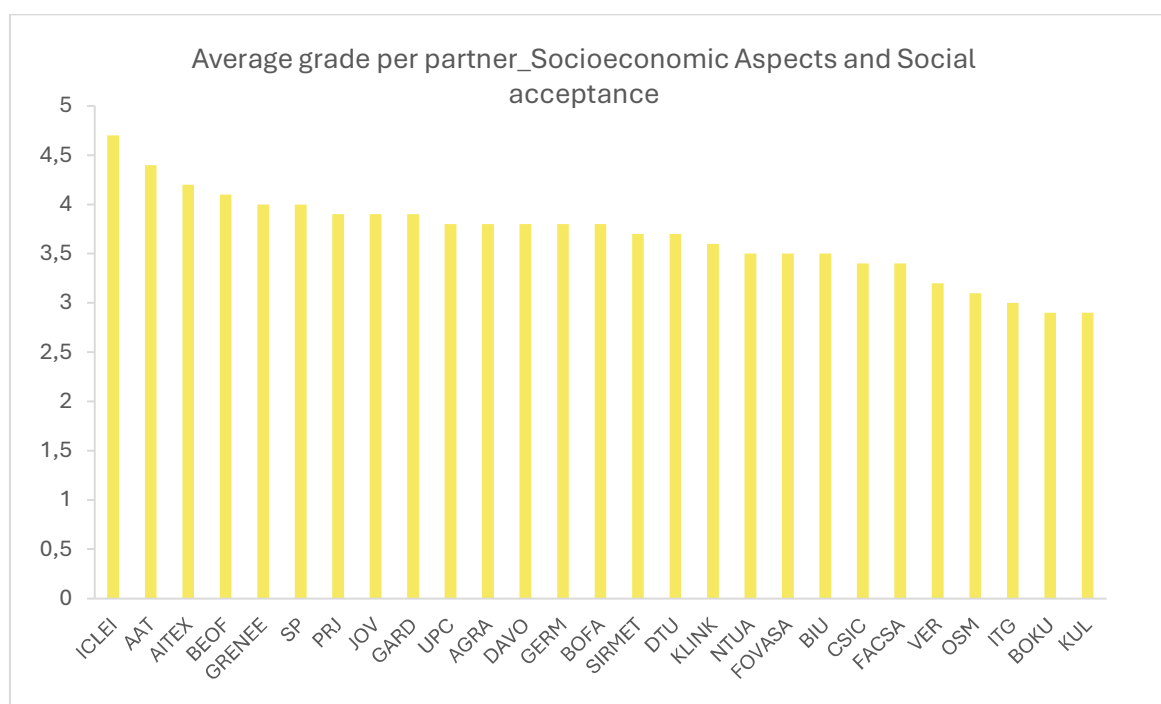


Figure 4. Average score per partner_Socioeconomic Aspects and Social acceptance

To present the results for each of the socioeconomic and social aspects assessed, Table 11 shows the score recorded for each aspect.

The table shows that the EcoSite receives a generally positive evaluation across all socioeconomic and social aspects assessed, with scores ranging from 3.22 to 4.07. Partners identify several strengths, particularly the EcoSite's potential to generate local employment (4.04) and its ability to promote competitiveness and business innovation (4.07), which are the highest-rated aspects. These results suggest that the EcoSite is perceived as a meaningful contributor to local economic development.

Other aspects also receive favourable scores. Partners report that the EcoSite is well accepted by the local community (3.63), that participating organisations benefit from an improved reputation



(4.00), and that regional companies show a clear interest in participating (3.70). The familiarity of actors with circular-economy principles (3.78) further supports effective collaboration and implementation.

The lowest values relate to the ease of involving all relevant stakeholders (3.22) and the level of community integration (3.44), indicating that, while positive overall, these areas may still require additional engagement efforts. Even so, the general pattern across the table reflects a shared perception that the EcoSite contributes positively to social inclusion, cooperation among local actors, and the economic vitality of the region.

Table 11. Average Score for each of the Socioeconomic and Social aspects assessed

Socioeconomic Aspects and Social Acceptance	Average
The ECOSITE contributes to social inclusion and equity	3.33
The ECOSITE has the potential to generate local employment	4.04
The actors involved are well acquainted with the principles of the circular economy and IUS	3.78
The local community largely accepts the ECOSITE	3.63
Regional companies are interested in participating	3.70
There is good collaboration between businesses , the administration and citizens	3.63
It is easy to involve all relevant stakeholders	3.22
The ECOSITE is well integrated into the local community	3.44
The ECOSITE improves the reputation of the participating entities	4.00
The ECOSITE promotes competitiveness and business innovation	4.07

Finally, Table 12 provides the average score reported for each EcoSite.

Table 12. Score obtained for each of the Socioeconomic and social aspects analysed per EcoSite.

