D6.5
Proposals and recommendations for the validated ECF

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WHO WE ARE

The ECF consortium consists of ten partners. The project is coordinated by Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas-CIEMAT.

Name	Country	Logo
Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas – **CIEMAT**	ES	
Instituto Superior Técnico. University of Lisbon. **IST**	PT	
Universidad de Sevilla **USE**	ES	
University of Jyväskylä **JYU**	FI	
Universitat Autònoma de Barcelona **UAB**	ES	
Meda Research Ltd **MedaResearch**	RO	
Instituto de Soldadura e Qualidade **ISQ**	PT	
Trebag Szellemi Tulajdon Es Projektmenedzser Korlatolt Felelossegu Tarsasag **TREBAG**	HU	
Smartwatt Energy services SA **Smartwatt**	PT	
Que Technologies Kefalaiouchiki Etaireia **QUE**	GR	
ENLITIA S.A. **ENLITIA**	PT	

ABOUT THE PROJECT

Through a multidisciplinary, transdisciplinary and participatory process, ECF4CLIM develops, tests and validates a European Competence Framework (ECF) for transformational change, which will empower the educational community to take action against climate change and towards sustainable development.

Applying a novel hybrid participatory approach, rooted in participatory action research and citizen science, ECF4CLIM co-designs the ECF in selected schools and universities, by: 1) elaborating an initial ECF, supported by crowdsourcing of ideas and analysis of existing ECFs; 2) establishing the baseline of individual and collective competences, as well as environmental performance indicators; 3) implementing practical, replicable and context adapted technical, behavioural, and organisational interventions that foster the acquisition of competences; 4) evaluating the ability of the interventions to strengthen sustainability competences and environmental performance; and 5) validating the ECF.

The proposed ECF is unique in that it encompasses the interacting STEM (Science, Technology, Engineering, and Mathematics) -related, digital and social competences, and systematically explores individual, organisational and institutional factors that enable or constrain the desired change. The novel hybrid participatory approach provides the broad educational community with: an ECF adaptable to a range of settings; new ways of collaboration between public, private and third-sector bodies; and innovative organisational models of engagement and action for sustainability (Sustainability Competence Teams and Committees).

To encourage learning-by-doing, several novel tools will be co-designed with and made available to citizens, including a digital platform for crowdsourcing, IoT solutions for real-time monitoring of selected parameters, and a digital learning space. Participation of various SMEs in the consortium maximises the broad adoption and applicability of the ECF for the required transformational change towards sustainability.

LEGAL NOTICE

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1 OUR POLICY BRIEF

This document was developed with the aim of formulating **proposals and recommendations** on **key components and requirements of the European Competence Framework** (ECF), as well as on ways to strengthen educational practices in order to promote climate action and sustainable development (D6.5). To this end, the project produced the Policy Brief "*Empowering Educational Communities for Climate Action*", which was subsequently validated through consultations with policymakers and members of the Advisory Board, both prior to and during the ECF4CLIM Final Conference held on 11 December 2025. The policy Brief is attached in Annex 1 and available online in the web page of the project under Outcomes https://ecf4clim.eu/.

The Policy Brief supports evidence-based policymaking by providing concrete, practice-oriented recommendations to inform the further development and operationalization of the European sustainability competence framework, with particular emphasis on GreenComp, the European Sustainability Competence Framework.

The recommendations set out in this Policy Brief are grounded in the five core outcomes of the ECF4CLIM project: (1) an expanded conceptual framework for sustainability competences; (2) a validated Roadmap for Sustainability Competences; (3) an innovative hybrid participatory approach to promote sustainability competences; (4) a catalogue of practical, replicable sustainability interventions; and (5) a set of digital tools and learning materials supporting competence development. For each of the outcomes, the Policy Brief includes recommendations for both policy makers and educational communities. The Policy Brief was formally validated during the project's Final Conference through dialogue with policymakers, educators, researchers and other key stakeholders. The feedback and perspectives gathered during this validation process are reflected in the subsequent sections of the document.

Next, we include a brief description of each outcome.

Outcome 1. An expanded conceptual framework for sustainability competences.

ECF4CLIM responds to the growing recognition that sustainability transitions require not only individual knowledge and skills, but also supportive organizational structures and enabling material conditions. Moving beyond traditional individual-centered approaches, the project advances an integrated conceptual framework that defines sustainability competences across three interdependent spheres: individual, collective, and technical-material competences. Individual competences encompass the knowledge, skills, attitudes and values required for sustainability-oriented action. Collective competences refer to the capacity of educational institutions to act coherently for sustainability through governance arrangements, norms, organizational cultures and

decision-making processes. Technical-material competences highlight the role of infrastructures, technologies, tools and physical environments as active enablers or constraints of sustainability action.

Outcome 2. A validated roadmap for sustainability competences

A central outcome of the project is the Roadmap for Sustainability Competences, which builds on GreenComp while extending its scope beyond the individual level. Developed, tested and validated through a transdisciplinary and participatory process across 13 schools and universities in four Member States, the Roadmap provides a structured and practice-oriented framework to support implementation. It organizes sustainability competences around four interconnected dimensions—Engagement, Connections, Change and Action—conceived as an iterative cycle fostering continuous learning, institutional development and long-term transformation. The Roadmap identifies key enabling conditions, including leadership commitment, participatory governance, cooperation across sectors, adequate human and financial resources, supportive infrastructures and access to transdisciplinary knowledge. Where these conditions are lacking, they constitute structural barriers to sustainability transitions in education.

Outcome 3. An innovative hybrid participatory approach

To operationalize the Roadmap in practice, ECF4CLIM designed and implemented a hybrid participatory approach rooted in participatory action research and citizen science. This approach actively involves students, teachers, administrative staff, families and other representatives from the wider educational community in co-designing, co-implementing and co-evaluating sustainability actions. Dedicated organizational structures—Sustainability Competence Teams and Sustainability Competence Committees—were established at demonstration sites to embed participation, reflexivity and shared ownership within institutional governance. The results show that participatory processes strengthen collective competences, enhance institutional capacity, and transform evaluation into a learning and competence-building process.

Outcome 4. A catalogue of practical, replicable sustainability interventions

Through this participatory framework, the project co-designed 159 sustainability interventions, of which 64 were implemented and systematically monitored. These interventions addressed priority areas such as energy and water management, waste reduction, sustainable food systems, mobility, green spaces and curriculum innovation. A selection of showcase interventions was identified based on impact, replicability and alignment with the three competence spheres and the four Roadmap dimensions. The resulting catalogue provides a practical reference for policymakers and educational institutions seeking scalable and context-adaptable solutions.

Outcome 5. A set of digital tools and learning materials

In parallel, ECF4CLIM developed an integrated suite of digital tools and pedagogical resources to support evidence-based decision-making and learning-by-doing. These include an Environmental Footprint Calculator tailored to educational institutions, a Retrofitting Toolkit for energy efficiency improvements, a Sustainability Intervention Evaluation Tool, and an IoT ecosystem for real-time data collection. Complementary learning resources, such as interactive flipbooks and a learning game, support engagement and pedagogical uptake. Together, these tools link educational, organizational and technical-material dimensions, reinforcing the systemic approach promoted by the Roadmap.

On the basis of its findings, **the Policy Brief formulates targeted recommendations** for European, national and regional policymakers, as well as for educational communities. Key priorities include: expanding sustainability competence frameworks to explicitly integrate collective and technical-material dimensions; embedding sustainability across education policy, governance and curricula; institutionalizing participatory governance models; ensuring adequate investment in infrastructure, skills and capacity-building; and strengthening monitoring, evaluation and research to support continuous improvement. For educational communities, recommendations focus on mainstreaming sustainability into everyday practices, fostering inclusive participation, strengthening cooperation networks and sustaining long-term institutional commitment.

Overall, ECF4CLIM demonstrates that empowering educational communities for climate action requires a systemic, whole-institution approach aligned with European policy objectives for the green and just transition. By combining a validated conceptual framework, a practice-oriented Roadmap, participatory governance mechanisms, concrete interventions and digital tools, the project provides a robust and transferable evidence base to support the evolution and implementation of European sustainability competence policies.

2 VALIDATION PROCESS

The validation of the Policy Brief followed a structured and participatory process. A draft document was circulated in advance to policymakers and members of the Advisory Board, together with a set of guiding questions, which are detailed in the following sections. Written feedback was collected prior to the Final Conference and is compiled in Annex 2 to this document. Building on this initial consultation, a dedicated session was organised during the ECF4CLIM Final Conference to discuss the feedback received, reflect collectively on the main messages and recommendations, and gather additional inputs from participants. This combined process ensured both the robustness of the Policy Brief and its relevance for policy development and implementation.

2.1 Experts providing feedback

The profile of the experts who provided feedback is summarised below.

Policy Makers

- → Policy maker 1. Directorate General for Innovation Programs and Teacher Training. Directorate General for Bilingualism and Quality of Education. Regional Ministry of Education, Science and Universities. Community of Madrid. Spain
- → Policy maker 2. European Fund raising Area. Community of Madrid. Spain
- → Policy maker 3. Municipality of Sercaia. Romania
- → Policy maker 4. Education Programs. Barcelona Provincial Council. Spain

Advisory Board

- → Advisory Board member 1. Professor of Ecology, Autonomous University of Madrid. Spain
- → Advisory Board member 2. Professor. University of Galati. Romania
- → Advisory Board member 3. Doctor of Business Administration. GREEN SCENT project (ecf4clim sister project). Italy
- → Advisory Board member 4. Social Sciences teacher. Youth studies. Universitat Pompeu Fabra. Spain

2.2 Questions guiding the feedback session

To support a structured and focused validation process, consultees were invited to reflect on a set of guiding questions aimed at assessing the relevance, feasibility, and added value of the proposed recommendations. These questions were designed to capture expert judgement on the practical applicability of the recommendations, identify potential gaps, and gather targeted suggestions for different policy and stakeholder groups. The guiding questions are presented below.

- → Which recommendations do you think are the most/least feasible and useful, and why?
- → Additional recommendations that should be included for specific target groups

3 SUMMARY OF OUTPUTS

This section provides a consolidated summary of the feedback received in response to the guiding questions. The summary highlights converging views, key considerations for implementation, and cross-cutting themes that emerged from the consultation process, with the aim of informing the refinement and strengthening of the Policy Brief recommendations.

3.1 Question 1: Which recommendations do you think are the most/least feasible and useful, and why?

This section summarises the feedback received in response to the first guiding question, which invited consultees to assess which recommendations were considered the most and least feasible and useful, and to explain the underlying reasons for their assessments. For clarity, the recommendations identified as less feasible are highlighted in blue in the summary presented below.

Expanding the concept of "sustainability competence"

→ The proposed competence model based on the three levels of action: **individual, collective and technical-material** is considered a good suggestion that reinforces the areas of intervention in which planning is necessary to develop effective sustainability projects in educational centres.

→ ECF4CLIM has convincingly demonstrated that **'sustainability' is not just about individual knowledge**, but requires organizational capacity and material infrastructure.

→ The most useful recommendations are those emphasizing the **collective and technical-material** dimensions of sustainability competences. Their strategic importance is high, though their implementation probably requires structural change and long-term political commitment.

→ **Integrate the expanded Competence Framework into EU Education Policy**: Officially augment the European Sustainability Competence Framework GreenComp (and the one developed by the GreenSCENT project) to include collective and technical-material competences as defined by ECF4CLIM.

Curriculum transformation

→ The **curricular integration of sustainability competences** represents a feasible and impactful approach. It can be introduced gradually and adapted to existing subject areas. Although it does not require systemic curriculum reform, it significantly enhances students' capacity for critical, interdisciplinary and action-oriented learning.

→ Provide more concrete guidance on how to embed **interdisciplinarity** within the curriculum. Compile a catalogue of example initiatives (interventions) and organize them using an interdisciplinary framework.

Institutionalization of sustainability

→ The recommendations regarding the **institutionalization of sustainability** within the organization's overall strategy (beyond just the curriculum) are particularly interesting.

→ Sustain long-term commitment through continuous learning is **less feasible**. Schools face high staff turnover, curriculum pressures, and shifting priorities. Maintaining long-term focus on sustainability is difficult without systemic support.

Participatory approach

→ The **institutionalisation of participatory structures—such as Sustainability Competence Teams and Committees**—is particularly realistic. These mechanisms can be integrated into existing governance frameworks with minimal financial cost, while offering strong benefits in terms of collective engagement, democratic participation and the development of shared responsibility for sustainability.

- → Many schools already have student councils or parent associations. **Extending these to sustainability committees is a natural evolution**.
- → Participatory processes are most effective when they openly address the **complexity and contestation inherent in sustainability**. Because sustainability involves diverse and sometimes **conflicting socio-economic visions**, deliberative practices supported by explicit critical thinking can help educational communities navigate these **tensions** constructively.
- → The ECF4CLIM hybrid participatory approach should require a more detailed explanation for replication (from the one that appears in the policy brief).
- → Funding for participatory projects is often competitive and short-term, making sustained support challenging.

Integrating sustainability practices into everyday activity

- → Use the **school environment as a learning resource**. Turns existing infrastructure (buildings, grounds) into teaching tools (no extra resources required).
- → Integration of evidence into real-life learning projects, ensuring that sustainability competences are **rooted in practical and lived experience,** is very important.
- → For students, **integrating service-learning projects** and participatory budgeting mechanisms would **strengthen agency** and embed sustainability in authentic decision-making contexts.
- → Recommendations involving major infrastructural upgrades—such as renewable energy installations or large-scale building renovations—are **less feasible in the short term due to financial, administrative and political constraints**.
- → It requires significant funding, staffing, and long-term investment in infrastructure (e.g., retrofitting buildings, installing solar panels). Feasibility depends heavily on national budgets and political will.

Using data evidence and digital tools

- → Encourage **data-driven monitoring**. Many schools already collect environmental data (energy, waste). Formalizing this into sustainability dashboards is feasible and supports accountability.
- → The focus on **data utilization** (evaluation, research, and knowledge transfer perspectives) is a valuable contribution.
- → Including **sustainability indicators in performance evaluations of the schools**, and publishing annual sustainability reports, would institutionalise long-term commitment and transparency.
- → The deployment of **digital tools for sustainability assessment and monitoring** is increasingly practical, given that ECF4CLIM has already developed validated

instruments. Their usefulness lies in supporting **evidence-based decision-making** and linking pedagogical activities to concrete environmental data.

