



Skills Alliance for Industrial Symbiosis: A Cross-sectoral Blueprint for a Sustainable Process Industry (SPIRE-SAIS) Policy Recommendations

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List of Abbreviations

Abbreviation	Meaning
APG	Advisory and Programming Group
CoVEs	Centres of Vocational Excellence
EE	Energy Efficiency
EQF	European Qualifications Framework
ESCO	European Skills, Competences, Qualifications and Occupations
ESF	European Social Fund
ESIF	European Structural and Investment Funds
ESSA	European Steel Skills Agenda
EU	European Union
H4C	Hubs4Circularity
HR	Human Resources
IS	Industrial Symbiosis
I-US	Industrial Urban Symbiosis
JTF	Just Transition Fund
KICs	Knowledge and Innovation Communities
LMS	Learning Management System
LSP EII	Large Scale Partnership Energy-intensive industries
PWG	Permanent Working Groups
SCORM	Shareable Content Object Reference Model
SET Plan	Strategic Energy Technology Plan
SPIRE-SAIS	Skills Alliance for Industrial Symbiosis: A Cross-sectoral Blueprint for a Sustainable Process Industry

VET	Vocational Education and Training
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SPIRE-SAIS DELIVERABLES THAT HAVE CONTRIBUTED TO THIS DOCUMENT:

- **SPIRE-SAIS Deliverable D2.1** Industrial Symbiosis and Energy Efficiency in European Process Industry: State of Art and Future Scenario (Branca et al., 2024)
- **SPIRE-SAIS Deliverable D3.2** (Company) Skills Requirements and Foresight (Bayón, 2024)
- **SPIRE-SAIS Deliverable D4.1** SPIRE-SAIS VET System Support (Visionary Analytics, 2024)
- **SPIRE-SAIS Deliverable D5.1** Training Framework (Muract et al., 2024)
- **SPIRE-SAIS Deliverable D5.3** Blueprint (Schröder, Muract, et al., 2024)
- **SPIRE-SAIS Deliverable D6.1** Implementation Plan (Schröder et al., 2022)
- **SPIRE-SAIS Deliverable D6.3** Exploitation Plan (Schröder, Branca, & Woodcock, 2024)

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Executive Summary

During the project's implementation and the rollout of the Blueprint Skills Alliance for Industrial Symbiosis of the Energy Intensive Industries, specific policy recommendations have emerged in order to support the integration of skills adaptation into strategies and policy support measures. Moreover, several solutions have been developed and tested during the project's activities to support the implementation of these recommendations. The SPIRE-SAIS project and the Blueprint framework provide specific measures, tools, cooperation and alliances to serve as a strong basis for addressing gaps in skills adaptation and training programmes. SKILLS4Planet can serve not only as an up-to-date skills assessment and training tool but also as a collaboration platform between different sectors and various stakeholders.

The policy recommendations have been grouped according to the level of stakeholders addressed, such as European, national or general (overarching) with the last addressing stakeholders of more than one level.

Overarching Policy Recommendations

- Increase the level of awareness of Industrial Symbiosis (IS) practices and relevant (green) skills by establishing a common terminology, increasing the level of green skill awareness, developing information on good practices for Vocational Education and Training (VET) institutions
- Increase attention to sector specifics within a cross-sectoral approach
- Ensure regular monitoring of skills demand and supply and adaptation of strategies to pro-actively address the emerging needs
- Integrate the provisions of Industry 5.0, human-centricity and sustainability by developing pieces of training that emphasise the human side of digital technologies, continuous training in digital skills and a sustainable industry

European Policy Recommendations

- Develop a European-coordinated strategy integrating cross-sectoral and sector-specific aspects
- A strategy for green skills in VET through the development of green skills, dual VET systems in a European compatible format, fostering collaboration and strengthening existing systems
- The definition of new strategies should be aligned with relevant stakeholders and existing training programmes, platforms and schemes
- Establish an integrated course structure and tools for Industrial Symbiosis (IS) and Energy Efficiency (EE)
- An open online training and support platform should be provided to all interested stakeholders.
- Implementing instruments and providing funding to support the development of green skills and required training

National and Regional Policy Recommendations

- National policymakers should collaborate with sectors, VET institutions, and industry organisations, to promote green skills and the training of teachers to provide current theoretical and practical knowledge to students
- Develop monitoring and evaluation tools to better assess existing green skills delivery instruments and the educational programs' effectiveness
- Incorporating green skills into national secondary education systems
- Create a unified skills recognition system
- Ensure the integration of Energy Efficiency and Industrial Symbiosis concepts and (online training) tools into the qualification processes at the national and VET school level
- Develop training for intersectoral transitions
- Develop a train-the-trainer strategy to increase educators' readiness
- Incentivise employers to provide training opportunities for employees

Specific Recommendations for Individual Companies and Organizations

- Designing internal HR and training strategies that increase the level of green skills awareness and training within companies
- Establish collaboration with training providers to provide feedback on industry needs to national policymakers, VET institutions and other stakeholders
- Raising awareness and readiness of company staff to implement IS through self-assessment, training programmes and exchange of good practices
- Facilitate workers' involvement in training programs through increased training offers in companies, financial and non-financial support, promotion of apprenticeships, various training formats and peer learning
- Spotlight image of IS and EE and improve recruitment and retention of young talent.