Socioeconomic Aspects and Social Acceptance	Spanish	Greek	Danish	Austrian	Transversal partners
The ECOSITE contributes to social inclusion and equity	3.25	3.75	3.50	2.75	3.43
The ECOSITE has the potential to generate local employment	3.75	4.50	4.25	4.00	4.00
The actors involved are well acquainted with the principles of the circular economy and IUS	3.75	3.50	3.75	3.25	4.29



Socioeconomic Aspects and Social Acceptance	Spanish	Greek	Danish	Austrian	Transversal partners
The local community largely accepts the ECOSITE	3.63	3.50	4.25	4.00	3.14
Regional companies are interested in participating	4.00	3.25	4.00	3.75	3.43
There is good collaboration between businesses, the administration and citizens	3.50	3.50	3.75	3.75	3.71
It is easy to involve all relevant stakeholders	3.38	2.75	3.25	3.50	3.14
The ECOSITE is well integrated into the local community	3.25	3.75	3.75	3.50	3.29
The ECOSITE improves the reputation of the participating entities	3.75	3.75	4.00	4.25	4.29
The ECOSITE promotes competitiveness and business innovation	4.13	4.00	4.25	3.50	4.29
Average	3.56	3.56	3.81	3.56	3.55

The table provides a comparative view of how the different EcoSites evaluate a series of socioeconomic and social aspects, and the results show a generally positive perception across all regions. The average scores range from 3.56 to 3.81, indicating that the EcoSites are broadly seen as delivering social value and economic benefits.

Across all locations, some aspects consistently receive high ratings. These include the EcoSite's potential to generate local employment, the improvement of the reputation of participating entities, and its ability to promote competitiveness and business innovation. These elements score close to or above 4.00 in most regions, suggesting strong confidence in the EcoSite's contribution to local economic development and business dynamism.

The table also shows that the EcoSites are largely accepted by the local community and that participating actors are familiar with circular-economy principles, with scores generally above 3.5. This indicates a favourable social environment and a good basis for collaboration between companies, public authorities and citizens. Regional companies also express interest in participating, reinforcing the EcoSite's role in activating local networks.

Some aspects, however, show more moderate scores. The ease of involving all relevant stakeholders presents the lowest values (around 3.22–3.25), suggesting that engagement remains an area where additional efforts may be beneficial. Integration into the local community also varies slightly across EcoSites, though all scores remain positive.

Overall, the table reflects a shared view across regions: the EcoSites are socially well-received, create economic opportunities, and strengthen cooperation between local actors, while also highlighting specific areas—such as stakeholder engagement—where continued attention can further enhance their impact.



Open questions

Main social and economic barriers to implementing ECOSITES in the country

The responses indicate that EcoSites face a number of social and economic barriers that can slow down their implementation. Several partners highlight financial constraints, such as high initial investment costs, uncertainty about returns and difficulties in securing private funding. Others note concerns about who should assume the economic risk of scaling up the technologies. Some stakeholders, including wastewater treatment companies, show reluctance to adopt new solutions due to cost considerations.

On the social side, the main challenges relate to limited public awareness, concerns about water quality, and resistance to change in some communities. In certain cases, citizens may not feel directly benefitted by the EcoSite, or may distrust the use of reclaimed resources. Issues such as odour, perceptions of risk or lack of information can also reduce acceptance.

Overall, the answers show that successfully deploying EcoSites requires stronger communication with citizens, clearer financial frameworks and broader engagement of local stakeholders to build confidence and ensure long-term social and economic viability

Key factors for increasing social acceptance and participation

The responses indicate a broad agreement that increasing social acceptance of EcoSites depends on better awareness, clearer communication and early stakeholder involvement. Partners highlight the importance of education and outreach activities, such as workshops and visits, to explain the environmental and economic benefits of EcoSites. Many underline the need for transparent information, especially regarding water quality, environmental safety and the practical benefits for communities.

Several responses stress that engaging citizens, local companies and public authorities from the beginning helps build trust and shared responsibility. Quick, visible benefits and accessible language can also improve community perception. Overall, the feedback suggests that participation, transparency and communication are essential to strengthening public confidence and encouraging wider involvement in EcoSite initiatives.

5. Economic viability

The following list outlines the economic viability aspects assessed within the survey:

- **ECOSITE reduces waste management costs.**
- **ECOSITE improves the production efficiency of companies.**
- **The long-term economic risk of ECOSITE is low.**



- **Lack of funding significantly limits ECOSITE.**
- **The viability of ECOSITE depends largely on the SYMSITES project.**

The table below presents the average score assigned by each partner for the economic viability aspects, together with the overall average score for this category.

Table 13. Economic Viability: average score per partner

PARTNER	AVERAGE
AITEX	4
CSIC	3.4
BIU	4
ITG	3.4
UPC	3.6
KUL	3.8
FACSA	3.6
FOVASA	3.4
BOKU	3.2
NTUA	4.2
GRENEE	4
OSM	3.4
PRJ	3.6
ICLEI	3.4
AGRA	3.8
GERM	3.6
JOV	3.8
BER	3
AAT	4.4
BOFA	2.6
BEOF	3
GARD	3.8
DAVO	4.2
SP	3.4
KLINK	3.2
SIRMET	3.6
DTU	3.6
AVERAGE	3.59

Figure 5 presents all partner scores, ordered from the highest (AAT, 4.4) to the lowest (BOFA, 2.6).

The table and graph show that partners generally view the economic viability of the EcoSites positively, with an overall average of 3.59 out of 5. Several organisations—such as AAT, NTUA, and DAVO—assign the highest scores, indicating strong confidence in the EcoSites' economic potential. Most partners fall within the 3.4 to 3.8 range, suggesting a broadly favourable perception across the consortium. In contrast, a few partners, including BOFA and BER, provide lower ratings, reflecting



more cautious expectations. Overall, the data indicate that while economic conditions may vary by region, EcoSites are widely viewed as a promising and feasible economic opportunity.