→ Include an **assessment of the environmental impact of technological and learning resources**; the integration of technology must be measured and coherent.

Teacher training

→ Support **teacher training and professional development**. Teacher training is a well-established mechanism. Funding for sustainability-focused CPD (continuous professional development) is realistic and can yield high impact.

→ For teachers, the introduction of **micro-credentials in sustainability competences** would recognise and incentivise **professional development** while promoting clearer standards of practice.

→ It would also be very interesting to be able to convey concrete proposals aimed at the teachers who teach the **Master's degree in secondary education** that all graduates who will dedicate themselves in the future to teaching in secondary and high school must complete.

→ At the **policy level**, embedding sustainability education within initial teacher training programmes and establishing a long-term legislative roadmap towards climate-neutral schools would create structural conditions for systemic change.

→ **Local authorities** could establish support centres providing technical guidance, funding advice and training, thereby reducing disparities between institutions.

Collaboration networks

→ Strengthening **collaboration networks among schools, universities, NGOs and local authorities** is also highly feasible, as many such structures already exist and require primarily coordination rather than new resources.

→ This strengthens collective skills and facilitates the sharing of best practices.

→ Build local learning networks is difficult. It requires time, coordination, and often-funding elements already in short supply in many schools.

Strategic suggestions (impact/feasibility matrix)

As part of the consultation process, one of the Advisory Board members proposed a prioritisation of the recommendations based on their expected impact and feasibility. This approach differentiates between *Quick Wins*—actions characterised by high feasibility and high impact that can deliver rapid results; *Major Projects*, which have high transformative potential but require more complex implementation, resources or longer timeframes; *Fill-Ins*, referring to measures that are relatively easy to implement but generate more limited impact and often play a complementary role; and *Long Shots*, which currently face significant feasibility constraints and lower impact, but may become viable under future policy or funding conditions. Building on this categorisation, the

following table translates these distinctions into differentiated implementation strategies to support effective sequencing, resource allocation and policy planning.

Plan for Major Projects: . Seek phased funding for infrastructure upgrades. . Develop partnerships with municipalities, NGOs, or EU grants for participatory projects.	**Start with Quick Wins:** . Policymakers: Roll out teacher training and curriculum integration. . Schools: Launch green routines and student-led sustainability committees.
Reassess Long Shots: . Some may become feasible with policy shifts or new funding streams. Keep them in view but don't prioritize early.	**Monitor Fill-Ins:** . Ensure that easy-to-implement recommendations (e.g., governance models) are supported with real authority and resources.

3.2 Question 2: Additional recommendations that should be included for specific target groups

This section summarises the feedback received in response to the second guiding question, which invited consultees to suggest additional recommendations for specific target groups and governance levels. The responses place particular emphasis on strengthening lifelong learning approaches, reinforcing links between educational institutions and local climate governance, improving access to financial mechanisms for school-level initiatives, and leveraging existing educational networks for dissemination and scaling up. Together, these inputs highlight opportunities to enhance the reach, coherence and systemic impact of the Policy Brief recommendations across the wider educational and policy ecosystem.

→ Reinforce the concept of **lifelong learning** (LLL) to expand the scope of education beyond children and young people, integrating it across the formal and informal educational ecosystem.

→ **Integrate schools into municipal climate plans**: include them in sustainable mobility strategies, waste management, and green spaces.

→ Facilitate **microfinance for school projects**: participatory budgeting for student-led sustainable initiatives.

→ There are already several **educational networks with a proven track record in sustainability and climate change** that would be worth involving in the dissemination of these findings. A plan for this purpose may exist, but it is not referenced in the document.

4 CONCLUSIONS

The validation of the ECF4CLIM Policy Brief confirms the relevance and robustness of its core messages and recommendations, as well as their strong alignment with current European policy priorities on education for sustainability and climate action. Feedback from policymakers and Advisory Board members broadly supports the need to move beyond individual-centred approaches to sustainability competences, recognising the critical role of collective and technical-material dimensions in enabling effective and lasting transformation within educational institutions.

The consultation highlights a high level of consensus regarding the strategic value of recommendations related to participatory governance, curriculum integration, teacher training, data-driven monitoring and the use of educational environments as living laboratories for sustainability. These measures are widely perceived as both feasible and impactful, particularly when embedded within existing governance structures and supported by targeted capacity-building. At the same time, recommendations involving long-term institutionalisation and major infrastructural investments are acknowledged as essential for systemic change, while also being constrained by financial, administrative and political factors. This underlines the importance of phased implementation, multi-level governance and sustained policy commitment.

The feedback also reinforces the importance of differentiation and prioritisation in implementation strategies. The impact–feasibility perspective proposed by one Advisory Board member provides a useful lens for sequencing actions over time, combining short-term “Quick Wins” with longer-term “Major Projects”, while keeping “Long Shots” under review and ensuring that “Fill-Ins” are supported by adequate authority and resources. This approach offers practical guidance for policymakers and educational leaders seeking to balance ambition with realism.

In addition, the consultation process generated valuable proposals to further strengthen the Policy Brief, including a stronger emphasis on lifelong learning, closer integration of schools into municipal climate strategies, improved access to microfinance and participatory budgeting for school-level initiatives, and more systematic engagement with existing educational networks to support dissemination and scaling up. These inputs highlight the importance of viewing education for sustainability as part of a wider policy ecosystem that spans sectors, governance levels and learning contexts.

While the majority of the recommendations identified as less feasible fall largely outside the direct scope and timeframe of the ECF4CLIM project, one specific point raised during the consultation process is being directly addressed. In response to feedback indicating that the ECF4CLIM hybrid participatory approach would benefit from a more detailed explanation to support replication beyond the level presented in the Policy Brief, the project is currently preparing a comprehensive methodological guide. In addition, a shorter, practice-oriented version of the method is being developed to facilitate uptake and implementation in schools and other educational institutions.

Together, these materials aim to strengthen the transferability and practical application of the ECF4CLIM approach beyond the project's lifetime.

Overall, the conclusions drawn from the validation process confirm that the ECF4CLIM framework, Roadmap and associated recommendations provide a solid, evidence-based foundation for advancing the European sustainability competence agenda. By combining conceptual innovation with practical tools, participatory approaches and policy-relevant guidance, the project offers a transferable model to support the further development and operationalisation of GreenComp and to accelerate sustainability transitions across European educational systems.

5 ANNEX 1. POLICY BRIEF

Empowering Educational Communities for Climate Action:

Policy Brief based on ECF4CLIM Findings

ECF4CLIM **project**

In the face of socioecological crises, sustainability competences are essential for humankind's survival. The required sustainability transformations need citizens with the knowledge, skills, and attitudes that enable effective individual action, as well as societal institutions that empower and encourage citizens and organisations to act in favour of sustainability. The acquisition of the necessary competences requires transdisciplinarity, that is, collaboration across disciplinary boundaries and between the different "social worlds" – in brief, science, policy, and society. Such competence-building can only succeed if citizens are enrolled in processes of continuous learning, dialogue, and empowerment.

Through a multidisciplinary, transdisciplinary and participatory process, ECF4CLIM develops, tests and validates a European Competence Framework (ECF) for transformational change, which will empower the educational community to take action against climate change and towards sustainable development. Notably, in ECF4CLIM, we broaden the concept of **sustainability competences** from an individual perspective to spheres of collective and technical-material competences.

ECF4CLIM is **genuinely transdisciplinary**. The project mobilises a **multidisciplinary group of academics** (educational sciences, social sciences, environmental sciences, IT sciences, engineers, etc.,) and **engages students, teachers, parents, and the wider educational community** (NGOs, citizen associations, local and regional authorities, etc.) **in fostering transformational change towards sustainable development.**

Applying an innovative hybrid participatory approach, rooted in participatory action research and citizen science, ECF4CLIM co-designs the Roadmap for Sustainability Competences in selected schools and universities, by:

- **Elaborating an initial ECF**, supported by crowdsourcing of ideas and analysis of existing ECFs.
- **Establishing the baseline of sustainability competences**, i.e., individual, collective, and technical-material competences.
- **Implementing practical, replicable and context-adapted technical, behavioural, and organisational interventions** that foster the acquisition of competences.

- **Evaluating the ability of the interventions** to strengthen sustainability competences.
- **Validating the Roadmap** for Sustainability Competences.

The proposed Roadmap for Sustainability Competences is unique in that it systematically explores individual, collective and technical material competences that enable or constrain the desired change.

The hybrid participatory process is unique in that it fosters a co-learning culture with equal voice for all educational actors. It provides a rich collaborative learning experience that bridges theory and practice while aligning diverse stakeholders' expectations around sustainability. Additionally, it facilitates new ways of collaboration between public, private and third-sector bodies; as well as innovative organisational models of engagement and action for sustainability (Sustainability Competence Teams and Committees) and a catalogue of showcase interventions.

To encourage learning-by-doing, several novel tools have been co-designed with and made available to citizens, including a digital platform for crowdsourcing, IoT solutions for real-time monitoring of selected parameters, sustainability assessment tools and a digital learning space.

Project **outcomes**

Working hand-in hand with 13 primary and secondary schools and universities in Finland, Portugal, Romania and Spain ECF4CLIM has produced a set of five relevant outcomes:

A **new conceptual framework** to understand sustainability competences that goes beyond individual competences and includes collective and technical-material competences.

A **validated Roadmap for Sustainability Competences** that builds upon GreenComp and outlines the key drivers for sustainability competences in educational practice to empower educational communities to take action against climate change and promote sustainability.

A **novel hybrid participatory approach** designed to support the work of educational communities in the co-design, co-implementation and evaluation of interventions aiming to promote sustainability competences.

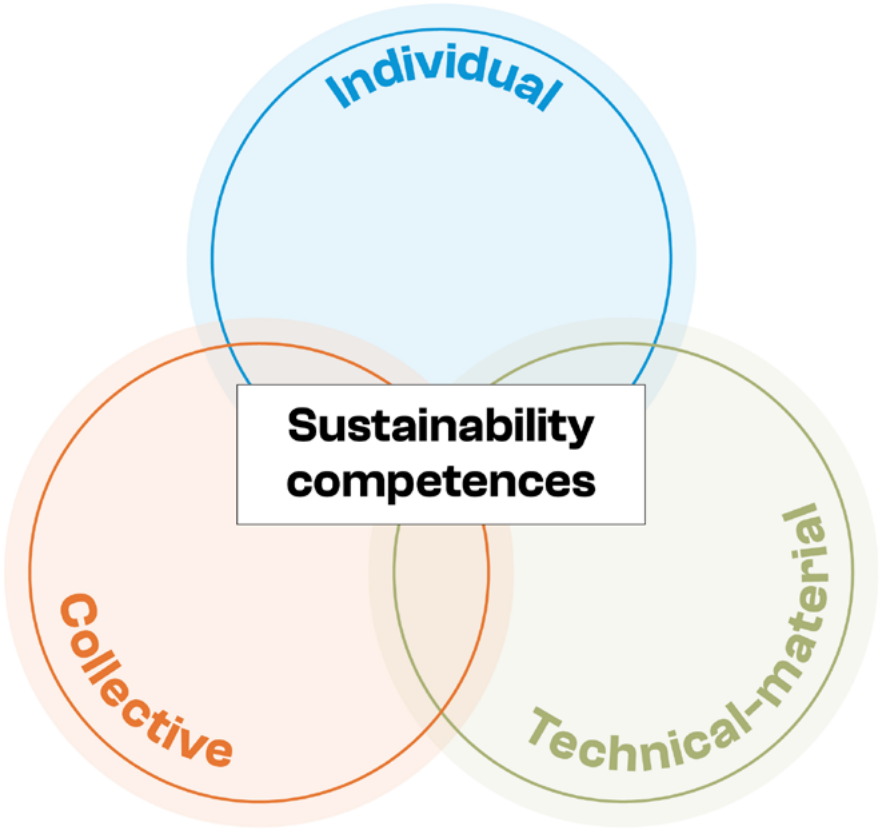
A catalogue of practical, replicable and context-adapted **showcase interventions** exemplifying successful sustainability competence-fostering practices, and providing a practical guide for their replication in other educational centres.

Various **digital tools and learning materials** designed to promote sustainability competences and support active learning through simulation, reflection and action-oriented experiences.

Outcome 1.

The conceptual framework

Traditionally, the concept of competences, and more specifically, sustainability competences, has been considered from an individual perspective. However, during the ECF4CLIM project, it became evident that the entire community's ability to act in building a sustainable future is essential, and that material and technical conditions play a significant role as either constraints or enablers of sustainability. Therefore, we expand the concept of **sustainability competences** to encompass not only individual competences, but also collective and technical-material competences.



By **individual competences,** we mean the development of a combination of personal qualities and qualifications, i.e., the knowledge, skills and attitudes that individuals need in order to achieve certain goals through their actions and activities. In our case, these goals are promoting sustainability and planetary wellbeing.

Individual sustainability competences are not only essential for students but also for teachers, administrators and other stakeholders in educational settings. This understanding aligns with the lifelong learning approach: no one is ever fully 'ready' or completely competent in sustainability because contexts evolve and new phenomena emerge. Furthermore, individual competences are always context-specific; they are developed and exercised within specific social, cultural and material contexts. This means that individual sustainability competences are deeply intertwined with collective and technical-material competences.

By **collective competences**, we refer to the capacity of an organisation to act coherently and purposefully for sustainability. An organisation's ability to act is shaped by more than just the competences of its individual members or leaders. It emerges from collective dynamics that transcend the sum of individual competences and efforts. Thus, collective sustainability competences comprise:

- **Regulative competences** (external to the organisation): Derive from written rules (laws, regulations) that stipulate how sustainable development is to be considered and promoted and by whom.
- **Normative competences** (internal to the organisation): Norms and values reflected and institutionalised in the organisation's own strategies, programmes of action, plans, guidelines, result agreements with authorities at different levels of governance, etc.
- **Cultural-cognitive competences**: the internalisation of regulative and normative competences as taken-for-granted social norms of normal and acceptable behaviours; the translation of regulative and normative competences into the organisation's operating culture, daily routines, habits and practices.