1 Overview of the SPIRE-SAIS Project

1.1 The Scope

The industrial world is looking for solutions to efficiently use resources and reduce CO₂ emissions, while maintaining competitiveness. As a result, sustainability concerns are gradually being incorporated into policymakers' agendas and companies' strategies. Subsequently, the general interest in Industrial Symbiosis (IS) and Energy Efficiency (EE) has increased significantly in recent years, by acknowledging its environmental, economic, and social potential. **A multi-skilled workforce that can cope with the implementation of new business models compatible with IS & EE and technological developments is the most important key pre-condition to create a competitive and**

The main objective of the project is to build a **Skills Alliance** to develop a **Blueprint for a European Intensive Industries Skills Agenda and Strategy (SPIRE-SAIS)** for an ongoing and short-term implementation of new skills demanded for the wide implementation of Industrial Symbiosis and Energy Efficiency. Its mission is to **enable industry-driven proactive adjustment of future skills with the industry and for the industry.**

sustainable (circular) industry in Europe.

A highly skilled workforce can only be achieved by anticipating future skills requirements and updating the qualifications and skills of the current workforce through upskilling and reskilling activities.

Starting with the **challenge** of adjusting IS and EE skills needs caused by new technological and economic developments, environmental and societal demands, the development of a cross-sectoral Blueprint funded by the Erasmus+ program has led to the **European Skills Agenda and Alliance on IS and EE** with interested stakeholders from companies, research, training providers, and social partners (steel associations and unions). With this partnership of about 30 organisations (see Figure 2) we facilitated the process of testing and improving the Blueprint as a co-creation process, and setting the claims for institutionalisation and **impact** right from the beginning. Organised as a social innovation process iterative and cyclical feedback loops were integrated in the interventions and implementation of the Blueprint with the objective to change social practices for skills adjustments.

The implementation and rollout of the SPIRE-SAIS Blueprint follows the five-fold social innovation process highlighted in Figure 2 below.

SPIRE-SAIS: Policy Recommendations (Deliverable 7.1)

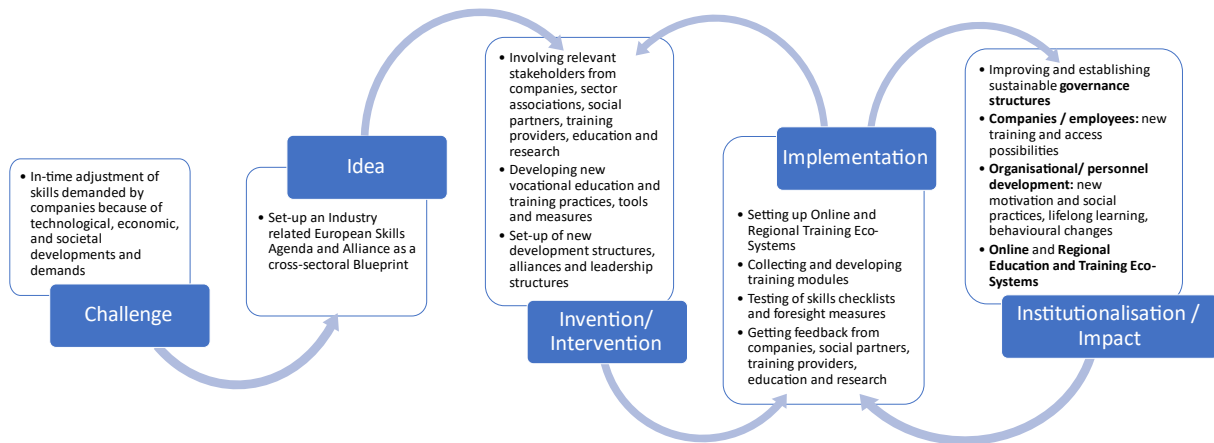


Figure 1: Social Innovation Process (taken from D5.3; Schröder, Muract, et al., 2024)

1.2 SPIRE-SAIS Pathway towards a European Skills Agenda for EE and IS

SPIRE-SAIS has focused on both the demand and supply sides for skills adjustment. On the demand side, the holistic and industry driven approach to develop the Skills Alliance is based on technology, economy, environment, and societal driven skills adjustment as the genuine driver for new applications within companies and collaboration measures. The triangle of *technology - organisation - human* is the frame for defining the new skills needs. The supply side is reflected by (a) the assessment of the affected industry job profiles within related production and functional areas (of the companies) as well as the affected industry occupations (of the education system) and (b) related (private) training offers and education system support (via curricula of initial and continuous VET, tertiary education, aiming to identify and close gaps in the provision of certain skills categories) (D5.2; Schröder, 2021).