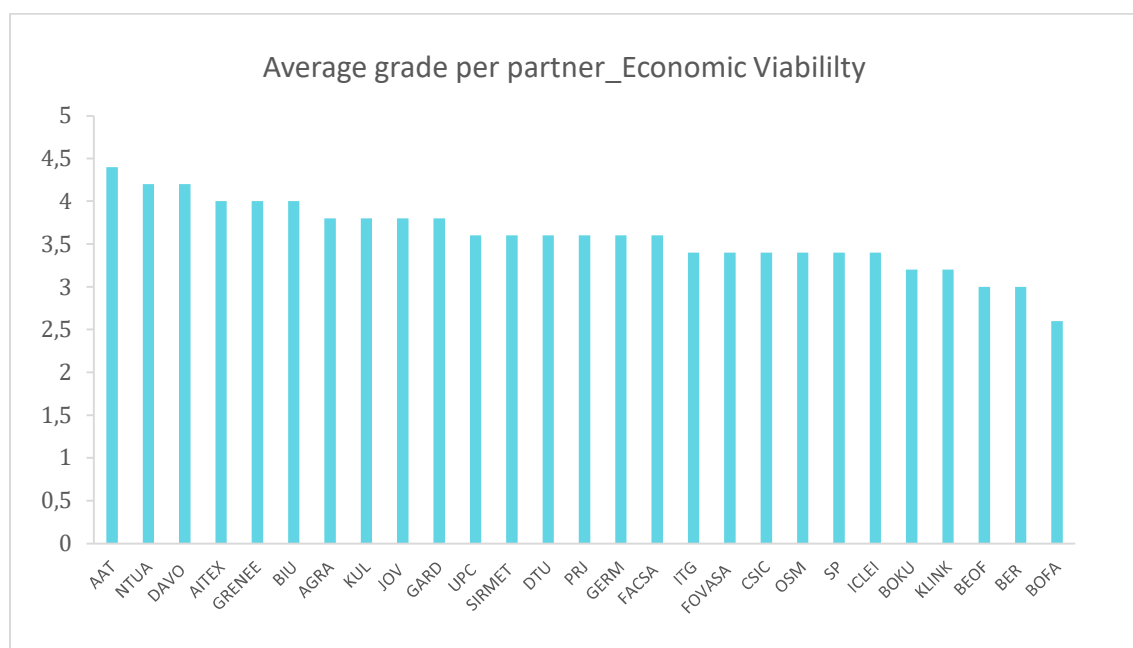


Figure 5. Average score per partner_Economic Viability

To present the results for each of the economic viability aspects assessed, Table 14 shows the score recorded for each aspect.

Table 14. Average Score for each of the aspects related to Economic Viability assessed

Economic Viability	Average
The ECOSITE reduces waste management costs	3.41
The ECOSITE improves the production efficiency of companies	3.59
The long-term economic risk of the ECOSITE is low	3.41
Lack of funding significantly limits the ECOSITE	4.07
The viability of the ECOSITE depends largely on the SYMSITES project	3.48

The table provides an overview of how different aspects of the EcoSite's economic viability are perceived, and the results indicate a moderately positive overall assessment. Partners consider that the EcoSite can help reduce waste-management costs and that its long-term economic risk is relatively low, both scoring 3.41. They also view the EcoSite as contributing to improved production efficiency, which receives one of the highest ratings (3.59).



At the same time, the table highlights a significant challenge: lack of funding, which is the highest-rated concern with a score of 4.07. This suggests that securing financial resources remains a key barrier to fully realising the EcoSite's economic potential. Finally, the perception that the viability of the EcoSite depends largely on the SYMSITES project (score 3.48) indicates that long-term sustainability may require continued support beyond the project framework.

Overall, the results show that while the EcoSite is seen as economically promising, its success will depend on addressing funding limitations and ensuring stable financial conditions for future deployment

Finally, Table 15 provides the average score reported for each EcoSite.

Table 15. Score obtained for each of the aspects related to Economic Viability analysed per EcoSite.

Economic Viability	Spanish	Greek	Danish	Austrian	Transversal partners
The ECOSITE reduces waste management costs	3.5	4	2.25	4	3.29
The ECOSITE improves the production efficiency of companies	3.87	3.75	3.25	3.75	3.29
The long-term economic risk of the ECOSITE is low	3.5	3.75	2.75	3.5	3.43
Lack of funding significantly limits the ECOSITE	4.12	4.5	4.5	3.5	3.86
The viability of the ECOSITE depends largely on the SYMSITES project	3.5	4	3.5	2.75	3.57
Average	3.7	4	3.25	3.5	3.49

The table shows that the EcoSites obtain overall positive assessments regarding their economic viability, although the results vary across regions. The Greek EcoSite receives the highest average score (4.0), indicating strong confidence in its economic potential. The Spanish and Austrian EcoSites follow closely with an average of 3.7 and 3.5, respectively, showing favourable but slightly more moderate evaluations. The Danish EcoSite, with the lowest average score (3.25), reflects greater economic challenges, particularly in terms of funding needs and long-term financial sustainability.