By **technical-material competences**, we refer to the role of tools, infrastructures, technologies and physical environments in enabling (or constraining) sustainability action. Change (like sustainability action) depends not only on people's intentions but also on how materials and infrastructures enable or constrain those intentions. Material conditions are not neutral backgrounds, but active components of what people and communities are able to do and become. Competence, in this view, is not only a matter of human or collective abilities, but also of material conditions and capabilities.

The three spheres of sustainability competences – individual, collective, and technical-material – are not isolated or hierarchical, but **deeply intertwined and interdependent**, overlapping like a trio of coloured spotlights illuminating the same phenomenon. Competences in educational practices rarely emerge from one of these domains alone, rather they are generated through their dynamic interaction.

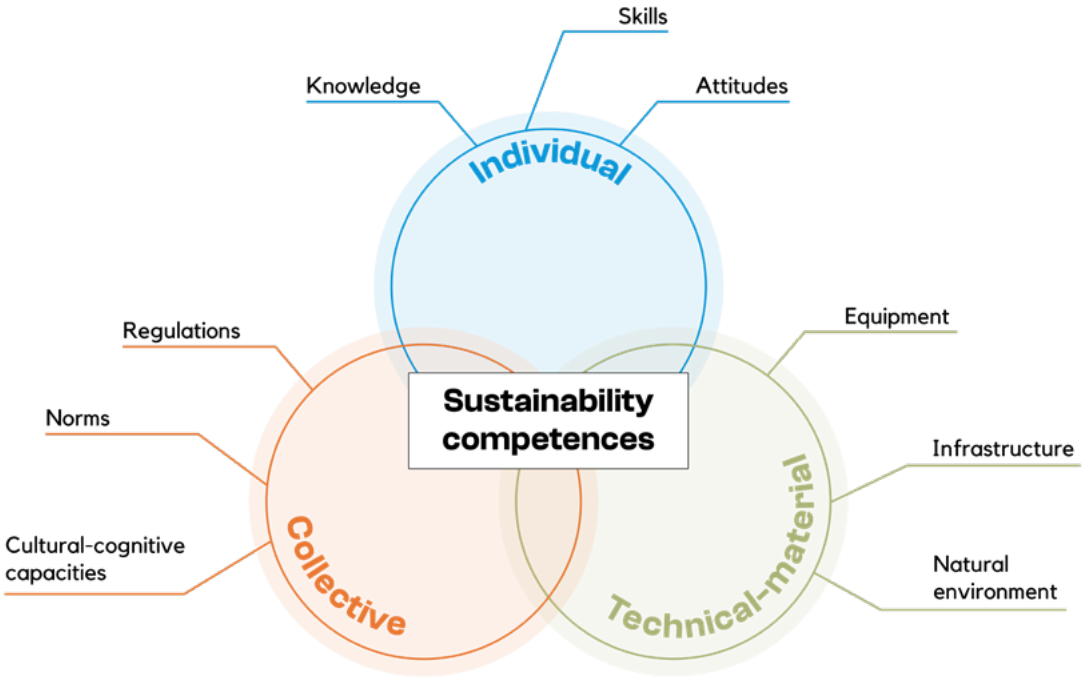


Figura 1. Overview of the three interconnected types of sustainability competences: individual, collective and technical.

Individual sustainability competences, i.e. knowledge, skills and attitudes concerning sustainability, are required when developing collective competences, or when the operational culture of a school or university evolves towards sustainability. Conversely, collective sustainability competences, such as regulations, curricula and cultures that promote sustainability, guide individuals in making sustainable personal choices and adopting sustainable behaviours. Both individual and collective sustainability competences are prerequisites for improving technical-material sustainability competences. This is because individuals and communities need to understand how technical-material conditions must be improved for sustainability, but also because collective norms, regulations, cultures and resources are needed to support the implementation of new solutions. Similarly, individuals and communities cannot act sustainably without considering the laws of nature and the technical and material environment. If technical-material conditions are poor, it becomes difficult for individuals or communities to make meaningful choices for sustainability. For instance, without the necessary infrastructure to enable sustainable choices, individual awareness alone

cannot minimise environmental impact. Similarly, even if regulations exist, without adequate equipment to measure environmental impact, organisations will struggle to identify the most effective ways to change their practices.

In short, what makes this framework unique is that it broadens sustainability competences beyond the individual, incorporating collective and technical-material dimensions and emphasising their deep interdependence in enabling meaningful and effective sustainability action.

Recommendations

For policy makers

- Expand the conceptualisation of sustainability competences in the current European framework of sustainability competences (GreenComp) by, besides the individual competences, incorporating collective and technical-material competences, as well as the interrelationships between them.
- Incorporate collective and technical-material competences into laws, programmes, plans and strategies in the field of education for sustainability. Ensure that curricula adequately and sufficiently cover this type of competence.
- Allocate material and human resources to schools and universities to ensure the suitability of technical-material competences: efficient and sustainable infrastructure and equipment, staffing for the proper maintenance and operation of infrastructure and equipment, and training of staff in these areas (heating, electricity, air quality, food services, waste management, transportation systems, green spaces, green procurement, etc.).
- Allocate resources, human capital, and time to schools and universities to ensure the suitability of collective competences: teaching hours to facilitate their involvement in participatory processes or other initiatives; incentives for teachers to facilitate their involvement in activities outside school hours; training for teachers in sustainability competences; provision of additional staff.

- Provide incentives and training to promote motivation, knowledge and skills among school and university leaders to facilitate the promotion of sustainability competences.
- Support research through dedicated calls and/or topics to clarify and operationalise collective and technical-material competences intertwined with individual competences.

For the educational community

- Facilitate incentives and training to promote motivation, knowledge and sustainability competences among teachers and staff at schools and universities.
- Promote cooperation networks with other educational communities, local and/or regional authorities, NGOs and universities/research centres to reinforce transdisciplinarity and strengthen collective competences.
- Include activities related to the promotion of sustainability competences in the internal rules and regulations of educational centres, as well as in their annual action programmes.
- Prioritise environmental sustainability criteria in the acquisition of equipment and infrastructure, as well as in the provision of the material resources necessary for the activity of educational centres.
- Prioritise social and economic criteria (e.g. fair trade, social and solidarity-based economy networks, avoiding labour exploitation) when acquiring equipment, infrastructure and material resources.

Outcome 2.

The Roadmap for Sustainability Competences

Traditionally, the concept of competences, and more specifically, sustainability competences, has been considered from an individual perspective. However, during the ECF4CLIM project, it became evident that the entire community's ability to act in building a sustainable future is essential, and that material and technical conditions play a significant role as either constraints or enablers of sustainability. Therefore, we expand the concept of **sustainability competences** to encompass not only individual competences, but also collective and technical-material competences.

The Roadmap for Sustainability Competences developed in the ECF4CLIM project outlines the key drivers for sustainability competences in educational practice. Its goal is to empower educational communities to take action against climate change and promote sustainability.

Through a transdisciplinary and participatory process conducted in four European countries – Spain, Finland, Portugal and Romania – with the support of technical partners in Hungary and Greece, ECF4CLIM developed, tested and validated this Roadmap for Sustainability Competences through multiple phases. Initial data was collected through crowdsourcing, and the initial roadmap was tested through our innovative hybrid participatory approach in project schools and universities. Throughout its development the Roadmap was assessed both internally and externally.

One essential starting point for this Roadmap was the European sustainability competence framework, GreenComp, which was published in the same spring that the ECF4CLIM project began. This Roadmap expands on the ideas presented in GreenComp: while GreenComp focuses primarily on describing individual-level knowledge, skills and attitudes, this Roadmap broadens the concept of competences from an individual perspective to the spheres of collective competences and technical-material competences. This idea is based on the theory of practice architectures, which suggests that

competences are formed and enacted within practice. It is also based on sociomaterialist and capability theories, which argue that material conditions are active components of what people and communities are able to do and become, rather than neutral backgrounds. Our data confirms these theoretical underpinnings: collective and technical-material competences can be developed, and they can also support the development of individual competences.

This Roadmap has a strong practical aim: we hope that it will help schools and universities move from the conceptual level of GreenComp to practical implementation, as evidenced by intervention results from our project and our insights from demonstration sites, which have deepened our understanding of sustainability competences in practice. This approach ensures that the framework is grounded in real educational practices rather than being purely theoretical.

This Roadmap for Sustainability Competences elaborates on competences through four key focus areas that are important for promoting sustainability in educational practices: engagement, connections, change and action. We structure each area around individual, collective and technical-material competences in educational practice, and also describe their intertwinedness as we have found that all spheres and practical focus areas related to sustainability competences are deeply intertwined.

The Roadmap for Sustainability Competences demonstrates that across all areas, the main enablers of sustainability and the promotion of sustainability competences include management, participatory approaches, cooperation, resources, and the motivation and commitment of actors. Supporting infrastructures, regulations and norms, and transdisciplinary knowledge are also important. If these enablers are missing, they become the main constraints to sustainability in education. When we study these enablers or constraints, we see that they are closely related to the presence or absence of individual, collective or technical-material competences.

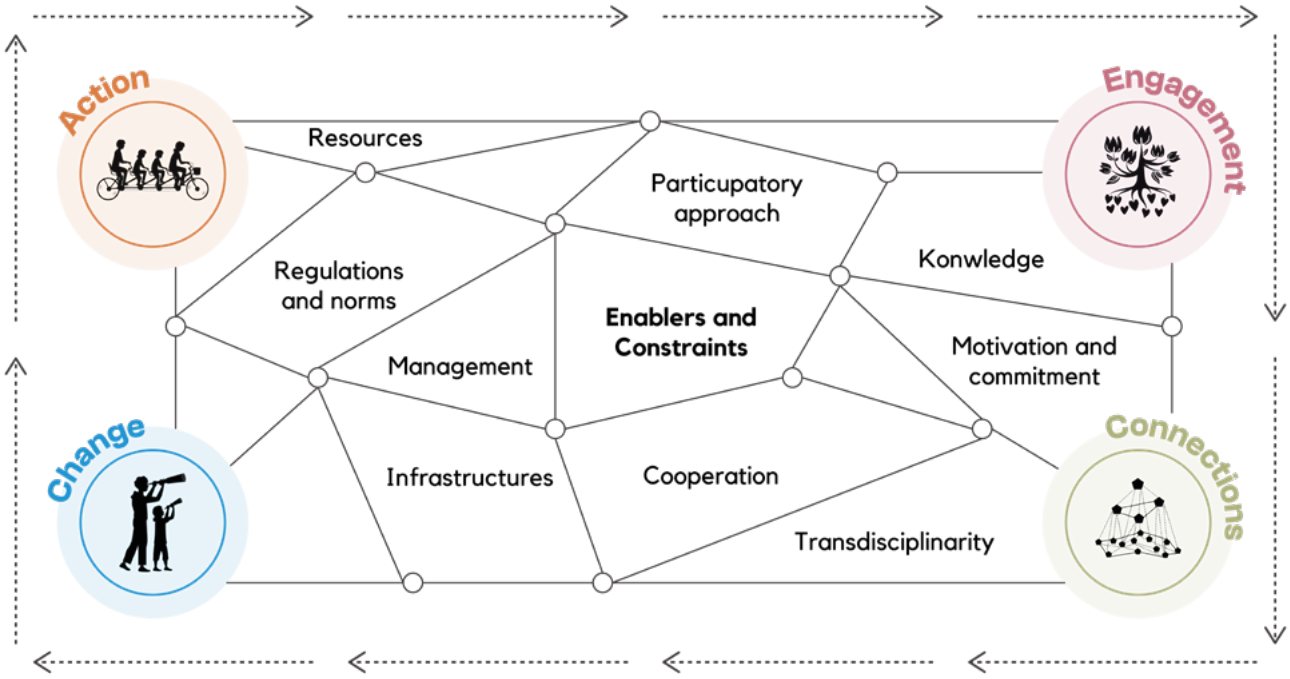


Figura 2. Roadmap for Sustainability Competences

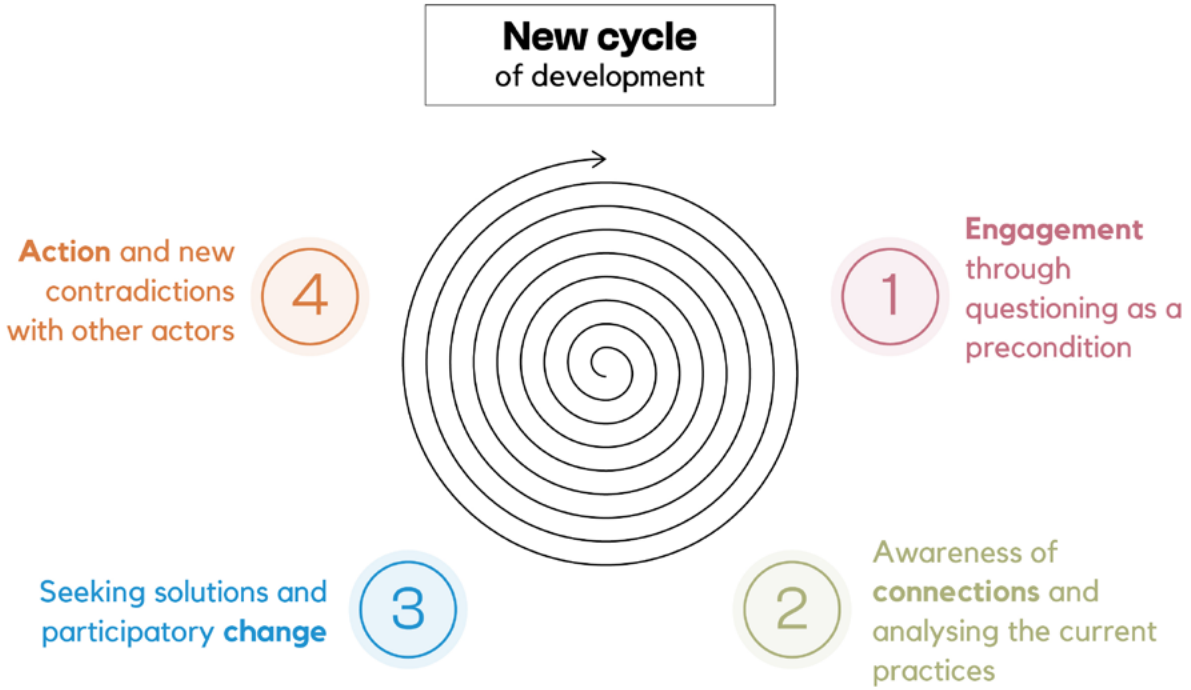


Figura 3. Spiral showing the iterative development cycle: Engagement, Connections, Change, and Action.

