Best Practices in Energy Education

Compilation Report

Project Title: Solar Village

Project Acronym: SoVil

Deliverable Information

Work Package: WP2 – Energy Education and Best Practices Analysis for Green Integration

Deliverable Title: Best Practices Compilation

Lead Organisation:
School Center Ptuj

Project Partners:
AMAR TERRA VERDE, LDA, Vila Verde, Portugal

CAVIT CAGLAR MESLEKI VE TEKNIK ANADOLU LISESI, Bursa, Turkiye

CFP Cebano Monregalese S.c.a r.l., Ceva, Italy

TEHNIČKA ŠKOLA ,,IVAN SARIĆ", Subotica, Serbia

VALMIERAS TEHNIKUMS, Valmiera, Latvia

Project Duration:
1. 9. 2024 – 31. 5. 2026

Table of Content

Abstract

The main outcomes of this report include a structured compilation of best practices in energy education, the development of an evaluation framework, and a set of recommendations for integrating these practices into educational systems and policy contexts. The objective of this activity was to identify innovative, effective, and replicable approaches to teaching energy and sustainability topics across secondary and vocational education.

The study is based on a combination of fieldwork, stakeholder engagement, and desk research conducted by project partners across several European countries, including Slovenia, Portugal, Italy, Latvia, Türkiye, and Serbia. Each identified practice was evaluated according to its educational value, relevance to energy and sustainability, applicability within school curricula, and potential for replication in different educational contexts.

The findings highlight the critical role of experiential learning, real-world energy infrastructure, digital tools, and cross-sector collaboration in enhancing energy literacy among students. The report also demonstrates that successful energy education initiatives are often interdisciplinary and closely connected to local environments and community engagement.

In addition to presenting a structured overview of best practices, the report provides a comparative analysis of approaches across countries and identifies key success factors and common challenges. Based on these insights, a set of practical recommendations is proposed for educators, policymakers, and institutions aiming to integrate energy education into formal and non-formal learning systems.

The results contribute to the broader objectives of the European Green Deal and support the development of a more sustainable, energy-aware, and climate-resilient society.

1 Introduction

The transition towards a climate-neutral and sustainable society requires significant improvements in energy literacy and education. Schools play a key role in equipping young people with the knowledge, skills, and attitudes necessary to understand energy systems, reduce consumption, and support the transition to renewable sources.

This report contributes to this objective by presenting a curated collection of best practices in energy education identified through the Erasmus+ KA220 project. It aims to support educators, policymakers, and institutions in integrating sustainability and energy topics into curricula and everyday teaching practices.

2 Objectives and Methodology

The objective of Work Package 2 was to identify and analyse best practices in energy education by researching and highlighting innovative teaching methods, educational resources, and curriculum integration approaches from across Europe and globally.

To achieve this, project partners conducted a combination of desk research, fieldwork, and stakeholder engagement, including site visits and interviews. Each identified practice was reviewed based on its educational value, relevance to energy and sustainability topics, applicability within school curricula, and potential for replication in different educational contexts.

This approach ensured a comprehensive and comparable collection of practices, enabling the identification of effective and transferable models for integrating energy education into secondary and vocational education systems.

The methodology also included a qualitative assessment of selected practices based on predefined criteria and student feedback. The quality of the analysed educational resources was reviewed through expert feedback provided by teachers and mentors from partner organisations. This process was supported by interviews and guided discussions with students, allowing for the evaluation of the perceived impact of the selected practices in terms of understanding, engagement, and relevance.

The combination of expert review and student feedback ensured that the assessment reflects both pedagogical quality and learners' perspectives, in line with a participatory and evidence-based approach.

3 Best Practices by Country

Slovenia - GEN-i Energy School, Krško

Type: Educational programme

Target Group: Primary and secondary school students, teachers

Educational Value: Strong connection between theory and real energy infrastructure; promotes understanding of energy systems, sustainability, and climate change

Replicability: High – transferable through partnerships with energy companies and institutional support

GEN-i Energy School is a national educational program developed by the Slovenian energy company GEN Energija. It is aimed at primary and secondary school students and their teachers. Through guided tours of the Krško Nuclear Power Plant and other facilities, interactive workshops, and simulation-based learning, the program offers insight into various aspects of energy production, consumption, and sustainability.