Across all EcoSites, the highest values correspond to the perception that lack of funding significantly limits implementation, suggesting that financial support is viewed as a key requirement for success. Other aspects, such as the EcoSite's ability to improve production efficiency and reduce waste-management costs, also receive positive scores, highlighting that partners see clear economic benefits. At the same time, the view that the viability of the EcoSite depends largely on the SYMSITES project indicates that long-term continuation may require additional investment and stable financial conditions beyond the project framework



Open question

Main economic barriers to scaling up the ECOSITE after the project.

The responses point to a common set of barriers to scaling EcoSites after the project: high upfront investment for infrastructure and industrial-scale operations, alongside uncertainty about long-term operating costs and profitability. Limited and unstable funding—together with the difficulty of bridging the scale-up/TRL gap—reduces private-sector willingness to invest. In some contexts, cheaper conventional options, high energy costs and costly distribution infrastructure weaken the business case. Additional hurdles include regulatory uncertainty over the use of recovered resources and practical requirements (e.g. waste collection and pre-treatment, gas cleaning, space and nuisance control) that add cost and complexity. Overall, wider deployment will depend on reducing investment risk, securing predictable finance and clarifying market and regulatory conditions.

6. Cross-cutting question

Economic, social, and regulatory differences between countries influence the success of the SYMSITES project.

The responses show that differences between countries in economic capacity, social attitudes and regulatory frameworks have a direct impact on the success of EcoSites. Several comments highlight that national rules on water reuse, product certification and permitting can either support or delay implementation. Economic conditions, including investment priorities, resource prices and the availability of public funding, influence how willing regions are to upgrade infrastructure or adopt new technologies.

The answers also point to variations in public awareness and acceptance. In some places, concerns about water quality, environmental risks or unfamiliar practices can limit engagement, while in others, stronger environmental pressures increase openness to circular solutions. Differences in waste composition, energy costs or labour conditions further shape how easily EcoSite technologies can operate and scale.

Overall, the responses suggest that the long-term expansion of EcoSites depends on adapting solutions to national contexts, reducing regulatory and economic barriers, and strengthening public understanding. Countries with clearer regulations, stronger incentives and higher social acceptance are better positioned to replicate and expand EcoSite initiatives effectively.



4. CONCLUSIONS

The results of the survey carried out across the four EcoSites show that the SYMSITES initiative is progressing positively and is broadly well-received by the partners involved. Overall, the EcoSites demonstrate clear environmental, social and economic benefits, with all average scores above 3 on a scale of 1 to 5. This indicates that, in general terms, the EcoSites are perceived as useful, relevant and aligned with the objectives of promoting circular economy practices in different European regions. Environmental aspects receive the highest ratings, reflecting strong confidence in the EcoSites' ability to reduce waste, support resource recovery and integrate well into their surroundings. Socioeconomic aspects also show favourable results, with partners valuing the potential for job creation, improved reputation of participating organisations and strengthened collaboration among local actors. Economic viability is assessed positively, although the need for stable financing and long-term investment remains a key concern.

Technical aspects receive moderately positive scores, showing that the technologies are innovative and functional, though not without challenges. Feedback highlights the need for further optimisation, addressing variability in waste streams and improving operational stability as systems move from pilot to full scale. The main difficulties identified relate to process complexity, limited space, equipment issues and the need for ongoing adjustments. Even so, partners report steady improvements and increasing reliability of the technologies thanks to enhanced monitoring, better maintenance and continuous adaptation.

The policy and regulatory dimension obtains the lowest scores among all categories. The results indicate that national and regional regulations are often not fully adapted to innovative circular solutions, which slows down implementation and limits scaling potential. Administrative complexity, lack of incentives and significant differences between countries create uncertainty and make it more difficult for EcoSites to operate under consistent and supportive conditions. Addressing these regulatory challenges, together with clearer and more flexible frameworks, will be crucial for the broader deployment of EcoSites across Europe.

When comparing EcoSites, differences between regions are evident. The Greek EcoSite obtains the highest overall results, followed closely by the Spanish and Austrian sites, while the Danish EcoSite faces greater technical, regulatory and economic challenges. These variations reflect the influence of local conditions, infrastructure, regulatory environments and levels of social acceptance. Despite these differences, all EcoSites achieve positive results and show that the SYMSITES concept can adapt to diverse contexts.

The open-ended responses reinforce the main findings. Partners highlight challenges linked to technological maturity, regulatory uncertainty, financing needs, public awareness and operational constraints. They also underline the importance of communication, education, stakeholder engagement and stronger institutional support. Across all themes, the feedback shows that EcoSites have strong potential, but achieving long-term sustainability will require addressing funding gaps,





simplifying regulations, improving public understanding of circular solutions and ensuring that technologies can scale efficiently.

In conclusion, the results of this deliverable show that SYMSITES is on a positive path, with clear environmental, social and economic value. The EcoSites demonstrate that circular and symbiotic systems can be implemented in real conditions and provide tangible benefits to communities. To fully unlock this potential, continued efforts will be needed to overcome regulatory, financial and technical challenges and to ensure that EcoSites can grow, replicate and consolidate as long-term solutions for sustainable resource management in Europe.