The Roadmap for Sustainability competences can be interpreted as a model of a development process (grey line with arrows) creating expanding cycles of growth. Alternatively, it can be used to study opportunities to promote sustainability in specific situations by analysing them through the lenses of Engagement, Connections, Change and Action, and identifying individual, collective and technical-material competences within them.

From the perspective of educational practices, this Roadmap for Sustainability Competences has potential for scaling up. The Roadmap is also presented on the MAPPA.fi platform in a user-friendly format, making it easy to apply in educational practice and enabling the sharing of materials and tools related to the Roadmap also in the future.

In short, the Roadmap for sustainability competences, building on the European GreenComp framework, expands sustainability competences beyond the individual to include collective and technical-material dimensions, emphasizing their interconnection in practice. Developed through a transdisciplinary and participatory process across multiple European countries, the Roadmap identifies key enablers—such as management, cooperation, resources, and commitment—and offers a structured approach around four focus areas: Engagement, Connections, Change, and Action. **EC4CLIM devoted special efforts to validating the Roadmap, through both internal and external processes. Grounded in real educational practices and made accessible via the MAPPA.fi platform, it supports both the implementation and scaling up of sustainability competences in schools and universities.**

Recommendations

For policy makers

- Create a national/regional/local **Strategy and Action Plan on Education for Sustainability** that prioritises sustainability across all levels of education policy and **explicitly links educational objectives to the four dimensions** (Engagement, Connections, Change, Action) and the three competence spheres (individual, collective, technical-material) outlined in the Roadmap for Sustainability Competences.
- **Institutionalise sustainability** through norms, governance, and resource allocation. Require educational institutions to develop sustainability plans, define responsibilities, and allocate sufficient human resources (additional teachers, maintenance and support personnel), financial resources and time to implement and monitor them. Require the educational institutions to meet minimum standards in sustainability.

- **Integrate sustainability across the curriculum.** Address sustainability issues in multiple subjects and/or through the coordinated teaching of different subjects to promote systemic, interdisciplinary and critical thinking. Encourage creative, practice-based learning that connects classroom theory with real-world challenges, taking into account values and diverse interests and supporting students' creativity to discover new connections.
- Establish national and regional support mechanisms—including **training, mentoring, and professional networks**—to empower educators as agents of change. Provide clear guidance, resources, and incentives for school leaders and teachers.
- Support **research and knowledge transfer**. Facilitate cooperation between researchers and educational institutions to facilitate that new findings and technical innovations in sustainability are effectively transferred into practice.
- Encourage **data-driven monitoring**. Promote cooperation between educational institutions, local authorities, and external stakeholders in collecting and publishing data on sustainability in education to inform evidence-based decisions and track progress.

For the educational community

- **Make sustainability visible in daily practices.** Use the school environment as a learning resource—highlighting energy use, waste management, mobility impacts, and green spaces—to cultivate awareness and concrete understanding among students.
- **Provide training and support for teachers and non-academic staff.** Encourage teachers and staff to participate in training activities related to sustainability competences and technical and digital literacy.

- **Support emotional engagement and wellbeing.** Recognise the emotional dimension of learning about sustainability. Provide students with opportunities for constructive action that transforms eco-anxiety into hope and agency.
- Sustain **long-term commitment** through continuous learning and engagement of the whole educational community. View sustainability education as an evolving process embedded in the **institution's mission**. Allocate time, resources, and technical systems for ongoing reflection, measurement, and improvement.
- **Foster collaboration and networks.** Engage in partnerships with other institutions, municipalities, community actors to share practices, co-design initiatives, and amplify impact. Engage in sustainability research projects.

Outcome **3.**

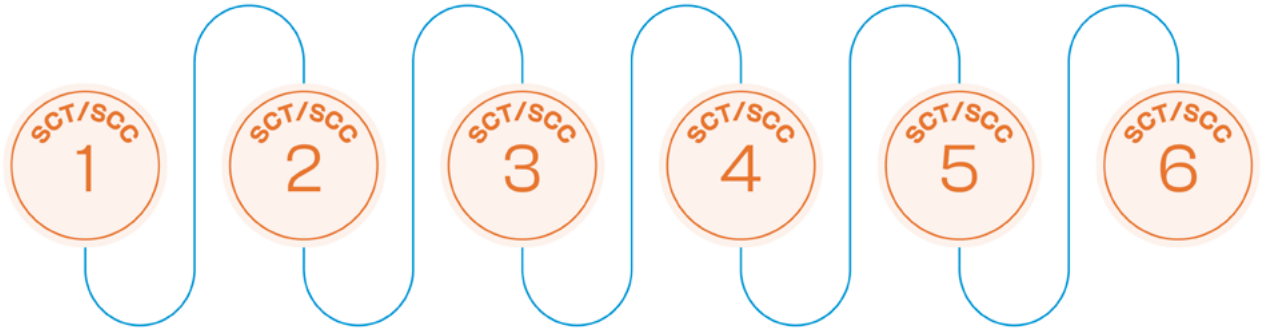
The hybrid participatory approach

The ECF4CLIM hybrid participatory approach, rooted in participatory action research and partly based on the STAVE tool (Systematic Tool for Behavioural Assumption, Validation and Exploration) **encourages students, teachers, staff and external stakeholders to work together to assess sustainability competences and reflect on the impact of actions.** By emphasising creativity, transdisciplinarity and iterative reflection, it supports transformative change and enhances institutional capacity to address sustainability challenges.

In each of our 13 Demonstration Sites (DS) in Finland, Portugal, Romania and Spain, we have established two types of innovative organisational structures: **Sustainability Competence Teams (SCTs)**, composed of students, teachers and staff, and **Sustainability Competence Committees (SCCs)**, which also include representatives from the wider education community, such as families, experts, authorities, NGOs, etc.

Each of them meets up to six times over the course of the project to encourage reflexivity and deliberation.

Over 500 students, teachers, staff and representatives from the wider educational communities at our DS are actively involved in our SCTs and SCCs (130 SCT meetings and 50 SCC meetings).



SCT/SCC session 1:

Establishing the baseline of sustainability competences at our demonstration sites (DS).

- Employing a wide range of quantitative and qualitative methods, the project establishes the initial state of play at schools and universities in terms of the individual and collective competences and the environmental performance.
- The methods include: environmental KPIs, environmental audits, short surveys, interviews, documentary analysis, and reconvened focus groups.

SCT/SCC session 2:

Co-designing interventions to foster the acquisition of competences.

- Drawing on the empirical evidence from the baseline assessment and through the participatory and deliberative process in SCT/SCC session 2, each demonstration site co-designs a tailor-made initial set of interventions to foster sustainability competences and climate action.
- The co-designed interventions include behavioural (e.g., changing habits, routines, social norms, organisational structures, etc.) and structural (e.g. small-scale retrofitting solutions, green spaces, green procurement procedures) measures.
- Out of 159, 64 interventions were selected for implementation.

SCT/SCC sessions 3 & 4:

Co-implementing practical, replicable and context-adapted interventions.

- To support the participatory implementation of our interventions, several monitoring mechanisms are in place: intervention templates (the research team, in close collaboration with the DSs, collects information on the interventions); monthly reporting; and SCT/SCC sessions 3 & 4 (to promote reflection on the interventions and gather initial evidence on the impact of the interventions on sustainability competences).

SCT/SCC sessions 5 & 6:

Participatory evaluation of the interventions and of the project as a whole.

- The theory-based stakeholder evaluation guides our evaluation approach to explore the relationships between the interventions (and the whole project) and sustainability competences.
- On the one hand, we analyse the expected and observed outcomes of the intervention (and of the whole project), and on the other hand, the expected and observed relationships between the intervention (and the whole project) and its outcomes.

The ECF4CLIM experience shows that the hybrid participatory process fosters a culture of co-learning by establishing new relationships among students, teachers, and external participants, encouraging mutual exchange and collaboration. It strengthens teamwork through joint planning, decision-making, and implementation, while ensuring inclusive and empowering participation that gives everyone a voice. Learning becomes more active and engaging, helping participants develop a deeper, more holistic understanding of sustainability and see how small actions contribute to broader environmental goals. At the same time, it bridges the gap between theoretical knowledge and real-world application, making learning meaningful, practical, and impactful. The iterative nature of the process enables the development of long-term sustainability projects that extend beyond isolated, one-off actions.

Overall, the participatory approach - bringing together students, teachers, staff, and external actors in shared planning and decision-making - was highly effective in catalysing self-reflection, deliberation and co-learning, effectively turning evaluation into a competence-building process. As with the Roadmap, ECF4CLIM devoted particular attention to evaluating the quality

of the participatory approach, in terms of both processes and outcomes. This was achieved through dedicated SCT/SCC sessions and short surveys conducted after each participatory initiative in our schools and universities.

Recommendations

For policy makers

- Develop policies that promote **equitable and socially inclusive sustainability transitions** in education, involving the entire educational community.
- Promote the **hybrid participatory methods** proposed in this project at different levels of decision-making and policy processes to foster sustainability competences within educational communities.
- **Recognise and institutionalise participatory governance models**. Encourage the formal creation of Sustainability Competence Teams and Committees or other kinds of organizational models for sustainability within educational institutions and include them into their governance structures.
- **Allocate resources** for the creation and maintenance of these organisational models for sustainability in educational institutions.
- Develop policies that support the **evaluation of participatory processes**. Allocate resources and guidance to assess the quality of both the process and the outcomes of participatory initiatives and processes.
- Support **research** to promote the development and implementation of evaluation theories and methods through dedicated calls and topics.

For the educational community

- Promote **inclusive and participatory governance**. Encourage decision-making processes that involve teachers, students, families, and local communities.
- **Promote and institutionalise participatory routines** (e.g., annual SCT/SCC cycles). Allocate time, foster recognition for educators and students, and resource facilitation/ coordination to keep reflective evaluation feasible and impactful. Facilitate systemic integration and adequate support.
- **Empower students as active sustainability actors.** Create spaces for student-led initiatives, workshops, and projects where they can contribute to sustainability proposals, participate in decision-making, and promote inclusion and non-discrimination.
- **Build participatory and inclusive school cultures.** Involve all community members—teachers, students, administrative staff, and local stakeholders—in co-designing and co-implementing sustainability action plans to foster a sense of shared ownership and collective responsibility.
- **Prioritise participatory processes** and allocate time and resources for their organisation, implementation and evaluation. Make timetables more flexible and allocate spaces.

Outcome **4.**

Catalogue of interventions

Through our innovative hybrid participatory process, involving Sustainability Competence Teams (SCTs) and Committees (SCCs), the ECF4CLIM project has co-designed, co-implemented and co-evaluated a high number of sustainability interventions to foster sustainability competences in our demonstration sites: **13 schools and universities from four EU countries over three school terms. A total of 159 interventions were initially designed, of which 87 were selected for implementation. Ultimately, 64 interventions were implemented during the project lifetime.**

In close collaboration with the demonstration sites, we identified and selected a set of showcase interventions that exemplify successful practices in fostering sustainability competences. This selection was made using a combination of qualitative and strategic criteria. These included their impact on the educational community, their potential for replication in other contexts and how well they covered the four dimensions of the Roadmap for Sustainability Competences (Engagement, Connections, Change and Action) and the three competence spheres defined in the ECF4CLIM conceptual framework (individual, collective and technical-material competences).

This selection of practical, replicable and context-adapted interventions for the promotion of sustainability competences in the educational community aims to provide a practical guide for replicating the sustainability measures developed by the ECF4CLIM project in other educational centres.

The selected interventions address a wide variety of sustainability-related topics, ranging from energy and water consumption and food production to the installation of solar panels and water sensors, the organisation of second-hand clothing markets and the provision of better canteen food, including vegetarian options and the sale of surplus food. Community gardens and green spaces were also created with student participation, and university courses and modules dedicated to ecological transition and climate justice were launched. In terms of waste management, weekly flag systems were employed, and competitions were held between

classes to encourage recycling, combining gamification with environmental awareness. Other interventions focused specifically on awareness campaigns, escape room games and the use of digital tools, such as WhatsApp groups, to reinforce communication. Educational talks and campaigns covered topics such as fast fashion, cycling, plant-based diets and nature-based activities, often supported by materials created by students and social media accounts managed by the school. New curricular units were also introduced to strengthen interdisciplinary learning, and dedicated teaching materials and cross-cutting learning spaces were designed to explore sustainability from diverse academic angles. Finally, educational visits provided hands-on experience of local environmental issues, reinforcing students' sense of responsibility.

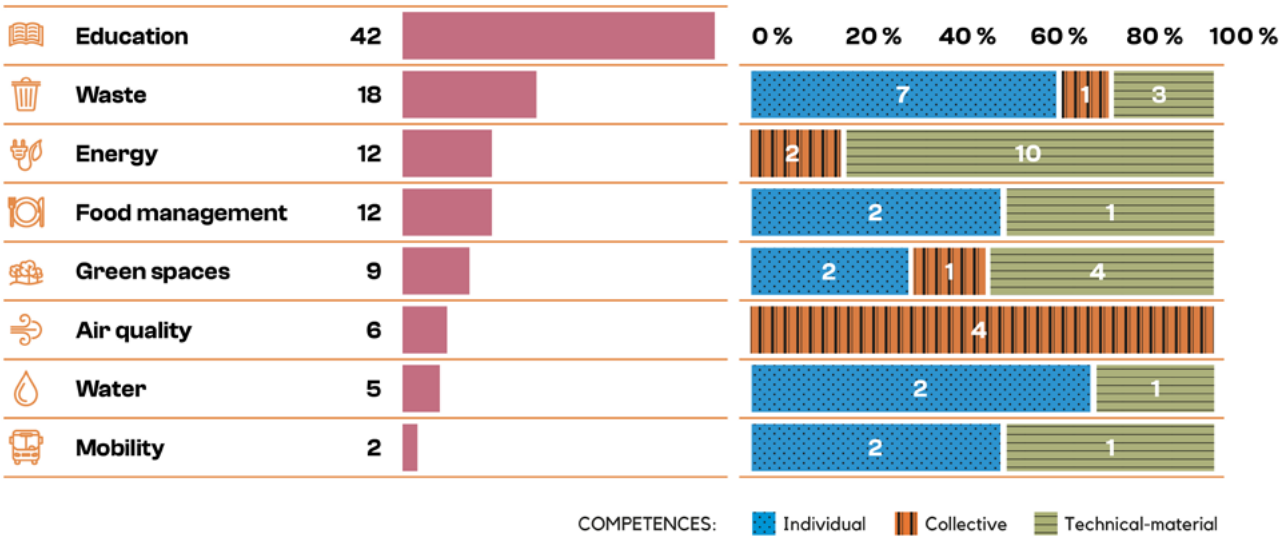


Figura 4. Classification of measures selected by main topic and ECF4CLIM Analytical Framework spheres

Monitoring these interventions involved various methods and tools, such as the Sustainability Competence Teams and Committees meetings, the intervention templates, and a monthly reporting procedure. This reflective, iterative and systematic follow-up approach enabled a deeper understanding of the practicalities of the different interventions, including their goals, tasks, milestones, outputs as well as the associated challenges and opportunities.