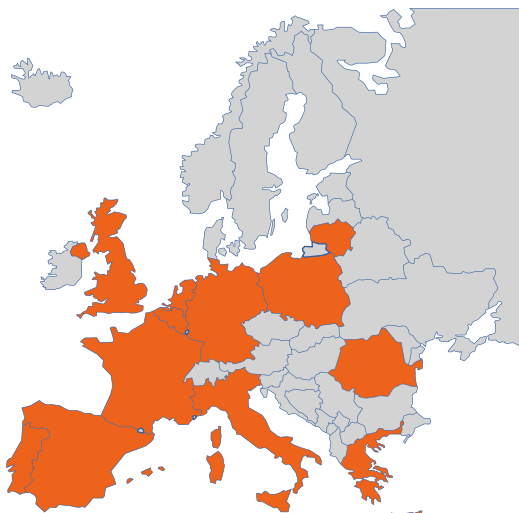
SPIRE-SAIS Blueprint provides a framework to proactively upgrade the workforce skills to meet the IS & EE needs of the Energy Intensive Industries, by:

- Adjusting the workforce skills in a proactive manner to deploy and implement new technologies for optimizing the production processes,
- Monitoring and accelerating the implementation of industry relevant qualifications and training,
- Successful cross-sectoral upskilling schemes and efficient management of related knowledge,
- Making careers in the green transition of energy intensive industries more attractive,
- Implementing strategies to attract and retain talented people.

2 SPIRE-SAIS Partnership

The partnership engaged in the SPIRE-SAIS project has spun over 12 countries and is composed of 24 Partners and 13 associated partners with multiple backgrounds, representing the industry driven eco-system approach of companies, training providers, industry associations and social partners, research institutions, and civil society.

PROJECT PARTNERS AND COUNTRIES



Industry sector associations: A.SPIRE, ESTEP, IMA Europe, European Aluminium, Water Europe, ECEG

Companies: Coverstro (Chemicals), Sidenor, Ferriere Nord (Steel), MYTILINEOS (Aluminium), SGAB/AGBAR (Water)

Education/training providers & RTOs: Scuola Superiore Sant'Anna, Fundation Circe, ITC, ISQ, International Synergies, H2Opeople

Research institutions: TU Dortmund University, CSM/RINA, Visionary Analytics, IMNR, Łukasiewicz-IMN

Regional institutions: ART-ER

Associated partners: EIT RawMaterials, thyssenkrupp Steel Europe, CEFIC, CEMBUREAU, ITQ (Universitat Politècnica de València), Carbon Market Watch, Circle Economy, University of Deusto, Cerame-Unie, Skillman, ArcelorMittal Global R&D, Mota Ceramics Solutions MCS, ARGO, IndustriALL

Figure 2: SPIRE-SAIS Partnership

3 Skills and talent-related challenges in the industrial sectors

Industry 4.0 and sustainability related challenges appear to be the main drivers for the evolution of the skills needed in the process industries. The main barriers to the implementation of EE and IS, as identified in the SPIRE-SAIS survey (see D2.1; Branca et al., 2024), are the cost of investment, regulatory issues, outdated infrastructure and equipment, collaboration challenges, lack of integration of regional stakeholders and lack of symbiosis with other sectors, lack of skilled and qualified workforce, and skills gaps within existing workforce.

Based on the company survey across different sectors, the SPIRE-SAIS project has concluded that in today's companies, the **level of technological implementation and skills** is higher for EE rather than for IS (D2.1; Branca et al., 2024), although the IS practices do lead to new tasks, jobs and professions and higher performance of the workforce. In principle, specific training programmes are scarce or the current training measures are mainly non-formal/unstructured.

Skills are seen as an important enabler and missing link for IS, developing and establishing a common ground for cross-company and cross-sector collaboration beyond competitiveness for the sake of the environment (D5.3; Schröder, Muract, et al., 2024). The main challenges for upskilling and reskilling the workforce have been identified through the project's lifecycle in order to address them in the Blueprint prototype (D3.1 (Carballedo et al., 2024) and D4.1 (Visionary Analytics, 2024)).

Additionally, the energy intensive industries require to address the human resources challenges such as:

- Improving the attractiveness of the Intensive Industries and fostering careers for talented people (recruitment and retention),
- Including the identification of strategies for overcoming recruitment difficulties and widening the talent pool for a more diverse workforce (with knowledge of cross-sectorial needs and opportunities for cooperation),
- Increasing workforce mobility and diversity (e.g. increasing the attractiveness of Energy Intensive Industries for women).

To support the integration of skills adaptation into strategies, policy support measures, mobilisation and involvement of stakeholders and policy makers at EU, sectoral, national and regional level require coordinated actions and are of utmost importance.

4 SPIRE-SAIS Blueprint governance and sustainability

4.1 Alignment with European Activities and Initiatives

The SPIRE-SAIS Blueprint has not been designed as a stand-alone solution. The Blueprint strategy is led by a cooperative approach with a division of responsibilities and leadership. Proposed measures such as the Foresight Observatory, the SKILLS4Planet online training platform and the (to be still established) European IS Training Community are aligned with and support European activities related to energy-intensive industries, to name a few:

- The Processes for Planet (P4Planet) Strategic Research and Innovation Agenda 2050, and its governance structures and working groups.
- The Hubs4CircularityCommunity of Practice and regional Hubs4Circularity and Industrial Urban Symbiosis.
- Central stakeholder groups (social partners, sector associations and unions, policymakers, education system players, etc.).
- European networks and projects: e.g. the CircLean Network and Circle Economy, the INSIGHT project results for establishing the profile/occupation of the IS Facilitator, etc.
- European programs: European Pact for Skills; especially the Large Scale Partnership Energy Intensive Industries (LSP EII); CEDEFOP Skills Intelligence Platform; European Skills, Competence, and Occupation Database (ESCO), Industry 5.0 Community of Practice.