ANNEX

1. Answers to open questions technological barriers

Main technical barriers of ECOSITE and how they are being addressed:

- **CSIC:** Scaling up of the technology.
- **ITG:** Collection and distribution of waste for treatment, and distribution of products for sale, complemented by awareness campaigns in waste management environments and adaptation of recovery processes to specific food conditions. Implementation of IT solutions to support decision-making and optimize operational efficiency.
- **UPC:** The main technical barriers across ECOSITES, particularly at the tertiary treatment level, are linked to the scalability of adsorptive materials, the production of antimicrobial nanoparticles, and their reuse within filtration systems. These challenges were addressed by scaling up the production of functionalised lignin from 200 mL to 8 L, followed by nanoparticle synthesis scaled from 50 mL to 2 L. In addition, agricultural residues provided by project partners were converted into biochar, as well as a platform for nanoparticle immobilisation for their reusability. This approach improves material recovery, reusability, and applicability under real operational conditions.
- **KUL:** From KUL point of view: the integration of the vibration system into the technical control system of the pilot plant has been a barrier.
- **FACSA:** The main technical barriers are related to process integration and operational optimisation of the AnMBR-MMV system, which are being addressed through real-time monitoring and continuous pilot operation.
- **FOVASA:** Waste supply. Channels to assure it have been implemented.
- **BOKU:** Changing wastewater quality, only by different design of buffer or control automatization. High salt concentrations, by dilution and water purification after wastewater treatment. High iron content in sludge, by testing for better suitable flocculant.
- **NTUA:** At the pilot-scale it has proved rather difficult to secure an uninterrupted supply of waste, especially for the production of hydrogen. This would not be a problem at full-scale. The second problem is the variability of the characteristics of the industrial wastewater. It is important to measure the organic strength of every batch delivered to the plant and to adjust the amount added to the buffer tank so as to avoid significant fluctuations in the feed.
- **GREENE:** In the Spanish Ecosite (Alcoy), the SYMSITES project faces specific technical barriers related to the complexity of local industrial waste (textile and cosmetic) and water scarcity. technical barriers are being addressed by integrating advanced waste and water treatment technologies.
- **AGRA:** continuous work- it's being done on various channels, both human interface and automation.
- **GERM:** production at a scale.
- **BER:** Space requirements - land acquisition. Reduction of the salt content in clear water for reuse - Reverse osmosis, Reduction of chemical usage - Testing different Coagulants.
- **AAT:** the clogging of the membranes
- **BOFA:** pumps and pipes.





- **BEOF:** Poor sorting of food waste -> Restaurants and consumers need to be trained. Pre-treatment system is clogging - > needs to be redesigned to avoid clogging.
- **GARD:** distribution and storage of large quantities of permeate.
- **DAVO:** A superficial understanding of the community benefits provided by installing SYMSITES among the decision-makers.
- **SP:** Only minor technical issues occurred, such as incorrectly positioned sensors. These were relocated and recalibrated, after which the system operated reliably.
- **SIRMET:** To setup the Ecosite, the WWTP of the involved area has to be prepared to welcome the pilot. It took more time to be settled up. Thus, the pilot was initially worked at the premises of one of the Ecosite partners. But rather soon, it was placed at its final destination and works now properly. The other issue that is addressed during the operation of the Ecosite is the wide range of wastes that has to treat. From urban waste to olive industry wastewater and urban liquid waste residues. However, it proved that can support and treat all the provided streams with success.
- **DTU:** The Ecosite lacks a proper pulping unit to pretreat food waste, which gave trouble processing it through the drum filter and subsequent digestion step. The current waste sorting system has some shortcomings, since some of the food waste is not ideal for the AnMBR.

2. Answers to open questions Policy and regulatory framework

Main regulatory and administrative barriers identified

- **ITG:** The nature of the materials fed into the processes as waste increases administrative requirements and complicates their utilization, since they are neither raw materials nor intermediate products per se.
- **UPC:** Current regulations establish water quality standards for treated effluents for different uses, which have become more stringent with the inclusion of limit values for new organic pollutants. At the same time, limitations of conventional disinfection processes such as chlorination, ozonation, and UV have been identified. Within the project, these constraints were addressed by exploring a novel disinfection strategy based on antimicrobial nanoparticles. This approach is designed to complement existing treatment infrastructure while remaining compatible with current regulatory frameworks.
- **FACSA:** Key barriers include excessive bureaucracy, long permitting timelines, regulatory rigidity and limited adaptation of existing frameworks to innovative circular economy solutions.
- **FOVASA:** Complexity and heterogeneity of the laws, lengthy approval and certification processes, uncertainty of the upcoming laws.
- **BOKU:** Water reuse not allowed in Austria difficult and very strict legislation high investments no support for biogas production currently in Austria.
- **NTUA:** It is important to shorten out who pays what and to whom and to have a clear plan for the use of the generated products.
- **ICLEI:** Water reuse and I-US are progressively being favoured by EU policies as they are seen as key levers to achieve climate neutrality and CE objectives. However, member states decision on i.e. opting out of the Water Reuse Regulation is highly impacting.





- **BOFA:** Challenges related to wastewater and its use. Regulations concerning the mixing of food waste without hygienisation.
- **BEOF:** EU 741/2020 Wastewater reuse regulation not implemented in Denmark
- **GARD:** EU regulation prohibits reuse of WW for farmers.
- **DAVO:** Certain local administrative regulations relating to the environment and the exploitation of specific areas may be in conflict with SYMSITE's operating rules.
- **SP:** Austria's opt-out from the EU Water Reuse Regulation (2020/741) is viewed critically, as it relies on currently sufficient water levels while failing to proactively establish sustainable infrastructure for future climate challenges.
- **DTU:** Currently we lack a proper water reuse framework, although this seems to be coming soon.