In short, the ECF4CLIM project co-designed, implemented, and evaluated a high number of interventions across 13 schools and universities in four EU countries. Selected interventions, covering topics from energy and water management to sustainable food, waste reduction, green spaces, and ecological education, were chosen for their impact, replicability, and alignment with the Roadmap's four dimensions—Engagement, Connections, Change, and Action—and the three competence spheres: individual, collective, and technical-material.

Systematic monitoring, evaluation and reflective follow-up allowed the project to assess practical outcomes, challenges, and opportunities, providing a replicable guide for fostering sustainability competences in other educational communities.

Recommendations

For policy makers

- Provide sufficient **financial support** for the co-design, co-implementation and co-evaluation of sustainability projects, ensuring equity and inclusiveness. Ensure that all types of schools and universities, including those with fewer resources or located in rural or disadvantaged areas, have access to funding and resources.
- Facilitate **knowledge exchange and replication**. Support networks and platforms where schools and universities can share their sustainability interventions, results, and best practices. Promote the use of the Roadmap for Sustainability Competences, tools and interventions as models for replication across regions and countries.
- Develop **evaluation frameworks and indicators**. Provide institutions with clear guidance and flexible methodologies for monitoring the outcomes of sustainability interventions. Encourage the use of evaluation approaches that combine qualitative reflection—for example, through the hybrid participatory method developed in ECF4CLIM—with quantitative indicators - such as the Environmental Footprint Calculator or the Sustainability Intervention Evaluation Tool.
- Provide sufficient **technical, financial, administrative and institutional support** for the implementation of technical and infrastructural interventions in educational settings, such as the installation of solar panels or water monitoring systems.

For the educational community

- **Plan and allocate time** for participatory learning creating time within the school schedule for students, teachers and staff to engage in interventions. Embrace reflection and adaptability, discussing both successes and challenges and refining interventions and adapting them to changing local needs and resources.
- Embed sustainability in everyday practice. Integrate **sustainability interventions into teaching activities, and school management** using the ECF4CLIM catalogue of interventions as adaptable models for local implementation.
- Encourage **cooperation across disciplines and between teachers, students, and local communities**. Working together on concrete sustainability interventions strengthens collective and technical-material competences while enhancing also individual competences.
- Facilitate the collection of **consistent data** and the definition of **meaningful indicators**, and make these visible to the educational community. **Assess progress** driven by interventions across diverse dimensions of engagement, connections, change and action, as well as the three spheres of individual, collective and technical material competence.

Outcome 5.

Tools and learning materials

As part of the ECF4CLIM project, **we have developed digital tools and learning materials designed to promote sustainability competences and support active learning through simulation, reflection and action-oriented experiences.** These include an Environmental Footprint Calculator tailored for educational communities, a Retrofitting Toolkit for assessing building energy efficiency, a Sustainability Intervention Evaluation Tool for improving sustainability competences at educational settings, and an IoT Ecosystem for acquiring indoor air quality and energy consumption data. All of these tools are hosted on the project's digital platform.

The project has also developed pedagogical tools to provide teachers and educators with resources to promote sustainability in their teaching, including Flipbooks and a Learning Game. These resources were co-designed with the educational communities at our demonstration sites in response to emerging pedagogical needs, and were used throughout the project. Serving as both learning tools and diagnostic instruments, they provide a practical mechanism for implementing the competence-based approach to sustainability education set out in the Roadmap for Sustainability Competences.

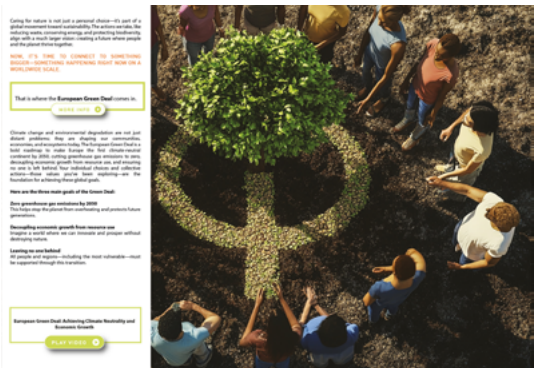
All the tools can be adapted for different educational levels and used in both formal and non-formal educational contexts, as well as for lifelong learning. These resources are also hosted on the project's digital platform.

The digital tools developed in the ECF4CLIM integrate data collection, self-assessment, and participatory learning features within a unified digital ecosystem, enabling schools and universities to analyse their sustainability practices, plan improvements, and engage their communities in meaningful action.

A particularly distinctive feature is the Environmental Footprint Calculator, which has been specifically adapted to the characteristics and needs of educational centres and educational communities. This tool allows institutions to measure and understand their environmental impact, beyond climate change impacts, through parameters directly linked to school

operations—such as energy consumption, mobility, waste management, and resource use—making it both an educational and decision-making instrument. Complementing it, the Sustainability Intervention Evaluation Tool enables schools to assess their performance and to evaluate the effects of sustainability interventions across a series of environmental KPIs (energy, waste, green procurement, green spaces, transport, water), providing evidence-based insights into the outcomes of their actions. In addition, the Retrofitting Toolkit supports the technical and infrastructural transformation of educational buildings by helping institutions identify, plan, and implement improvement measures that enhance energy efficiency, reduce environmental impact, and align with broader sustainability goals. It bridges the gap between pedagogical practices and the technical material environment, reinforcing the Roadmap's approach to sustainability competences.

In addition to these digital tools, **the interactive flipbooks and the learning game foster the pedagogical and motivational dimensions of sustainability education.** Both make explicit reference to the Roadmap for Sustainability Competences, helping educators and students understand and apply its principles in practice. They also include concrete examples of sustainability interventions carried out within the project, which serve as inspiration and practical guidance for implementing the Roadmap in other educational institutions. The flipbooks present complex sustainability concepts in an engaging, visual, and accessible way, while the learning game promotes active engagement and collaboration among students, enabling them to internalise sustainability competences through experiential and playful learning.



Overall, these tools stand out for their integration of educational, organisational, and technical dimensions: they function not only as learning materials but also as instruments for institutional transformation. Developed collaboratively with educators, students, and technical partners, they ensure pedagogical relevance, usability, and adaptability across diverse European contexts. In line with the overall evaluation strategy of the ECF4CLIM project, the tools and learning space underwent several internal and external validation processes.

Recommendations

For policy makers

- **Integrate digital sustainability assessment tools into national education curricula**. Recognise tools such as environmental footprint calculators and retrofitting simulators as valuable resources for developing sustainability competences at individual, collective and technical-material level, and include them in teaching recommendations and textbooks.
- **Support teacher training and professional development:** Allocate funding and design continuous learning programmes for educators to use these digital resources effectively.
- Create **long-term support mechanisms.** Encourage partnerships between ministries, regional governments, research projects and providers of educational materials to ensure that digital learning tools are maintained and updated beyond the project lifecycle.
- Foster **evidence-based policy**: Fund research and pilot programmes to monitor and evaluate the impact of digital sustainability assessment tools on the development of individual, collective and technical-material competences.

For the educational community

- Integrate tools into **real-life learning projects:** Use the tools in project-based learning to connect classroom activities with actual school/university sustainability interventions.
- Promote **collaborative learning and reflection**: Encourage students, teachers and school/university managers to jointly analyse sustainability data and reflect on possible interventions to improve sustainability competences at individual, collective and technical-material level.

- Build **local learning networks:** Share experiences and results with other institutions to create communities of practice around digital sustainability assessment tools.
- Promote **digital and sustainability competences simultaneously**: Leverage the IoT Ecosystem and digital resources to enhance both digital literacy and sustainability competences.
- Provide educators with the **time and institutional support** they need to incorporate these digital resources into their teaching.

The ECF4CLIM **project team.**

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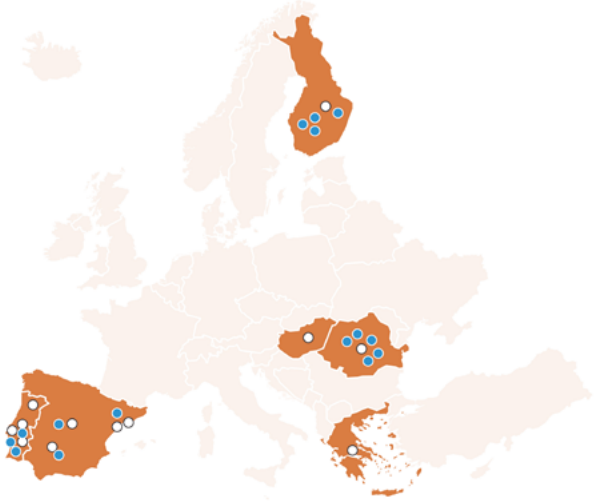

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6 ANNEX 2. FEEDBACK FROM POLICY MAKERS AND MEMBERS OF THE ADVISORY BOARD

POLICY MAKER 1

Ahora que llegamos al final quería daros la enhorabuena por el trabajo realizado incorporando un conjunto de competencias en sostenibilidad en la educación. Hay propuestas reales y viables que desde el mundo de la educación son fundamentales, y sirven para imaginar futuros sostenibles y actuar a favor de la sostenibilidad.

Pregunta 1. ¿Qué recomendaciones crees que son las más/menos factibles y útiles, y por qué?

Integrar la sostenibilidad en el Proyecto educativo de Centro (incorporando valores de sostenibilidad al currículo y a las prácticas diarias)

- Es relativamente fácil de implementar porque se pueden implementar en las asignaturas existentes y no requiere grandes inversiones iniciales.
- Tiene un impacto alto: promueve el pensamiento crítico, la interdisciplinariedad y conecta la teoría con los problemas reales.

Ofrecer capacitación e incentivos al profesorado y a los líderes escolares

Este punto es factible participando en los programas de formación continua y reconocimiento profesional a nivel de créditos que las administraciones realizan con sus planes de formación (como los cursos de Formación del Profesorado que se realizaron en el Centro Territorial de Innovación y Formación Madrid-Sur)

Realizar proyectos en el Centro educativo a largo plazo. Se necesita que se asignen recursos significativos y apoyo institucional para la Creación de infraestructura como la Creación de espacios verdes, paneles solares... Posteriormente se puede participar en programas Institucionales: Programas de Educación Ambiental, STEM, Proyectos de Innovación...) y presentar dichos proyectos a diferentes convocatorias de premios convocados para centros educativos.

Pregunta 2. ¿Se te ocurre alguna recomendación adicional que debería incluirse para sectores específicos?

<u>Para estudiantes:</u>

- Realizar Aprendizaje basado en Gamificación y aprendizaje experiencial: usar retos, juegos, escape room y simulaciones para transformar la eco-ansiedad en acciones positivas.

<u>Para autoridades locales y municipios:</u>

- Integrar los centros educativos en planes climáticos municipales: incluirlos en estrategias de movilidad sostenible, gestión de residuos y espacios verdes.

Las recomendaciones y la Hoja de Ruta para las Competencias en Sostenibilidad desarrolladas en el marco del proyecto ECF4CLIM son plenamente coherentes con los principios y objetivos establecidos por la Ley Orgánica de Modificación de la LOE (LOMLOE). En particular, la LOMLOE establece la necesidad de integrar la educación para el desarrollo sostenible y la ciudadanía global en todas las etapas educativas y fomentar el aprendizaje competencial, interdisciplinar y basado en proyectos, que conecta la teoría con los retos del mundo real.

Translated text

Now that we are reaching the end of the project, I would like to congratulate you on the work carried out to incorporate a comprehensive set of sustainability competences into education. The proposals put forward are realistic and feasible, and from the perspective of the education sector they are fundamental, as they help envision sustainable futures and promote concrete action in favour of sustainability.

Question 1. Which recommendations do you think are the most/least feasible and useful, and why?

Integrating sustainability into the School Educational Project (by embedding sustainability values into the curriculum and daily practices)

This is relatively easy to implement, as it can be integrated into existing subjects and does not require major initial investments.

It has a high impact: it promotes critical thinking, interdisciplinarity, and connects theory with real-world challenges.

Providing training and incentives for teachers and school leaders

This recommendation is feasible through participation in continuous professional development programmes and professional recognition schemes based on credit systems implemented by educational authorities, such as the teacher training courses delivered at the Madrid-South Territorial Centre for Innovation and Training.

Developing long-term projects within educational centres

This requires the allocation of significant resources and strong institutional support for the creation of infrastructure, such as green spaces and solar panels. Subsequently, schools can participate in institutional programmes (e.g. Environmental Education Programmes, STEM initiatives, Innovation Projects) and submit these projects to different award and funding calls targeted at educational centres.

Question 2. Are there any additional recommendations that should be included for specific sectors?

For students:
Promote gamification-based and experiential learning approaches: using challenges, games, escape rooms and simulations to transform eco-anxiety into positive action.

For local authorities and municipalities:
Integrate educational centres into municipal climate plans, including them in strategies related to sustainable mobility, waste management and green spaces.

The recommendations and the Roadmap for Sustainability Competences developed within the ECF4CLIM project are fully consistent with the principles and objectives established by the Organic Law amending the LOE (LOMLOE). In particular, the LOMLOE emphasises the need to integrate education for sustainable development and global citizenship across all educational stages, and to promote competence-based, interdisciplinary and project-based learning that connects theory with real-world challenges.