Figure 3 illustrates the alignment of the Skills Alliance for Industrial Symbiosis with a broad range of European Programs and projects and stakeholders.

SPIRE-SAIS: Policy Recommendations (Deliverable 7.1)

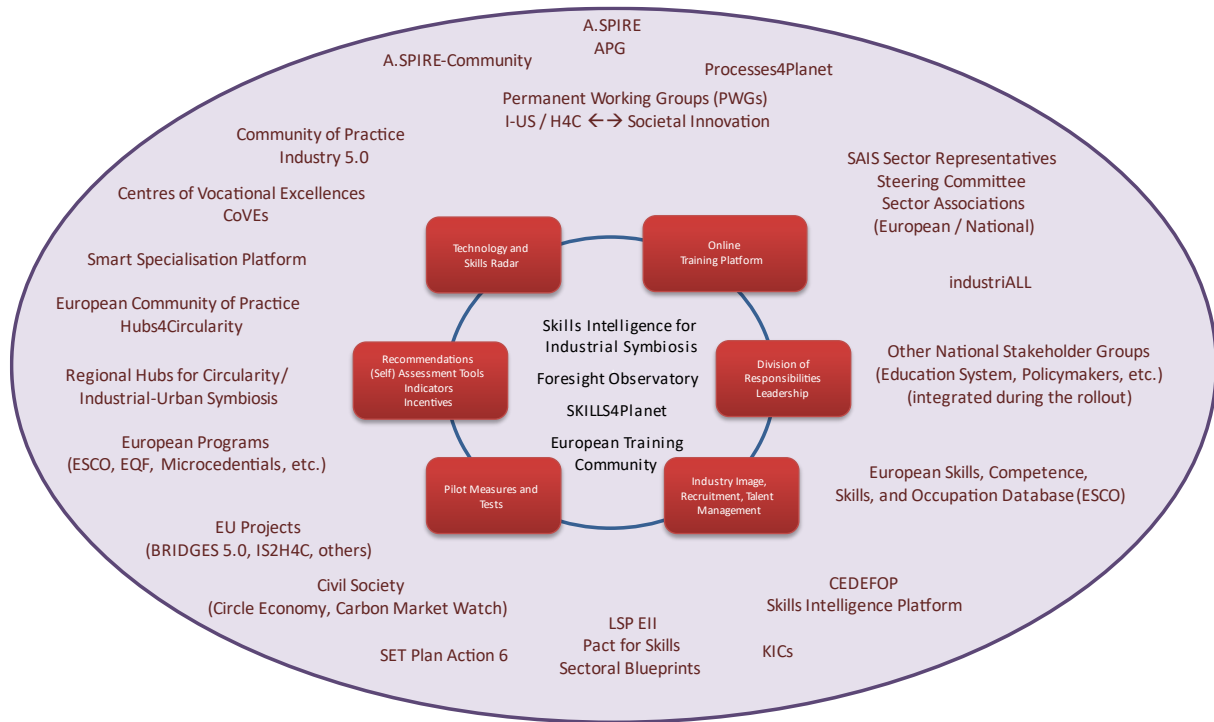


Figure 3: Alignment of SPIRE-SAIS with European Activities (taken from D5.3; Schröder, Muract, et al., 2024)

4.2 Lessons learnt

Following the social innovation process to develop the Skills Alliance and building on input from stakeholders through different stages of the project and the rollout, we have identified the following lessons:

1. There is a need to identify the specific transversal and sectoral elements of training;
2. The importance of mobilising stakeholders at regional level to reach directly into the workforce, where the orientation and recruitment of skilled workers takes place;
3. Both, cross sectorial and sector-specific elements have prominent importance due to specificities of energy intensive sectors and should be identified from the training and skills needs perspective. Special importance should be given to sector specificities to reach the sector specific workforce and related audiences.

The next section presents policy recommendations for Energy Intensive Industries and actors implementing the Industrial Symbiosis. These policy recommendations have been compiled from various results of the SPIRE-SAIS surveys, outputs, deliverables, and sectoral rollout workshops.

5 Policy Recommendations

During the project's implementation and the rollout of the Blueprint for Energy Intensive Industries and IS, specific policy recommendations have emerged to support the integration of skills adaptation into strategies and policy support measures. Moreover, several solutions have been

developed and tested during the project's activities to support addressing these recommendations. SPIRE-SAIS project and the Blueprint framework provide specific measures, tools, cooperation and the alliance to serve as a strong basis in addressing gaps in skills adjustment strategies, training programmes and qualifications. The online training platform SKILLS4Planet established in SPIRE-SAIS can serve not only with up-to-date skills assessment and training, but also as a collaboration platform among different sectors and various stakeholder groups.