What public measures would facilitate the replicability and scaling up of ECOSITE?

- **ITG:** Economic and fiscal incentives for companies participating in EcoSites to better position their products in the market.
- **UPC:** Public measures that would facilitate the replicability and scaling up of ECOSITE include maintaining systematic monitoring of influent and effluent water quality at wastewater treatment plants and ensuring access to historical datasets. Such data would allow technologies to be properly adjusted to ECOSITE requirements based on flow rates and contamination levels. This data-driven approach supports informed decision-making and improves the transferability of solutions across different sites.
- **FACSA:** Simplification of administrative procedures, regulatory harmonisation, the creation of regulatory sandboxes and dedicated public funding schemes would support ECOSITE replication and scaling.
- **FOVASA:** more investments, clear and flexible laws.
- **BOKU:** If the bill would pass Austrian legislation about biogas (not legally clear, which stops investments until investors know future legal status), If Austria would also implement the EU wastewater reuse, if there were stronger incentives for industries to reduce drinking water consumption and would have to pay more for wastewater treatment.
- **NTUA:** A law that would rectify and facilitate the logistics and the economics of IUS, including governmental subsidies.
- **GREENE:** A strong commitment from the public entities
- **ICLEI:** Effective replication of an Ecosite also depends on proximity between waste producers, utilities, and industrial users. Public authorities can facilitate this through regional resource mapping, eco-industrial park development, coordinated land-use planning, and co-investment in shared infrastructure such as biogas upgrading and water storage systems. Also, cross-sector collaboration is key so establishing regional symbiosis coordinators, formal stakeholder platforms, and tailored public-private partnership frameworks would strengthen the institutional capacity and support integrated planning.
- **AGRA:** funding of the CAPEX, favouring these WWTP
- **BER:** Publication in community newspapers and district news, construction of a 1:1 system to demonstrate its functionality.
- **BOFA:** More funding and greater visibility. Fewer regulations.
- **BEOF:** Funding, regulation that encourages reuse.



- **DAVO:** The success of the implementation of the first SYMSITES must be made known on a large scale through various means. Knowledge of these results will naturally determine the large-scale multiplication of these installations.
- **SP:** The most critical measure is to move away from a general opt-out toward a differentiated regulation. This includes establishing legal 'sandboxes' for pilot regions to test EU 2020/741 standards and defining clear, uniform water quality requirements to minimize liability risks for operators.
- **KLINK:** Fostering the ECOSITE logic at regional scale could increase adoption. Where clusters strive to comply with new and upcoming environmental regulations, adoption the ECOSITE model at regional/national scale as a recommended best available practice could help both replication and scale-up.
- **DTU:** Engagement with citizens to improve food waste sorting for safe operation of the AnMBR. Training on safe water reuse practices for safe fertigation, so there is a wider demand from local farmers.

3. Answers to open questions Environmental aspects

Main environmental challenges facing the ECOSITE and possible improvements

- **ITG:** The scale and technological maturity can negatively impact the environment, for example, when the consumption of additional raw materials and electricity exceeds that of conventional treatment or production options. To mitigate this, it is necessary to continue investing resources in scaling and optimizing technologies so that the associated environmental costs are reduced through "economy of scale".
- **UPC:** The main environmental challenges of the ECOSITE are related to the variability of wastewater effluents and the potential environmental risks associated with the release of nanoparticles. These challenges were addressed by immobilising the nanoparticles onto solid supports through grafting strategies and by evaluating their potential release in treated effluents at laboratory scale using the filtration system. This approach reduces environmental exposure while ensuring effective performance under variable operating conditions.
- **FACSA:** The main challenges are ensuring stable reclaimed water quality and minimising environmental impacts, which can be improved through enhanced environmental monitoring, energy optimisation and resource recovery.
- **FOVASA:** To change the traditional waste management technologies so the organic fraction could be used at the Ecosite.
- **BOKU:** Energy consumption (should improve at larger scale), risk of chemical spills- > better management at large scale noise and smell.
- **GREENE:** the Spanish EcoSite (Alcoy) continues to focus on overcoming environmental challenges related to resource scarcity and industrial waste through Industrial-Urban Symbiosis.
- **PRJ:** At the current stage, the main environmental challenge of the ECOSITE is its higher environmental impacts compared to conventional treatment systems, primarily due to its pilot-scale operation and incomplete implementation of the full process chain. The ECOSITE is not yet operating as a fully closed-loop system, as not all targeted waste streams are being treated simultaneously and not all recovered HVNRs are fully utilized. A



further challenge is related to scale effects, as pilot-scale facilities generally exhibit higher specific energy consumption and emissions per functional unit. This limits the environmental performance that can be achieved at this development stage.