The program covers a wide range of topics including energy efficiency, renewable energy sources, carbon emissions, nuclear energy, and the structure of national and European energy grids. Students participate in hands-on activities, use digital tools to simulate power systems, and learn about the role of energy in climate change mitigation.

This program is highly relevant for energy education because it connects theoretical concepts with real infrastructure, introduces students to future careers in energy and engineering, and raises awareness about sustainability. It also fosters collaboration between the energy sector and the education system.

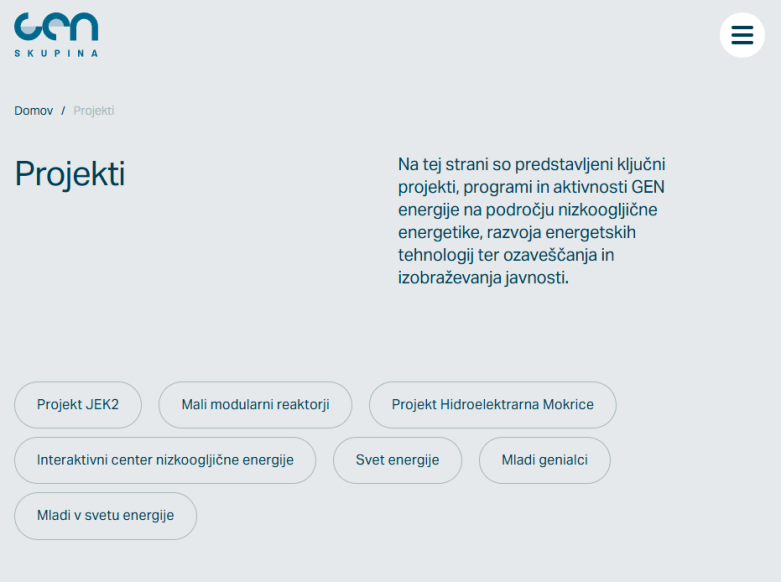

Figure 1 Source: gen-energija.si

Slovenia - Solar School Energy Community, Hrastnik

Type: Renewable energy community / infrastructure project
Target Group: Primary school students, local community
Educational Value: Hands-on learning through real-time energy monitoring; introduces prosumer concepts and community energy models
Replicability: High – applicable in schools with access to solar infrastructure and community engagement

This is Slovenia's first solar energy community initiative involving a school – the Hrastnik Primary School – as a self-consumption energy prosumer. The project is supported by the URBACT program and involves a 300-kW rooftop solar power plant. It supplies electricity to 16 households, 3 public buildings, and 2 companies.

This initiative is particularly suitable for integration into school curricula, as it combines technical, environmental, and social dimensions of energy education. Students can learn to measure energy production, monitor real-time outputs, understand the concept of "prosumers", and explore how energy can be managed and shared within a community framework.

Figure 2: Source: urbact.eu

Slovenia - Eco-Schools Program in Slovenia

Type: International educational programme
Target Group: All school levels
Educational Value: Promotes interdisciplinary learning, student participation, and environmental responsibility
Replicability: Very high – already widely implemented internationally

Slovenia has a strong tradition of participating in the international Eco-Schools program, with a high number of schools, students, and teachers involved. Schools conduct environmental monitoring, awareness campaigns, and projects related to energy and water consumption. They collaborate with local communities and professionals to develop practical sustainability initiatives.

This program is a powerful example of how theory and practice can be combined in education. It promotes student participation, interdisciplinary learning, and teacher mentorship in environmental topics.