In this chapter, the policy recommendations have been divided according to the level of addressed stakeholders. Some recommendations are overarching and need to be addressed by most stakeholders and at all policy levels, while others are more specific to the European, national and regional levels.

5.1 Overarching Policy Recommendations

1. Increase the level of awareness of IS practices and relevant (green) skills

- a. Although IS practices and training linked to circular economy have been available for years, the glossary should be established by policymakers and sectoral associations to have a common terminology across the different sectors and stakeholders.
- b. Stakeholders at regional and national level should aim at increasing the level of green skills awareness and training in companies by organising dedicated workshops (e.g. integrating engaged organisations, companies on a regional level) or EU-wide campaigns encouraging companies to submit commitments to invest in green IS and EE skills (comparable to e.g. apprenticeships for the construction industry of tomorrow¹). These campaigns should highlight benefits of new skills as well as inform about funding opportunities to develop mentorship programs. Showcasing successful case studies where green skills training led to tangible benefits is also effective. Moreover, a series of incentives could be taken into consideration by policy makers, such as tax incentives or grants, recognition via certificates for companies investing in green skills training.
- c. Develop systematised information on good practices for VET institutions and companies to improve the provision of IS and EE-related skills, the upskilling and re-skilling of staff, as well measures to attract and retain talents.

2. Increase attention to sector specifics within cross-sectorial approach. Europe's diverse sectors require tailored strategies, also regarding policies to promote resource sharing and circular economy practices. By integrating sector-specifics, policymakers can harmonise efforts while addressing unique challenges. **Such a framework should incentivise cross-sector collaboration, invest in targeted training for new skills, and set clear standards for sustainable practices across sectors.**

3. Ensure a regular monitoring of skill demand and supply and adaptation of strategies to proactively address the emerging skill needs. The establishment of a European monitoring

¹ https://single-market-economy.ec.europa.eu/sectors/construction/apprenticeships-construction-industry-tomorrow_en

framework will ensure an effective implementation of strategies and will drive Europe's green and resilient transition.

4. **Integrate Industry 5.0, human-centricity and sustainability provisions into training paths and VET system.** To realise the Industry 5.0 approaches, specific training elements should be implemented for
 - a. Human-centric approach: trainings should emphasise the human side of digital technologies, focusing not only on automation but also on enhancing human capabilities.
 - b. Digital skills upgrade: European workers need continuous training in digital skills.
 - c. Sustainable industry: As part of the circular economy transition, process industry should be resource-efficient and environmentally friendly.

5.2 *European Policy Recommendations*

1. **Develop a European coordinated strategy** that integrates cross-sectorial and sector specific aspects in Energy Intensive Industry that cover both, IS and EE, and support establishing the common understanding of the IS and EE terms, relevant skills and practices at the European level. The adoption of a common strategy and terminology within Energy Intensive Industry sectors can facilitate cooperation with other sectors outside Energy Intensive Industries and avoid possible duplication of policies.
2. **Green skills strategy in VET should:**
 - a. **Develop the "green skills"-specific strategic policy documents** through multi-stakeholder cooperation of relevant ministries and agencies of the Member States,
 - b. **Develop dual VET systems in a Europ-wide compatible format and increase the focus on the practical component of VET for green skills training.** High-quality VET plays a crucial role in ensuring that individuals have the right skills for today and tomorrow's jobs. The goal of VET systems in green transition processes is to equip learners with competences and mindset to achieve sustainable working and living. To achieve this, it is necessary to enhance collaboration between educational institutions and industry partners integrating environmental sustainability, energy efficiency, and renewable energy topics into the training and learners' curricula.
 - c. **Encourage collaboration between VET system, companies and key stakeholders.** To enhance the future EU readiness and competitiveness for IS and EE, it is crucial for companies and key stakeholders, as for instance industry associations and trade unions, to collaborate with the VET system. Their goal should be to incorporate the industry's current and anticipated skill requirements into educational curricula and training paths.
3. **Definition of new strategies should be aligned with relevant stakeholders and existing training programmes, platforms and schemes.** This can be ensured by the participation of these stakeholders in collaborative initiatives such as Pact for Skills, CEDEFOP Skills Intelligence Platform; European Skills, Competence, and Occupation Database (ESCO), Industry 5.0 Community of Practice, European Partnerships. The combination of different

sources of knowledge and data and different perspectives of stakeholders allows to develop a more effective and targeted skills strategy.

4. **Establish a learning management system for IS/EE.** It is crucial to identify effective measures that support the development of green skills and high-quality jobs. It is equally important to identify new emerging roles, for which workers will need to learn using advanced technologies. To achieve these goals, dedicated European and national support programmes (like the Pact for Skills) extending and valorising SPIRE-SAIS skill development and job training on the topics of IS and EE should run further or should be established (e.g. by making use of the European Social Fund – ESF).
5. **An open online training and support platform such as the SKILLS4Planet Online Training Platform** of SPIRE-SAIS should be available and accessible to all interested stakeholders and providing possibilities to integrate new resources and/or linkages to existing tools, so that the Europe-wide and cross-sectoral pool of training offers can be tapped into at one entry point.
6. **Implementation of instruments providing funding and support for the development of green skills and required training.** Funding of training development tends to be fragmented and limited to fixed-term project time while the development of industry relevant and cross-sectorial and/or sector specific training courses and curricula requires sustained resources in both, European and national schemes. Moreover, a system change is necessary aiming at active and continuous collaboration among VET system actors, companies and other key stakeholders (see point 2).