- **ICLEI:** Advanced treatment technologies such as AnMBR can be energy-intensive, while anaerobic digestion processes may lead to methane leakage. It was flagged by some of the partners that variability and contamination in organic waste or industrial wastewater streams further pose risks to system efficiency and to the environmental safety of recovered outputs. Also, the risk posed by using the reclaimed water for irrigation, and potential leakage of pesticides and forever chemicals is also part of the reason why Denmark and Austria have opted out of the regulation. We are not able to express how to address these, but they nevertheless highlight that it is crucial that the Ecosites operate strict quality controls.
- **AGRA:** water quality and energy balance.
- **BER:** Reduction of wastewater loads, recovery of energetically usable components, recirculation of treated wastewater within the company.
- **AAT:** fatty acids and membrane new material
- **BOFA:** Direct emissions of biogas. Can be easily addressed with increased funding.
- **BEOF:** Discharge of irrigation water in winter times. Water contains Nitrogen above discharge limits.
- **DAVO:** Practically, the substantial elimination of waste and its transformation into useful products will contribute to the success of these installations. The systems will be able to undergo improvements that will come naturally from those who exploit them.
- **SP:** Micro-pollutants (PFAS, microplastics) risk contaminating soil and the food chain. To address this, a 'fourth treatment stage' (ozone/active carbon) is essential. Crucially, this must be paired with advanced real-time monitoring and online sensors to ensure water quality far exceeds minimum legal requirements.
- **DTU:** Methane emissions from the permeate are not considered. Biological post-treatment to biologically oxidize methane, further biodegrading some of the chemicals of emerging concern.

4. Answers to open questions Socioeconomic aspects and social acceptance

Main social and economic barriers to implementing ECOSITES in the country

- **ITG:** Potential reluctance to disclose confidential information from stakeholders participating in ECOSITES. Possible lack of economic competitiveness of locally produced products compared to imports.
- **UPC:** The main social and economic barrier to implementing ECOSITES in the country is the reluctance of wastewater treatment companies to upgrade existing technologies due to cost considerations. This resistance is primarily driven by concerns over investment costs and the perceived economic risk associated with adopting new treatment solutions.
- **FACSA:** Major barriers include low public awareness, resistance to change, financial uncertainty, limited access to funding and high initial investment requirements.
- **FOVASA:** Economic Fluctuation prices of materials and equipment, compliance costs, lack of private financing. Social: Resistance to change, low trust to administrations, low participation in activities, disinformation.





- **BOKU:** Social: consumers don't want their food to be watered with recovered wastewater, very high standards on water quality, no pressure to use wastewater as resource.
- **NTUA:** It is important to campaign to the citizens on the benefits of the ECOSITE approach emphasizing the environmental and social benefits, especially employment opportunities. Regarding industry, it is important to highlight economic benefits.
- **GREENE:** Social commitment with new recycling routes and methods.
- **ICLEI:** Limited public awareness and trust regarding waste and wastewater reuse (local communities may express concerns about health risks, odour, increased traffic, or environmental impacts, particularly when technologies such as anaerobic digestion or reclaimed water reuse are poorly understood).
- **AGRA:** large scale adaptation of new directives and active actions of the Government to apply them offtake agreements for HVNRs.
- **BER:** Official acceptance in food production, odour nuisance, fermentation residue consumer.
- **BOFA:** It is a matter of prioritisation for everyone, and it takes time to participate in something on a voluntary basis.
- **BEOF:** Who should take the risk of upscaling and do the investment, Citizens are not directly benefitting from the Ecosite, only businesses...
- **DAVO:** The implementation of SYMSITES generates waste reduced quantities, their transformation into efficient by-products, a massive reduction in pollution. All these benefits will not generate social barriers. The costs of implementing these installations could generate economic problems.
- **SP:** Low water prices: Since groundwater in Austria is still cheap and abundant, investments in expensive recycling technologies have a very slow return on investment (ROI).
- **KLINK:** The main barrier arises when there is a disconnect between how residents use the environment and the impact of non-residents or industries from outside the area. A typical example is tourist exploitation through short-term rentals or by budget chains that are foreign to the area and the community.
- **DTU:** Economy of scale due to the strong seasonality of the municipal feedstocks. Awareness of the risk, benefits and challenges when operating this circular solution, hampering safe operation.

Key factors for increasing social acceptance and participation

- **ITG:** Continue raising awareness among new generations through workshops, visits, and similar activities (important long-term factors), while also promoting the economic and social benefits at the regional level, which ultimately is the primary scope of ECOSITES.
- **UPC:** Key factors for increasing social acceptance and participation include educational campaigns aimed at raising public awareness of the need to regenerate urban wastewater, emphasizing resource recovery, circular economy principles, and sustainability. In addition, the inclusion of stakeholders from different public and private sectors is essential to foster collaboration, trust, and shared responsibility in the implementation of ECOSITE solutions.
- **FACSA:** Clear communication, awareness campaigns, accessible language and early stakeholder engagement are key factors to increase social acceptance and participation.
- **FOVASA:** organize informative workshops, dissemination material.





- **BOKU:** Water management plan (example if no water for private pools or costs more) If imported food is also watered with reused water than also acceptable for home grown.
- **NTUA:** Campaigning is the main factor here.
- **GREENE:** discount on garbage collection fees.
- **ICLEI:** To increase social acceptance, it is necessary to pursue early stakeholder engagement, transparent communication of environmental and economic benefits, and participatory planning processes. The cases of the stakeholder fora organized by the EcoSites are an example of this.
- **AGRA:** Smell, Pollution, transparent details.
- **BER:** Cost-effectiveness, regulatory acceptance, construction costs.
- **BOFA:** That is a very good question, and one where I do not believe we have fully cracked the code yet. We are relying on a long-term approach, including education and similar initiatives.
- **BEOF:** Highlighting the benefits of the ECOSITES.
- **DAVO:** The successful operation of the first station of this kind will be the key factor in the recognition and acceptance of the efficiency of these installations.
- **SP:** Key factors for social acceptance include radical transparency through real-time quality dashboards, early stakeholder participation (co-creation), and positive branding of recycled-water products to overcome the 'yuck factor' and highlight environmental benefits.
- **KLINK:** Returning benefits to the community quickly and transparently
- **DTU:** Awareness.