POLICY MAKER 2

Enhorabuena por el trabajo realizado, dado el momento actual, trabajos como el vuestro con propuestas reales y factibles desde el mundo de la educación son fundamentales, para abordar tanto el presente como el futuro. Que este proyecto se haya desarrollado a través de un programa europeo, pone de relieve que la financiación europea a través de estos programas son una herramienta eficaz y clave para abordar temáticas como las tratadas en ECF4CLIM

Pregunta 1. ¿Qué recomendaciones crees que son las más/menos factibles y útiles, y por qué?

- Fomentar redes de cooperación entre instituciones educativas y actores locales aprovechando estructuras existentes como municipios, ONG, universidades. Esto permite fortalecer competencias colectivas y compartir buenas prácticas.
- Uso de herramientas digitales para evaluar sostenibilidad (p. ej., Calculadora de Huella Ambiental), aprovechando la plataforma desarrollada en el proyecto, esto facilitara tomar decisiones basadas en datos y así se pueden posteriormente ver los avances.
- Recomendaciones como crear Estrategias y Planes de Acción nacionales/regionales sobre Educación para la Sostenibilidad, en este sentido estaría bien enlazar y ver los puntos comunes del informe con el PAEAS (Plan de Acción de Educación Ambiental para la Sostenibilidad) liderado por el Ministerio para la transición ecológica y reto demográfico y Ministerio de Educación….

Pregunta 2. ¿Se te ocurre alguna recomendación adicional que debería incluirse para grupos objetivo específicos?

Para autoridades locales y municipios

- Integrar los centros educativos en planes climáticos municipales: incluirlos en estrategias de movilidad sostenible, gestión de residuos y espacios verdes.
- Facilitar microfinanciación para proyectos escolares: presupuestos participativos para iniciativas sostenibles lideradas por estudiantes.
- Crear indicadores locales de sostenibilidad educativa: para monitorear avances y orientar políticas.
-

Para empresas y sector privado

- Programas de patrocinio y mentoría: empresas que apoyen proyectos escolares con recursos, tecnología o asesoría.
- Prácticas y voluntariado corporativo: involucrar a empleados en actividades educativas sobre sostenibilidad.
- Donación de equipamiento sostenible: paneles solares, sensores materiales reciclados.

Translated text

Congratulations on the work carried out. Given the current context, initiatives such as yours—offering realistic and feasible proposals from the education sector—are essential to address both present and future challenges. The fact that this project has been developed within a European programme highlights the importance of European funding schemes as effective and key instruments for addressing issues such as those tackled by ECF4CLIM.

Question 1. Which recommendations do you think are the most/least feasible and useful, and why?

- **Promoting cooperation networks between educational institutions and local actors**, making use of existing structures such as municipalities, NGOs and universities. This helps strengthen collective competences and facilitates the sharing of good practices.
- **Using digital tools to assess sustainability** (e.g. the Environmental Footprint Calculator), leveraging the platform developed within the project. This facilitates data-driven decision-making and enables progress to be monitored over time.
- **Recommendations such as developing national and regional Strategies and Action Plans on Education for Sustainability.** In this regard, it would be useful to establish links and identify common elements between this report and the PAEAS (Action Plan for Environmental Education for Sustainability) led by the Ministry for Ecological Transition and Demographic Challenge and the Ministry of Education.

Question 2. Are there any additional recommendations that should be included for specific target groups?

For local authorities and municipalities:

- Integrate educational institutions into municipal climate plans, including them in strategies on sustainable mobility, waste management and green spaces.
- Facilitate microfinance for school projects, for example through participatory budgeting schemes supporting student-led sustainability initiatives.
- Develop local indicators for educational sustainability in order to monitor progress and inform policymaking.

For companies and the private sector:

- Establish sponsorship and mentoring programmes, through which companies support school projects by providing resources, technology or expertise.
- Promote internships and corporate volunteering, engaging employees in educational activities related to sustainability.
- Support the donation of sustainable equipment, such as solar panels, sensors and recycled materials.

POLICY MAKER 3

1. Ce recomandări sunt cele mai/puțin fezabile și utile pentru o comună ca Șercaia?

Ca primar al unei comune rurale, văd că cele mai ușor de pus în practică sunt recomandările care nu cer bani mulți. De exemplu, formarea unor echipe de sustenabilitate în școală este ușor de făcut. Profesorii, elevii și părinții se pot întâlni, pot discuta problemele locale și pot propune soluții. Este util pentru că îmbunătățește comunicarea și implică oamenii.

La fel, introducerea unor teme de mediu în orele de curs este fezabilă. Nu cere investiții. Profesorii pot discuta despre apă, energie, încălzire, deșeuri sau agricultură, lucruri pe care copiii le văd în comună. Este util pentru că îi ajută să înțeleagă problemele reale din jurul lor.

Colaborarea dintre școală, primărie și ONG-uri este tot fezabilă. În comunitățile mici oamenii se ajută între ei. Se pot organiza acțiuni de plantare, colectare selectivă sau amenajare de spații verzi cu costuri mici.

Recomandările mai greu de aplicat sunt cele care cer bani mulți—panouri solare, modernizări energetice, sisteme IoT pentru monitorizare. Bugetele locale sunt reduse, iar procedurile pentru finanțări sunt complicate. Sunt utile, fără îndoială, dar de obicei depind de proiecte europene sau județene. Și strategiile mari, la nivel național, sunt greu de pus în practică în comune mici fără sprijin suplimentar.

2. Ce recomandări suplimentare aș vedea utile pentru diferite grupuri?

Pentru profesori, ar prinde bine cursuri simple și gratuite, oferite de inspectorat. De exemplu, cum se poate reduce consumul de energie în școală sau cum se poate organiza mai bine colectarea deșeurilor.

Pentru elevi, aș propune proiecte practice: îngrijirea unui spațiu verde, verificarea calității apei din fântâni sau campanii de informare despre arderile ilegale. Învață mai bine făcând lucruri concrete.

Pentru conducerea școlii, ar fi util un raport scurt anual despre activitățile de mediu. Ajută la planificare și la cererile de finanțare.

Pentru primărie, ar fi nevoie de acces mai ușor la fonduri mici pentru eficiență energetică sau spații verzi. Un buget participativ pentru proiecte făcute de elevi ar fi o idee bună.

Pentru guvern, ar fi necesare programe speciale pentru școlile din mediul rural. Ele au nevoie de mai mult sprijin ca să ajungă la standarde moderne.

Translated text

Question 1. Which recommendations are most/least feasible and useful for a rural commune like Șercaia?

As a mayor of a rural commune, I find that the easiest and most useful recommendations are the ones that do not require large budgets. Creating sustainability teams in the local school is simple. Teachers, students and parents can meet and discuss local problems. This is useful because it improves communication and community involvement.

Adding sustainability topics to regular classes is also feasible. It does not cost anything. Teachers can talk about water, energy, waste, heating or agriculture—things students see every day in the village. This makes learning more relevant.

Cooperation between the school, the town hall and NGOs is also easy to achieve. In small communities, people know each other and can work together. Activities like planting trees or cleaning public areas can be done with little money.

The harder recommendations are those that need big investments—solar panels, energy renovations, or advanced monitoring systems. Our local budget is limited, and financing procedures are complicated. These ideas are useful, but they depend on EU or county-level projects. National strategies or mandatory standards are also difficult to apply in small rural schools without extra support.

Question 2. Additional recommendations for specific groups

For teachers, simple and free training sessions would be helpful—offered by the school inspectorate. For example, how to reduce energy use in the school or how to manage waste better.

For students, I would suggest practical projects: taking care of a green area, checking water quality in wells, or running awareness campaigns about illegal burning. They learn more when they work on real problems.

For school management, a short yearly sustainability report would help with planning and with applying for funds.

For the local government, we need easier access to small grants for energy efficiency or green spaces. A small participatory budget for student-led environmental projects would also be useful.

For national policymakers, special funding programmes for rural schools would make a big difference, as these schools have fewer resources and more challenges.

POLICY MAKER 4

Barcelona Education

Globally, the document is clear, well-structured, and comprehensive. Its recommendations address both structural and operational issues, and consider several organizational levels and stakeholders. Congratulations!

Question 1. Regarding most/least feasible and useful recommendations:

- The recommendations regarding the institutionalization of sustainability within the organization's overall strategy (beyond just the curriculum) are particularly interesting.
- The focus on data utilization—evaluation, research, and knowledge transfer perspectives—is a valuable contribution.
- The ECF4CLIM hybrid participatory approach should require a more detailed explanation for replication. The current recommendations in this section do not appear to logically follow from the described approach, and a broader explanation of this interesting outcome would be beneficial.

Question 2. Regarding the additional recommendations for specific target groups:

- Reinforce the concept of lifelong learning (LLL) to expand the scope of education beyond children and young people, integrating it across the formal and informal educational ecosystem.

Some minor issues, that may be considered:

Provide more concrete guidance for embedding interdisciplinarity within the curriculum.

Compile a catalogue of example initiatives (interventions) and organize them using an interdisciplinary framework.

Include an assessment of the environmental impact of technological and learning resources (outcome 5); the integration of technology must be measured and coherent.

ADVISORY BOARD 1

Gracias por el documento enviado y por el trabajo realizado que es muy interesante y completo. Sería necesario llevar a cabo una lectura y análisis mucho más pausado para hacer un análisis más en profundidad, pues son muchos los documentos que contiene la página web. Pero os traslado las primeras impresiones de una lectura quizás demasiado rápida que no permite un análisis en detalle.

De forma global el documento de síntesis es muy claro con la identificación de los cinco niveles de acción y la descripción de las aportaciones más relevantes para cada uno de ellos. También una visita rápida a la página web genera una impresión positiva del trabajo realizado. Una duda que me

genera, por experiencias previas de otros proyectos, es el mantenimiento de dicha web una vez que el proyecto haya finalizado.

El modelo de competencias propuesto basado en los tres niveles de acción: individual, colectivo y técnico se considera una muy buena sugerencia que viene a reforzar los ámbitos de intervención en los que hay que planificar para poder desarrollar proyectos efectivos de sostenibilidad en los centros educativos. Comparto la idea de que se suele dar mucha importancia a las competencias individuales cuando las técnicas y colectivas desempeñan un papel fundamental para generar los contextos necesarios para que las individuales se puedan desarrollar.

Las recomendaciones que se incluyen en cada acción son muy interesantes y valiosas, pero quizás tienen el riesgo de quedarse en un ámbito demasiado genérico sin identificar vías concretas para su aplicación. Sugiero una identificación mucho más clara de posibles aliados que permitan hacer suyas las propuestas para aplicarlas y llevarlas a cabo. Un proyecto que crea una red de colaboración entre distintas entidades o miembros de distintos países tiene el riesgo de generar una red interna cerrada a su propia dinámica sin plantearse la importancia de conectar con otras entidades, redes o instituciones que comparten los mismos objetivos. La finalidad no es crear una red nueva sino fortalecer las ya existentes para conformar una comunidad educativa de acción amplia y fuerte que sea eficaz en lograr sus objetivos. Ya existen bastantes redes educativas con trayectoria en temáticas de sostenibilidad y cambio climático que sería interesante implicar con estos resultados. Es posible que exista un plan con esta finalidad, pero no se identifica en el documento.

En este sentido, tanto en el ámbito más concreto de nuestro país, como a nivel europeo, existen muchas entidades que comparten los mismos objetivos del proyecto con los que sería muy interesante identificar lazos de colaboración. A nivel universitario en España estaría la sectorial de sostenibilidad de la CRUE o los programas de la Red Española de Desarrollo Sostenible. Mientras a nivel europeo e incluso internacional un buen actor sería la Unión Internacional de Universidades o la red Copernicus. También el CENEAM se encuentra en estos momentos elaborando el segundo Plan de Acción de Educación Ambiental para la Sostenibilidad, o también la red de centros ESenRED, la red de ecoescualeas de ADEAC, etc… No establecer estas conexiones es generar un producto que en muy poco tiempo se va a quedar aislado y probablemente olvidado.

En el ámbito de la Universidad que es donde más conocimiento e implicación tengo sería interesante trasladar los resultados a los tres grupos de la Sectorial de Sostenibilidad de la CRUE que tienen más relación con la temática del proyecto: Evaluación de la Sostenibilidad Universitaria, Biodiversidad y Clima y Sostenibilidad en la docencia Universitaria. https://www.crue.org/comision-sectorial/sostenibilidad/ . Concretamente el grupo de docencia ha trabajado en la elaboración de documentos para introducir la sostenibilidad en la docencia universitaria. Sería interesante incorporar ideas del proyecto a estos documentos. También resultaría muy interesante poder trasladar propuestas concretas dirigidas a los profesores que imparten el Master de secundaria que

deben cursar todos los graduados que van a dedicarse en el futuro a impartir docencia en secundaria y bachillerato.

En esta misma línea de sugerencias desconozco la posible colaboración que se ha podido establecer entre este proyecto y otras iniciativas puestas en marcha por algunas de las anteriores entidades. En el proyecto se cita la elaboración de una calculadora de la huella ecológica de los centros educativos. El grupo de evaluación de la sostenibilidad de las sectorial de la CRUE acaba también de elaborar un protocolo para calcular la huella de carbono de alcance 1, 2 y 3 para universidades en el que han estado trabajando varios años. Dado que en el proyecto ha participado la UAB es probable que exista cierta confluencia o coincidencia de ambas herramientas. Pero también REDS/SDSN recientemente ha traducido una guía para transformar nuestras universidades en Cero emisiones y están realizando una recogida de buenas prácticas a nivel mundial para sacar una segunda guía. El cálculo de las emisiones de un centro educativo es un marco de acción estratégico que está llevando a distintas entidades a trabajar en esa misma dirección. Sería interesante valorar la originalidad de las aportaciones que se realizan en el proyecto en relación con otras iniciativas similares e intentar buscar confluencias y colaboraciones para hacer propuestas comunes.

Una de las limitaciones más frecuentes para poder desarrollar algunas de estas iniciativas en los centros educativos es poder contar con recursos propios sobre todo si están relacionados con la generación de infraestructuras verdes o equipamiento técnico. Siempre resulta complicado aplicar medidas que tiene implicaciones económicas de instituciones de las que depende la gestión del centro educativo. Se sugiere aplicar el programa 50 x 50 que permite obtener recursos mediante el ahorro en consumos en electricidad, agua, etc… Es un programa que esta dando buenos resultados en algunos centros educativos y que permite obtener algunos recursos para desarrollar nuevos programas.
También sería de gran interés la posible traducción del documento final al castellano para que verdaderamente pueda tener un impacto real en los centros educativos y universidades de nuestro país. Sin duda, sería optimo si además pudieran hacerse versiones en catalán, gallego y vasco. En la página web la opción de la traducción está resuelta pues se puede hacer de forma automática. Me imagino que existe ya un plan de divulgación y difusión del proyecto.