5.3 National and regional Policy Recommendations

1. National policy makers should engage in a collaborative dialogue with companies, VET institutions and providers, as well as **encourage VET schools to cooperate with industry organisations** and provide incentives not only to promote green skills but also to train teachers, who would be able to provide both theoretical and practical up-to-date training to students.
2. **Develop monitoring and evaluation tools** that allow to:
 - a. Better assess the existing green skills delivery instruments. More extensive documentation of the emerging good practices of IS and EE skills delivery at the individual VET school level is needed.
 - b. **Assess educational programmes' effectiveness.** Empirical data are necessary to assess the effectiveness of relevant educational programmes delivering new IS and EE skills. **This empirical data should be systematically collected and analysed to prepare a consolidated and harmonised strategy for replicating good practices. Standardized templates and questionnaires are necessary to collect data comparable among different EU Member States, regions, and companies.** To produce robust assessments, national VET systems require a common toolbox of monitoring and evaluation tools (including specific questions and indicators).

3. **Incorporate in a timely manner green skills into the national secondary education systems** both through broad strategic policy documents as well as operational documents (e.g. subject curricula), including **regional specificities**, wherever needed.
4. **Create a unified skills recognition system.** Green skills are still difficult to be certified, which may seem discouraging for learners and harder for employers to understand their employees' level of green skills. Recognition difficulties also make tracking and forecasting green skills difficult. **A critical aspect of ensuring recognition of skills is adjusting sector-specific qualifications and occupational standards within national catalogues.**
5. **Ensure the integration of EE and IS concepts and (online training) tools into the qualification processes at the national and VET programmes level** through the development of EE- and IS-specific curricula as well as the development and integration of relevant modules and courses.
6. **Develop training for intersectoral transitions** (e.g. from energy-intensive sectors such as steel to circular-based ones such as waste management) **and for intra-sectoral transitions** contributing to circularity (e.g. from landfilling to circular waste management) in the cross-sectoral manner².
7. **Develop a train the trainer strategy to increase educators' readiness for IS and EE skills delivery.** Teachers often lack competencies for effective teaching of new green skills. Dedicated workshops, training paths, and guiding documents on IS and EE (such as the "Strategy for Enhanced Learning") should be developed by the national dedicated bodies and institutions in a **"train the trainer"** strategy and on the best methodologies to deliver it to trainers, focusing **on learner-centred methodologies** that provide learning based on tasks, problems, projects, challenges, case studies, etc.
8. **Incentivise employers to provide IS and EE training opportunities to their staff.** Recognizing the value of green skills can bring a series of positive effects, such as improved productivity, cost savings, and positive brand image associated with environmentally conscious practices. Therefore, encouraging employers to provide green skills training to workers (for instance via awareness campaigns, incentives or green recognition labels/awards) is essential for fostering a sustainable workforce.

5.4 Specific Recommendations for individual companies and organisations

1. Design **internal HR and training strategies that increase the level of green skills awareness** and training within companies. For instance via green skills requirements in job offer descriptions and internal career pathways (HR strategies), targeted internal communication campaigns or organisation/participation in dedicated workshops for employees and management (training strategy). Company's staff awareness and readiness for implementation of IS and EE skills can also be raised via self-assessments, training programmes and good practice exchanges.

² CEDEFOP Policy Brief "From linear thinking to green growth mindsets Vocational education and training and skills as springboards for the circular economy" (Cedefop, 2023)

2. **Establish systematic collaboration** schemes between companies and training providers, giving feedback on industry needs to the national policy makers, VET institutions and other stakeholders.
3. **Facilitate workers involvement in IS and EE skills training via support instruments³:**
 - a. **Increase company training offers and facilitate interaction with workers to shape the training portfolio** (upskilling and reskilling) to match the needs of the company and those of the workers. The interaction could be a two-way communication, instead of only a top-down approach.
 - b. **Provide financial and non-financial support system at several levels** to incentivise workers to participate in training programmes. Financial incentives could be various cost-sharing instruments such as training leave, grants, loans, etc.; while non-financial support could be guidance/ counselling/coaching, tailored provision, interest aggregation/networking, awareness raising. To this end, companies, trade unions and national employer associations, can also make use of funding opportunities at EU level such as European Structural Investment Funds (ESIF), Just Transition Fund (JTF), Recovery and Resilience Facility (RRF).
 - c. **Promote apprenticeships to gain hands-on experience** while contributing to sustainable practices. Wherever needed, provide a legal base to integrate company apprenticeships in the national or regional VET systems, to give formal recognition to companies and employees.
 - d. **Offer various training formats** (e.g., workshops, blended learning, e-learning, on-the-job training) to facilitate workers involvement.
 - e. **Promote peer learning.** Knowledge transfer within companies poses a significant challenge that should be overcome by bridging knowledge gaps. This is particularly important for green skills, since training paths, guide documents on IS and EE are still lacking, and essential know-how is often gained through on-the-job experiences. **To address this need, one-to-one mentor-led learning initiatives should be developed at several levels, such as training providers and company levels.** Moreover, knowledge transfer among companies from the same value chain should be encouraged, as for instance large companies could open their training facilities to smaller ones.
4. **Spotlight image of IS and EE and increase recruiting and retaining of young talents.** Highlighting the green skills and IS and EE practices in the recruitment process strengthens companies' brands and helps attracting the right talents.