5. Answers to open questions Economic viability

Main economic barriers to scaling up the ECOSITE after the project.

- **BIU:** system for collection and pre-treatment of bio-waste. Gas cleaning and compression.
- **ITG:** Market viability of the products and possible lack of interest from participating companies in investing in the scaling process.
- **UPC:** the main economic barriers to scaling up ECOSITE include high initial investment costs for infrastructure adaptation and industrial-scale material production, as well as uncertainty in long-term operational expenses. ECOSITE solutions also face strong competition from conventional, low-cost and already amortised technologies. As a result, unclear short-term economic benefits and return on investment limit operators' willingness to adopt the technology beyond the project.
- **FACSA:** the main economic barriers are the lack of stable long-term financing, uncertainty about profitability and high upfront investment costs.
- **FOVASA:** Lack of funding. The administrations need to demand the technology in the tenders.
- **BOKU:** Investment costs and unclear legal situation.
- **NTUA:** Lack of appropriate funds from the government and/or region to bring about the required changes.
- **GREENE:** involve public bodies and entities.
- **ICLEI:** after SYMSITES ends, scaling the Ecosites will face significant economic barriers, as such advanced technologies require substantial upfront investment and there are long-term maintenance costs (i.e. membrane replacement, energy demand, and skilled labour).



Limited access to private financing can further constrain the expansion if projects are perceived as technologically or commercially risky. Revenue instability represents another constraint, as markets for reclaimed water, biomethane, biofertilizers, or green hydrogen are often immature, unstable or highly dependent on policy incentives.

- **AGRA:** crossing the TRL 7-8 gap
- **GERM:** organization and facilities.
- **BER:** Space requirements, odour nuisance, use of chemicals, utilization of fermentation residues.
- **BEOF:** Energy balance is negative.
- **GARD:** Economic hurdles after project completion: The main obstacle is the lack of competitiveness compared to cheap and abundant groundwater. High energy costs (operating costs) for advanced treatment and the enormous investment costs for the distribution infrastructure (double pipelines) lead to a financing gap. Without higher prices for primary water or long-term subsidies, scaling up remains economically unviable.
- **DAVO:** the costs of carrying out these Projects can significantly influence their numerical expansion. Initially attention will need to be focused and the following costs: design and materials used.
- **DTU:** lack of funding to push it to higher TRLs, since as it is now, it hasn't caught enough interest from public authorities for investment. Lack of proper regulations that allows for exploiting the recovered resources, making a poor business case at the moment.

6. Answers to cross-cutting question

Economic, social, and regulatory differences between countries influence the success of the SYMSITES project.

- **ITG:** compliance with conditions for the reuse of treated water. Limitations in obtaining CE marking and legal commercialization for fertilizers produced from waste (related to WWTPs).
- **UPC:** variations in economic capacity and investment priorities affect the willingness to fund infrastructure upgrades, while differences in public awareness and social acceptance influence engagement with innovative water reuse solutions. In addition, national regulatory frameworks differ in the pace and strictness of implementing EU water quality directives, impacting permitting, compliance requirements, and the speed at which our solutions can be deployed and replicated across countries.
- **FACSA:** differences in regulatory frameworks, access to funding, market conditions and social acceptance levels significantly influence the implementation speed, scalability and overall success of the SYMSITES project across different countries.
- **FOVASA:** yes, these factors impact others such as "good waste separation" which correlates with the process efficiency in SYMSITES.
- **BOKU:** the differences between the countries economically, socially and regulatory makes the Symsites project in the end successful since it helps to learn from each other, find solutions, find other practices, see problems that may also concern other regions in the future. To well answer the question, what counts as success should be defined.
- **GREENE:** The project's success relies on tailoring circular technologies to each country's specific legal frameworks and social acceptance levels to ensure local viability. Effectively addressing these regional economic and regulatory disparities is essential for transforming SYMSITES into a scalable European model.



- **ICLEI:** variations in waste composition, energy prices, labour costs, regulatory frameworks for wastewater reuse, and public attitudes toward circular economy solutions can shape both feasibility and acceptance. Without considering environmental differences (i.e. climate), countries with supportive reuse and energy policies, clear end-of-waste regulations, and established cooperation models are better positioned to replicate or scale the Ecosites technologies.
- **DAVO:** the success of these installations will be determined primarily by the economic power of each country. An equally important element is the administrative and legislative regulations of each country regarding the approval of such investments.
- **SP:** the success of SYMSITES is shaped by national divergence: Regulatory hurdles like Austria's 'opt-out' conflict with proactive water-reuse policies in Southern Europe. Economically, low resource prices in water-abundant countries weaken the ROI for recycling. Socially, public acceptance (the 'yuck factor') varies depending on the local urgency of climate-related water scarcity.
- **KLINK:** with the knowledge available, given the different territorial characteristics and economies involved in ECOSITES, it is not possible for us to draw meaningful comparative conclusions.
- **DTU:** yes, countries with a proper water reuse regulation and suffering from more severe water shortage will get better benefit from most ecosites.