Generar un documento valioso a partir de las iniciativas aplicadas en 13 centros de diversos países es una tarea importante, pero lo es aún más hacer que se conozca y se llegue a poner en práctica en un ámbito mucho más amplio para que el documento al final no acabe archivado en cajones o estanterías sin generar ningún impacto en la comunidad educativa. Para que el trabajo no se quede en un documento de buenas intenciones sería muy recomendable que al menos cada país participante elabore un plan de intervención y difusión del documento en su país identificando actores y comprometiendo acciones de aplicación concretas. Sugiero conectar con cierta urgencia con Mónica Moraleda directora del CENEAM para intentar incorporar alguna de las propuestas que surgen del proyecto dentro del Plan de Acción de Educación Ambiental para la Sostenibilidad 2026-2030 que se encuentra en las últimas fases de elaboración.

Translated text

Thank you for the document you sent and for the work carried out, which is very interesting and comprehensive. It would be necessary to undertake a much more careful reading and analysis in order to provide a more in-depth assessment, as the website contains many documents. However, I would like to share my first impressions based on what was perhaps too quick a reading, which does not allow for a detailed analysis.

Overall, the synthesis document is very clear in identifying the five levels of action and describing the most relevant contributions for each of them. A brief visit to the website also creates a positive impression of the work undertaken. One question that arises for me, based on previous experience with other projects, concerns the maintenance of the website once the project has ended.

The proposed competence model based on the three levels of action—individual, collective, and technical—is, in my view, a very good suggestion that helps reinforce the intervention areas that require planning in order to develop effective sustainability projects in educational centres. I agree that individual competences often receive a great deal of attention, whereas technical and collective competences play a fundamental role in creating the necessary contexts for individual competences to be developed.

The recommendations included under each action are very interesting and valuable, but there is a risk that they remain at a rather generic level without identifying concrete pathways for implementation. I suggest a much clearer identification of potential allies who could take ownership of the proposals and help implement them. A project that creates a collaboration network among different entities or partners from different countries risks becoming an internal network that is closed within its own dynamics, without sufficiently considering the importance of connecting with other entities, networks or institutions that share the same objectives. The aim should not be to create a new network, but rather to strengthen existing ones in order to build a broad and strong education community for action that can effectively achieve its objectives. There are already many educational networks with a proven track record in sustainability and climate change that would be worth involving in the dissemination of these results. A plan for this purpose may exist, but it is not referenced in the document.

In this regard, both within our country and at European level, there are many entities that share the project's objectives with which it would be very valuable to establish collaborative links. In Spain, at university level, this includes the Sustainability Working Group of CRUE and the programmes of the Spanish Network for Sustainable Development (REDS). At European and even international level, a good actor would be the International Association of Universities or the Copernicus network. CENEAM is currently developing the second Action Plan for Environmental Education for Sustainability, and there are also networks such as ESenRED, the eco-schools network of ADEAC, etc. Failing to establish these connections would risk producing an output that very quickly becomes isolated and, likely, forgotten.

In the university context, which is where I have the greatest knowledge and involvement, it would be useful to transfer the results to the three working groups within the CRUE Sustainability Commission that are most closely related to the project's topic: University Sustainability Assessment, Biodiversity and Climate, and Sustainability in University Teaching. In particular, the teaching group has worked on documents to introduce sustainability into university teaching. It would be interesting to incorporate project ideas into those documents. It would also be very valuable to develop concrete proposals aimed at lecturers who teach the Secondary Education Master's programme, which all graduates who intend to teach in secondary education and upper secondary education must complete.

Along the same lines, I am not aware of the collaboration that may have been established between this project and other initiatives launched by some of the entities mentioned above. The project refers to the development of an ecological footprint calculator for educational centres. The University Sustainability Assessment group within the CRUE Sustainability Commission has recently developed a protocol to calculate Scope 1, 2 and 3 carbon footprints for universities, on which they have been working for several years. Given that UAB participated in the project, it is likely that there is some convergence or overlap between both tools. Moreover, REDS/SDSN has recently translated a guide to transform our universities towards zero emissions, and they are collecting good practices globally to produce a second guide. Calculating emissions in an educational institution is a strategic action area that is prompting different organisations to work in the same direction. It would be worthwhile to assess the originality of the project's contributions in relation to other similar initiatives, and to seek convergence and collaboration in order to develop joint proposals.

One of the most frequent limitations when implementing some of these initiatives in educational centres is the availability of internal resources, especially when they involve green infrastructure or technical equipment. It is always difficult to apply measures with economic implications when the management of the centre depends on external institutions. The document suggests applying the 50/50 programme, which enables resources to be generated through savings in electricity, water, etc. This programme is delivering good results in some educational centres and allows some resources to be freed up to develop new programmes.

It would also be highly beneficial to translate the final document into Spanish in order to achieve real impact in schools and universities in our country. It would undoubtedly be optimal to also produce versions in Catalan, Galician and Basque. On the website, the translation option is technically addressed, as it can be done automatically. I assume that a dissemination and communication plan for the project already exists.

Producing a valuable document based on initiatives implemented in 13 centres across different countries is an important achievement, but it is even more important to ensure that it becomes known and is put into practice on a much wider scale, so that it does not end up filed away without

generating any impact in the educational community. To prevent the work from remaining a document of good intentions, it would be highly advisable for each participating country to develop a national intervention and dissemination plan, identifying relevant actors and committing to concrete implementation actions. I suggest, with some urgency, contacting Mónica Moraleda, Director of CENEAM, in order to try to incorporate some of the project's proposals into the 2026–2030 Action Plan for Environmental Education for Sustainability, which is currently in its final stages of development.

ADVISORY BOARD 2

Question 1. Feasibility and usefulness of the recommendations

Several recommendations in the ECF4CLIM Policy Brief emerge as both highly feasible and substantively valuable. Among these, the institutionalisation of participatory structures—such as Sustainability Competence Teams and Committees—is particularly realistic. These mechanisms can be integrated into existing governance frameworks with minimal financial cost, while offering strong benefits in terms of collective engagement, democratic participation and the development of shared responsibility for sustainability.

Similarly, the curricular integration of sustainability competences represents a feasible and impactful approach. Because it can be introduced gradually and adapted to existing subject areas, it does not require systemic curriculum reform yet significantly enhances students' capacity for critical, interdisciplinary and action-oriented learning. Strengthening collaboration networks among schools, universities, NGOs and local authorities is also highly feasible, as many such structures already exist and require primarily coordination rather than new resources.

The deployment of digital tools for sustainability assessment and monitoring is increasingly practical, given that ECF4CLIM has already developed validated instruments. Their usefulness lies in supporting evidence-based decision-making and linking pedagogical activities to concrete environmental data.

By contrast, recommendations involving major infrastructural upgrades—such as renewable energy installations or large-scale building renovations—are less feasible in the short term due to financial, administrative and political constraints. Likewise, the development of national strategies or mandatory sustainability standards for all schools is valuable but difficult to achieve without long-term political stability and interministerial coordination.

Question 2. Additional recommendations for specific target groups

Several supplementary recommendations could enhance the framework. For teachers, the introduction of micro-credentials in sustainability competences would recognise and incentivise professional development while promoting clearer standards of practice. For students, integrating

service-learning projects and participatory budgeting mechanisms would strengthen agency and embed sustainability in authentic decision-making contexts.

For school leaders, including sustainability indicators in performance evaluations and publishing annual sustainability reports would institutionalise long-term commitment and transparency. Local authorities could establish support centres providing technical guidance, funding advice and training, thereby reducing disparities between institutions. At the policy level, embedding sustainability education within initial teacher training programmes and establishing a long-term legislative roadmap towards climate-neutral schools would create structural conditions for systemic change.

ADVISORY BOARD 3

Question 1. Most Feasible & Useful Recommendations

For Policymakers:

Integrate sustainability across the curriculum (Outcome 2, p.13–14)

- Why: Already aligned with existing educational reforms in many EU countries. Can be implemented through syllabus updates and teacher training without massive structural change.

Support teacher training and professional development (Outcome 5, p.27)

- Why: Teacher training is a well-established mechanism. Funding for sustainability-focused CPD (continuous professional development) is realistic and can yield high impact.

Encourage data-driven monitoring (Outcome 2, p.14)

- Why: Many schools already collect environmental data (energy, waste). Formalizing this into sustainability dashboards is feasible and supports accountability.

For Educational Communities:

Embed sustainability in everyday practice (Outcome 4, p.24)

- Why: Low-cost, high-impact actions (e.g., recycling programs, green spaces) can be integrated into daily routines without major funding or restructuring.

Promote inclusive and participatory governance (Outcome 3, p.20)

- Why: Many schools already have student councils or parent associations. Extending these to sustainability committees is a natural evolution.

Use the school environment as a learning resource (Outcome 2, p.14)

- Why: Turns existing infrastructure (buildings, grounds) into teaching tools—no extra resources required.

Least Feasible (but Still Useful) Recommendations

For Policymakers:

Allocate material and human resources for technical-material competences (Outcome 1, p.8)

- Why: Requires significant funding, staffing, and long-term investment in infrastructure (e.g., retrofitting buildings, installing solar panels). Feasibility depends heavily on national budgets and political will.

Create a national/regional/local Strategy and Action Plan (Outcome 2, p.13)

- Why: While useful, top-down strategies can be slow to implement and may lack local adaptability. Risk of becoming a bureaucratic exercise without real impact.

Provide sufficient financial support for co-design & co-evaluation (Outcome 4, p.23)

- Why: Funding for participatory projects is often competitive and short-term, making sustained support challenging.

For Educational Communities:

Prioritise social and economic criteria in procurement (Outcome 1, p.9)

- Why: Schools often have limited budgets and must comply with public procurement laws, which may restrict ethical purchasing options.

Sustain long-term commitment through continuous learning (Outcome 2, p.15)

- Why: Schools face high staff turnover, curriculum pressures, and shifting priorities. Maintaining long-term focus on sustainability is difficult without systemic support.

Build local learning networks (Outcome 5, p.28)

- Why: Requires time, coordination, and often funding elements already in short supply in many schools.

Overall Assessment:

- **Most feasible recommendations** tend to be those that:
  - Leverage existing structures (e.g., teacher training, curriculum updates)
  - Require low upfront investment
  - Are incremental and adaptable to local contexts
- **Least feasible recommendations** often involve:
  - Significant financial or human resource investment
  - Systemic or structural changes
  - Long-term commitment in uncertain funding environments

It is possible to define a **Priority Matrix** mapping the key ECF4CLIM recommendations based on **Feasibility** (x-axis) and **Impact/Usefulness** (y-axis). Recommendations are categorized into four quadrants for policymakers and educational communities.

Priority Matrix for ECF4CLIM Recommendations Legend:

- **Quick Wins:** High Feasibility, High Impact
- **Major Projects:** Low Feasibility, High Impact
- **Fill-Ins:** High Feasibility, Low Impact
- **Long Shots:** Low Feasibility, Low Impact

For Policymakers:

Quadrant	Recommendation	Why It Fits Here
🏆 **Quick Wins**	Integrate sustainability across the curriculum	Already aligned with educational trends; can be rolled out via teacher training.
	Support teacher training in sustainability	Uses existing CPD structures; high leverage for systemic change.
	Encourage data-driven monitoring	Builds on existing data collection; low-cost, high transparency.
🕶️ **Major Projects**	Allocate resources for technical-material competences (e.g., retrofitting)	High impact but requires significant funding and long-term commitment.
	Create national/regional sustainability education strategies	Can drive systemic change but is slow and politically complex.
	Fund co-design & co-evaluation of sustainability projects	Participatory but resource-intensive and hard to scale.
🔝 **Fill-Ins**	Recognize participatory governance models	Easy to endorse but may lack enforcement or resources.
	Support research on competences	Important but may not translate directly to practice.
👎 **Long Shots**	Mandate sustainability plans for all schools without funding	Unlikely to be implemented effectively without resources.

For Educational Communities:

Quadrant	Recommendation	Why It Fits Here
🏆 **Quick Wins**	Embed sustainability in daily practice	Low-cost, actionable, builds culture.
	Use school environment as a learning resource	No extra cost; turns infrastructure into pedagogy.
	Promote inclusive governance (e.g., student councils)	Builds on existing structures; fosters ownership.
🕶️ **Major Projects**	Prioritize ethical procurement (fair trade, etc.)	High impact but constrained by budget and regulations.
	Sustain long-term commitment through continuous learning	Culture-changing but hard to maintain amid turnover and priorities.
	Build local learning networks	Valuable for sharing best practices but time/resource heavy.
🔝 **Fill-Ins**	Allocate time for participatory learning	Important but often competing with curricular demands.
	Facilitate data collection and visibility	Useful but may not drive change without action plans.
🦶 **Long Shots**	Implement technical interventions without funding (e.g., solar panels)	Nearly impossible without external support.

Strategic Suggestions Based on the Matrix:

Start with Quick Wins:

- Policymakers: Roll out teacher training and curriculum integration.
- Schools: Launch green routines and student-led sustainability committees.

Plan for Major Projects:

- Seek phased funding for infrastructure upgrades.
- Develop partnerships with municipalities, NGOs, or EU grants for participatory projects.

Monitor Fill-Ins:

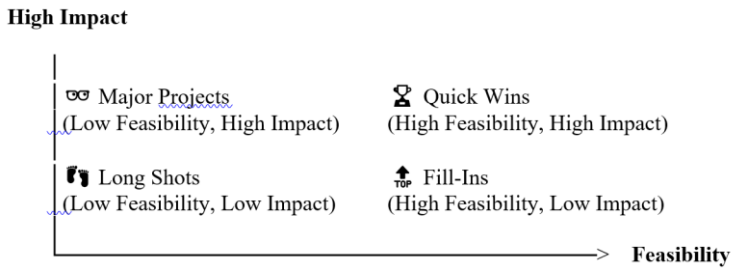
- Ensure that easy-to-implement recommendations (e.g., governance models) are supported with real authority and resources.