³ Elaborated from CEDEFOP Policy Brief "From linear thinking to green growth mindsets Vocational education and training and skills as springboards for the circular economy" (Cedefop, 2023)

6. SKILLS4Planet Online Platform – Systemic and Centralised HUB for IS and EE Trainings

Under the umbrella of the SPIRE-SAIS project one important solution to many of the mentioned challenges is an online platform that serves as an integrated catalogue for IS and EE trainings and provides additional functionalities such as skills assessment.

Skills4Planet can be considered a good practice as a systematic, integrated and centralised hub for IS and EE education and training, providing accessibility through an overview of cross-sectoral training. It currently consists of two directories for learning solutions and skills.

The Online Training Ecosystem SKILLS4Planet sets the infrastructure for a European (and potentially) worldwide exchange of training content, integrating inputs from and serving offers to industry associations and companies, VET systems, research centres, other sectoral Blueprints, European tools, and the non-formal and informal learning of individuals. SKILLS4Planet is an open online system. Based on a business model (agreements between the training publishers and the runner of the platform worldsteel) every training provider could offer training which could be used by every interested company, VET institution, association and individual learner.

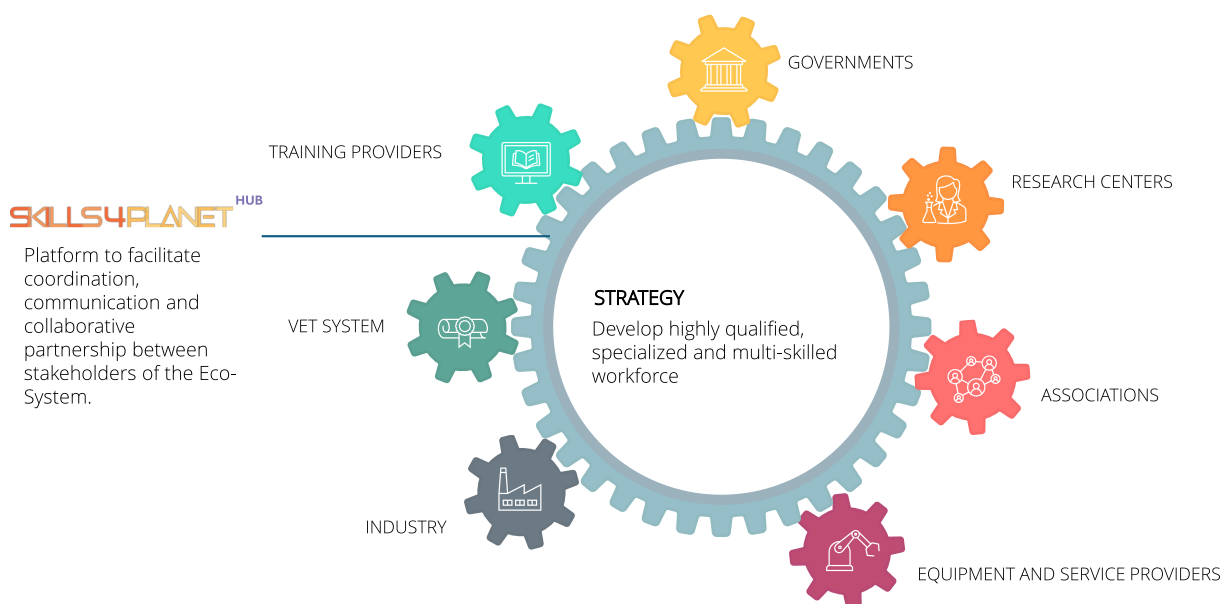


Figure 4: SKILLS4Planet Training Ecosystem

The flexible integration of this platform offers organisations the ability to easily connect and integrate learning solutions with their own training systems, which can improve productivity, reduce costs, and enhance overall efficiency. Additionally, regional industrial and professional associations are able to integrate these solutions to provide learning solutions to their members.

The main components of the platform are (1) Skill Directory, (2) Capability Assessor, (3) Learning Solution Directory, (4) Qualifications Directory, and (5) Micro-Credentials (see Figure 5).

SPIRE-SAIS: Policy Recommendations (Deliverable 7.1)



Figure 5: Modules of the Digital Platform – SKILLS4Planet

A key element for the successful implementation of SKILLS4Planet is its flexible integration using the international standard of communication (SCORM). The following diagram shows how SKILLS4Planet-HUB⁴ and SKILLS4Planet-LMS⁵ are connecting the training offers with the different target and user groups.

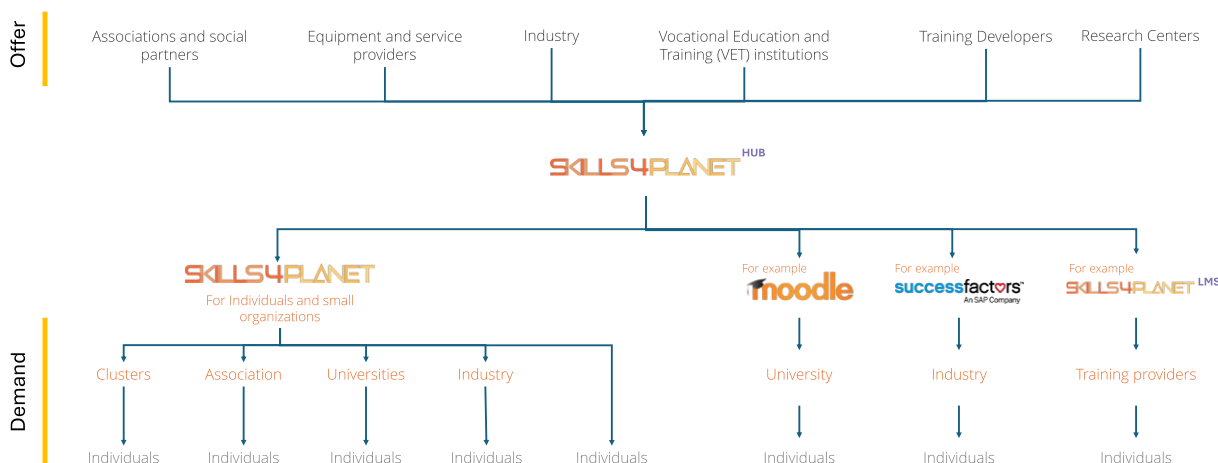


Figure 6: Information Flow Chart in SKILLS4Planet Connecting Offer and Demand

7. Outlook

To ensure the continuation of the Skills Alliance for Industrial Symbiosis (SPIRE-SAIS) the developed governance structure has taken advantage of already existing European structures, namely A.SPIRE and its Societal Innovation Working Group, and especially the **Large Scale Partnership Skills Energy Intensive Industries (LSP EII)** under the Pact for Skills. The framework of the LSP EII enables the possibility to continue developing the SPIRE-SAIS Blueprint further in the direction

⁴ <https://hub.skills4planet.eu/>

⁵ <https://skills4planet.eu/>

of a Skills Alliance for the Green, Digital and Social Transformation of the Energy Intensive Industries taking up the results of the European Steel Skills Alliance (ESSA) and the Skills Alliance for Industrial Symbiosis (SPIRE-SAIS). An essential part is to identify and adjust additional cross-sectoral and sector specific skills gaps and national-regional skills and training ecosystems. With this, we aim at creating a common framework integrating specificities of all industries to continuously and proactively adjust the skills demands of the energy intensive industries (including other process industry sectors).

This will be done by expanding the results of the two blueprint projects and developing a broader alliance and framework to close the skills gaps for specific (additional) sector needs (e.g. SME specific skills in the ceramic sector) and use synergies for cross-sectoral relevant topics and activities (such as Image & Recruitment, cooperation for the exploitation of Industrial Symbiosis, Industry 5.0, Artificial Intelligence). **It is essential to open and scale up the work on the challenges and gaps already identified** and those still to come in a more general scope (beyond steel and industrial symbiosis). It therefore requires focusing on the **specific needs of the different industrial sectors** (Steel, Minerals, Water, Engineering, Logistics, Non-Ferrous Metals, Ceramics, Raw Materials, Chemicals, Cement, Pulp & Paper, Refining). At the same time, **the rollout to existing and new national-regional ecosystems is key**. Central element to support this is the online training platform HUB 5.0 (integrating the ESSA steelHUB and the SPIRE-SAIS online platform SKILLS4Planet). Furthermore, the SPIRE-SAIS results, tools, and measures will allow us to take the next steps towards a Process Industry 5.0, becoming more human-centric, sustainable, and resilient.

A new lens on (Industry 4.0) technological development and innovation is given by the **Industry 5.0** concept strategically developed and fostered by the European Commission (Breque et al., 2021; Dixon-Declève et al., 2022). Central goal of Industry 5.0 is a **human-centric** (placing societal demands and human interest in the foreground), **sustainable** (accepting planetary boundaries) and **resilient industry** (in all its components, supply chains and production processes, critical raw materials).

This concept has to be operationalised in the direction of an Energy Intensive Industry 5.0 (see Processes4Planet SRIA Update document (A.SPIRE, 2024)). It provides a view on technology from a human-centric standpoint. As sustainability and resilience from a technical point of view are covered in various Innovation Areas and Programmes of Processes4Planet SRIA, human-centricity is the new challenge. It involves getting the right skills to develop, implement and run a human-centric, sustainable and resilient Energy Intensive Industry 5.0. Furthermore, it leads to choosing the right technologies for the sake of the people and society, to co-design and co-develop technological innovations with the users, customers and relevant stakeholders. It aims to empower workers to select, use and unfold the technologically innovative potential at the workplace.

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