Reassess Long Shots:

- Some may become feasible with policy shifts or new funding streams. Keep them in view but don't prioritize early.

Visual Summary:

The matrix below conceptually illustrates how various sustainability initiatives can be mapped according to their impact and feasibility, helping stakeholders to prioritise actions effectively. By positioning each project on this grid, schools and policymakers can identify which proposals should be fast-tracked, which require further development, and which might benefit from ongoing monitoring in case circumstances change.



Conclusion:

The **most actionable and high-impact recommendations** are in the 🏆 **Quick Wins** quadrant. Focusing here can build momentum, demonstrate value, and create a foundation for tackling the 🕶️ **Major Projects** over time.

Question 2. Can you think of any additional recommendations that should be included for specific target groups?

Drawing on the findings from ECF4CLIM and identified gaps in sustainability education, the following "additional recommendations for specific target groups" could be comprehensively addressed in the brief for its enhancement:

For University & Higher Education Institutions

Incorporate sustainability competences into accreditation & quality assurance frameworks

- Why: Universities respond strongly to accreditation requirements. Embedding sustainability into program reviews ensures long-term institutional commitment.

Establish cross-departmental sustainability hubs or living labs

- Why: Universities have the space, expertise, and student energy to create test-beds for sustainable technologies and social innovations, bridging research and practice.

Offer micro-credentials or digital badges in sustainability competences

- Why: Recognizes informal and non-formal learning, motivates students, and enhances employability in green careers.

For Local & Regional Governments

Create municipal-educational partnership agreements for sustainability

- Why: Local governments control infrastructure, waste, energy, and transport. Joint projects (e.g., school solar cooperatives, bike-to-school routes) leverage shared resources.

Develop "Sustainability in Education" grants with streamlined application processes

- Why: Schools lack capacity for complex bidding. Simplified, small grants can kickstart projects and build trust.

Include student representatives in local climate committees or youth councils

- Why: Ensures youth voice in policy, models participatory governance, and builds intergenerational collaboration.

For NGOs & Community Organizations

Act as "sustainability brokers" between schools, experts, and funders

- Why: NGOs often have networks and credibility to facilitate partnerships, provide training, and access grants.

Co-develop community-based sustainability projects with schools.

- Why: Projects like community gardens, repair cafés, or energy audits can serve both educational and local resilience goals.

Offer "train-the-trainer" programs for teachers and school staff

- Why: Builds local capacity and ensures sustainability knowledge is contextualized and culturally relevant.

For EdTech & Digital Tool Developers

Co-design tools with students and teachers, not just for them

- Why: Ensures usability, pedagogical relevance, and adoption. ECF4CLIM's participatory approach should extend to tool development.

Ensure tools are open-access, low-bandwidth, and available in multiple languages

- Why: Equity in digital access is crucial for inclusive sustainability education.

Integrate tools with existing school management systems (e.g., LMS, energy meters)

- Why: Reduces duplication of effort and increases data utility for decision-making.

For Teacher Unions & Professional Associations

Advocate for protected time and recognition for sustainability education work

- Why: Teachers are overburdened. Without formal recognition, sustainability becomes an "add-on" rather than integrated.

Create peer-mentoring networks for sustainability pedagogy

- Why: Teachers learn best from each other. Networks can share lesson plans, experiences, and emotional support around eco-anxiety.

Negotiate green clauses in collective agreements (e.g., sustainable school meals, green procurement, healthy buildings)**

- Why: Links professional welfare to environmental conditions, aligning staff and student interests.

For School Leadership & Administrators

Appoint a Sustainability Coordinator with release time and a budget

- Why: Central coordination is key for moving from ad hoc projects to whole-school transformation.

Conduct annual sustainability audits and publish the results

- Why: Transparency builds accountability, celebrates progress, and identifies gaps.

Integrate sustainability into staff performance and development reviews.

- Why: Signals that sustainability is a core professional competence, not optional.

For International Bodies (UNESCO, OECD)

Develop indicators for collective and technical-material competences in international education surveys (e.g., PISA)

- Why: What gets measured gets done. Currently, assessments focus mostly on individual knowledge.

Create a cross-border platform for sharing sustainability interventions, tools, and research

- Why: Accelerates learning and avoids duplication. ECF4CLIM's MAPPA.fi could be scaled EU-wide.

Fund longitudinal studies on the impact of sustainability education on community resilience and behaviour change

- Why: Builds the evidence base for policy and investment.

Summary Table: New Recommendations by Target Group

Target Group	Additional Recommendations
Universities	Integrate into accreditation; create living labs; offer micro-credentials
Local Governments	Form municipal-school partnerships; simplify grants; include youth in climate committees
NGOs	Act as brokers; co-develop community projects; offer train-the-trainer programs
EdTech Developers	Co-design tools; ensure open access; integrate with school systems
Teacher Unions	Advocate for protected time; create peer networks; negotiate green clauses
School Leaders	Appoint sustainability coordinators; conduct annual audits; include in performance reviews
International Bodies	Develop new indicators; create sharing platforms; fund longitudinal research

These additions address "structural, cultural, and systemic enablers" that can help move sustainability education from isolated projects to embedded practice.

Lastly, it is the case to give recommendation for an additional very relevant stakeholder: the European Union.

The foreword is that EU operates as a "supra-national policymaker, funder, and coordinator" uniquely positioned to scale the ECF4CLIM approach across member states. So, specific, actionable recommendations for the EU level could be:

Integrate the Expanded Competence Framework into EU Education Policy

- **Action:** Officially augment the European Sustainability Competence Framework GreenComp (and the one developed by the GreenSCENT project) to include collective and technical-material competences as defined by ECF4CLIM
- **Why:** GreenComp is the EU's reference framework. Expanding it signals that sustainability is not just about individual knowledge but requires organizational capacity and material infrastructure
- **How:** Issue a European Commission Recommendation or update the Council Recommendation on learning for environmental sustainability to adopt the tripartite competence model

Launch an EU-wide "Sustainable Schools & Universities Pact"

- **Action:** Create a voluntary but structured pact for educational institutions, similar to the Climate Pact or Green Deal, with commitments, reporting, and recognition
- **Why:** Provides a clear umbrella for national and local action, fosters peer learning, and creates visibility
- **How:** Managed by DG EAC and DG CLIMA, with access to EU funding and technical support

Embed Sustainability in EU Funding Programmes with a Competence Lens

- **Action:** Make the ECF4CLIM competence framework a cross-cutting criterion in relevant EU calls (Erasmus+, Horizon Europe, LIFE, ESF+, Regional Funds)
- **Why:** Ensures that funded projects explicitly develop individual, collective, and technical-material competences
- **How:** Update programme guides and evaluation grids to require competence-building plans

Establish an EU Observatory on Education for Sustainability

- **Action:** Create a permanent monitoring and knowledge-sharing hub (building on platforms like "School Education Gateway" and "EPALE") to track progress, share interventions, tools, and research
- **Why:** Centralizes fragmented efforts and provides evidence for policymaking
- **How:** Hosted by the "Joint Research Centre (JRC)" or a dedicated agency, linked to Eurostat data on school infrastructure and environmental performance

Develop EU-Level Indicators for Educational Sustainability Competences

- **Action:** Create a new set of indicators within the "European Education Area monitoring framework" to measure collective and technical-material competences (e.g., % of schools with sustainability committees, energy efficiency of school buildings, teacher training hours in sustainability)
- **Why:** What gets measured gets managed. Current EU indicators focus on access and attainment, not sustainability capacity
- **How:** Task Eurostat and the JRC with developing and piloting these indicators

Fund a Large-Scale, Cross-Border Pilot of the ECF4CLIM Roadmap

- **Action:** Launch a dedicated Horizon Europe or Erasmus+ "Partnership for Sustainability Competences" to test the Roadmap in 100+ schools across all member states.
- **Why:** Demonstrates scalability and gathers diverse contextual data to refine the framework
- **How:** Coordinated call requiring transdisciplinary consortia (schools, universities, NGOs, local authorities)

Create an EU Award & Certification Scheme for Sustainable Educational Institutions

- **Action:** Develop a European Eco-Schools / Sustainable University Certification with bronze, silver, and gold levels based on the ECF4CLIM framework
- **Why:** Provides motivation, recognition, and a clear progression pathway for institutions

- **How:** Build on existing schemes (e.g., FEE's Eco-Schools) but align with EU GreenComp (and possibly the one developed by the GreenSCENT project) and the tripartite competence model

Mandate Green Public Procurement (GPP) Criteria for All EU-Funded Educational Infrastructure

- **Action:** Update the EU GPP criteria and tie EU cohesion and regional funds to mandatory sustainable building standards (energy, materials, biodiversity) for new or renovated educational buildings
- **Why:** Ensures that the "technical material" competence is physically enabled by the infrastructure itself
- **How:** Revise the EU Construction Products Regulation and fund guidance for member states

Support an EU Network of Teacher Training Institutions on Sustainability

- **Action:** Fund a dedicated Erasmus+ Teacher Academy for Sustainability to develop and share curricula, pedagogy, and digital tools for pre- and in-service teacher training
- **Why:** Teachers are the linchpin. A specialized academy ensures quality and consistency across borders
- **How:** Structured as a multi-year EU partnership between universities, pedagogical institutes, and NGOs

Promote the "Whole Institution Approach" as EU Policy

- **Action:** Mainstream the whole-institution approach (integrating governance, curriculum, facilities, community) in all EU policy documents, guidelines, and funding calls related to education**.**
- **Why:** Prevents siloed projects and encourages systemic transformation
- **How:** Publish an EU Handbook on the Whole Institution Approach to Sustainability, co-created with practitioners.

EU Recommendation Priority Matrix

Quadrant	Recommendation
Quick Wins (High Feasibility, High Impact	1. Integrate expanded framework into GreenComp updates. 3. Embed competence lens in EU funding programmes. 10. Promote the whole-institution approach in guidelines
Major Projects (High Impact, Lower Feasibility)	2. Launch an EU Sustainable Schools Pact. 6. Fund a large-scale cross-border pilot. 8. Mandate GPP for educational infrastructure
Fill-Ins (High Feasibility, Lower Impact)	7. Create an EU certification scheme (builds on existing) 9. Support a Teacher Academy network (extends Erasmus+)
Long Shots (Lower Feasibility, Lower Impact)	5. Develop new EU indicators (complex, bureaucratic).

Proposed First Steps for the EU:

Short-term (2025): Adopt the tripartite competence model in the **mid-term review of GreenComp**.

Medium-term (2026-2027): Launch the Sustainable Schools Pact and a large-scale pilot under Erasmus+.

Long-term (2028+): Implement mandatory GPP criteria for schools funded by EU and establish the "EU Observatory".

These recommendations leverage the EU's unique role in setting standards, funding innovation, and fostering cooperation, ensuring that ECF4CLIM's groundbreaking work translates into system-wide change across Europe.

ADVISORY BOARD 4

UPF

General observations

The policy brief is clear, informative, and effectively communicates the project's aims and outcomes. However, it is longer than what is typically considered optimal for a policy brief (usually 3–6 pages). Shortening it—either by producing separate briefs for different audiences (e.g., policymakers, educational institutions) or by integrating the outcome sections into a set of overarching project conclusions—would strengthen its usability and strategic impact.

Question 1. Which recommendations do you think are the most/least feasible and useful, and why?

<u>Outcome 1</u>

The most useful—but also perhaps the most difficult to implement—recommendations are those emphasizing the collective and technical-material dimensions of sustainability competences. Recommendations for policymakers (particularly recommendations 1 and 2, and Outcome 2 recommendation 1) call for stronger integration of these dimensions in sustainability-related actions. Their strategic importance is high, though their implementation requires structural change and long-term political commitment.

A more immediately feasible recommendation with meaningful impact is recommendation 5 for the educational community, which highlights the importance of organisational coherence with sustainability principles. This can be enacted at the institutional level without major policy reforms.

<u>Outcome 2</u>

For policymakers, recommendation 2 stands out as essential. It provides an overarching framework that should guide all efforts to develop sustainability competences. Its transformative potential, however, depends on clear and sustained political determination.

For the educational community, recommendation 1 is highly feasible and impactful since making practices and decisions visible is a key first step towards deeper awareness and cultural change. Recommendation 3 is also crucial because it acknowledges the role of emotions as drivers of behavioural change—an aspect often under-addressed in competence-oriented approaches.

Outcome 3

This section is particularly strong, and key for the overall goa lof the Project. However, to me it could improve by giving a more explicit and prominent role to the idea of critical thinking and deliberation within the recommendations.

Participation is central to the project, but participatory processes are most effective when they openly address the complexity and contestation inherent in sustainability. Because sustainability involves diverse and sometimes conflicting socio-economic visions, deliberative practices supported by explicit critical thinking can help educational communities navigate these tensions constructively.

Making this dimension more visible strengthens the rationale of recommendations 2 and 5 for policymakers, and reinforces recommendations 2 and 3 for the educational community, which already point toward participatory and reflective engagement.

Outcome 4

The main strength of the interventions in Outcome 4 is their scalability. For policymakers, recommendation 2 concerning knowledge exchange and replication is therefore particularly important.

For the educational community, I would highlight recommendation 1 (allocating sufficient time and resources) and recommendation 2 (integrating sustainability practices into everyday activity). These conditions are essential for meaningful and durable scaling.

Outcome 5

The emphasis on evidence-based action is the most valuable contribution of Outcome 5. For policymakers, recommendation 4—which supports the use of evidence to frame policies—is especially important. Equally significant is the integration of evidence into

real-life learning projects, ensuring that sustainability competences are rooted in practical, lived experience.

Question 2. Additional recommendations that should be included for specific target groups

An overarching recommendation that could strengthen the brief is to highlight more explicitly the role of critical thinking and deliberation in sustainability competence development. Although these elements are already incorporated into the project, making them more visible would help clarify how the roadmap addresses one of the central challenges of sustainability education: the fact that "sustainability" can refer to divergent and sometimes conflicting socio-economic models.

The goal is not to resolve this debate, but rather to acknowledge it and emphasise that education can provide the tools—through critical thinking, reflection, and deliberation—to engage with these tensions productively. Positioning this dimension more prominently, especially in connection with participatory processes (Outcome 3), would reinforce the transformative potential of the recommendations for both policymakers and the educational community.