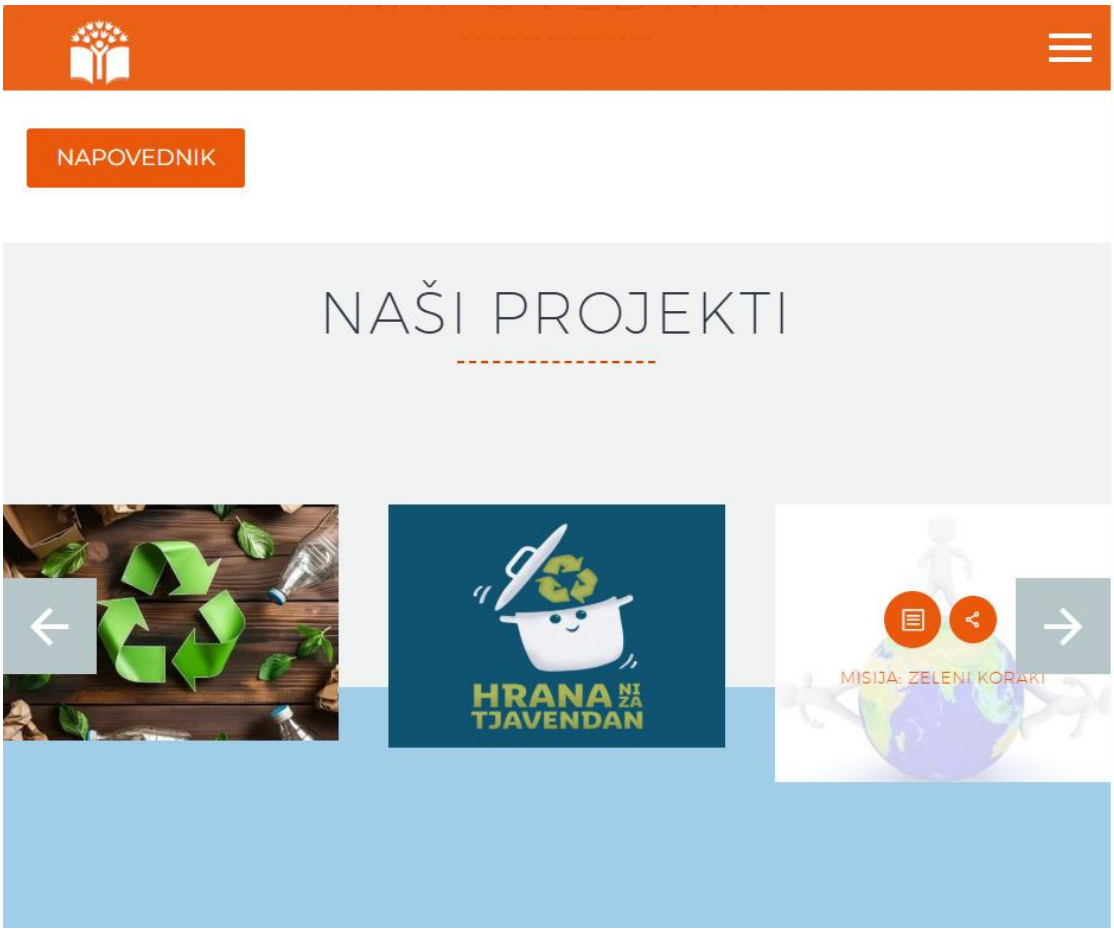

Figure 3: Source: https://ekosola.si/

Slovenia - Energy Student: Empowering the Next Generation for a Sustainable Future

Type: Erasmus+ project
Target Group: Students aged 10–15
Educational Value: Active participation in energy monitoring and awareness campaigns; promotes STEM careers
Replicability: High – adaptable to different school contexts

This Erasmus+ project connected Slovenian and Dutch schools to empower students aged 10–15 through hands-on activities in energy monitoring, awareness campaigns, and renewable energy careers. Students measured school energy use, implemented saving measures, and raised awareness about sustainability and technical professions.

The project resulted in tangible energy savings and increased student interest in STEM careers, making it a valuable model for energy education across Europe.

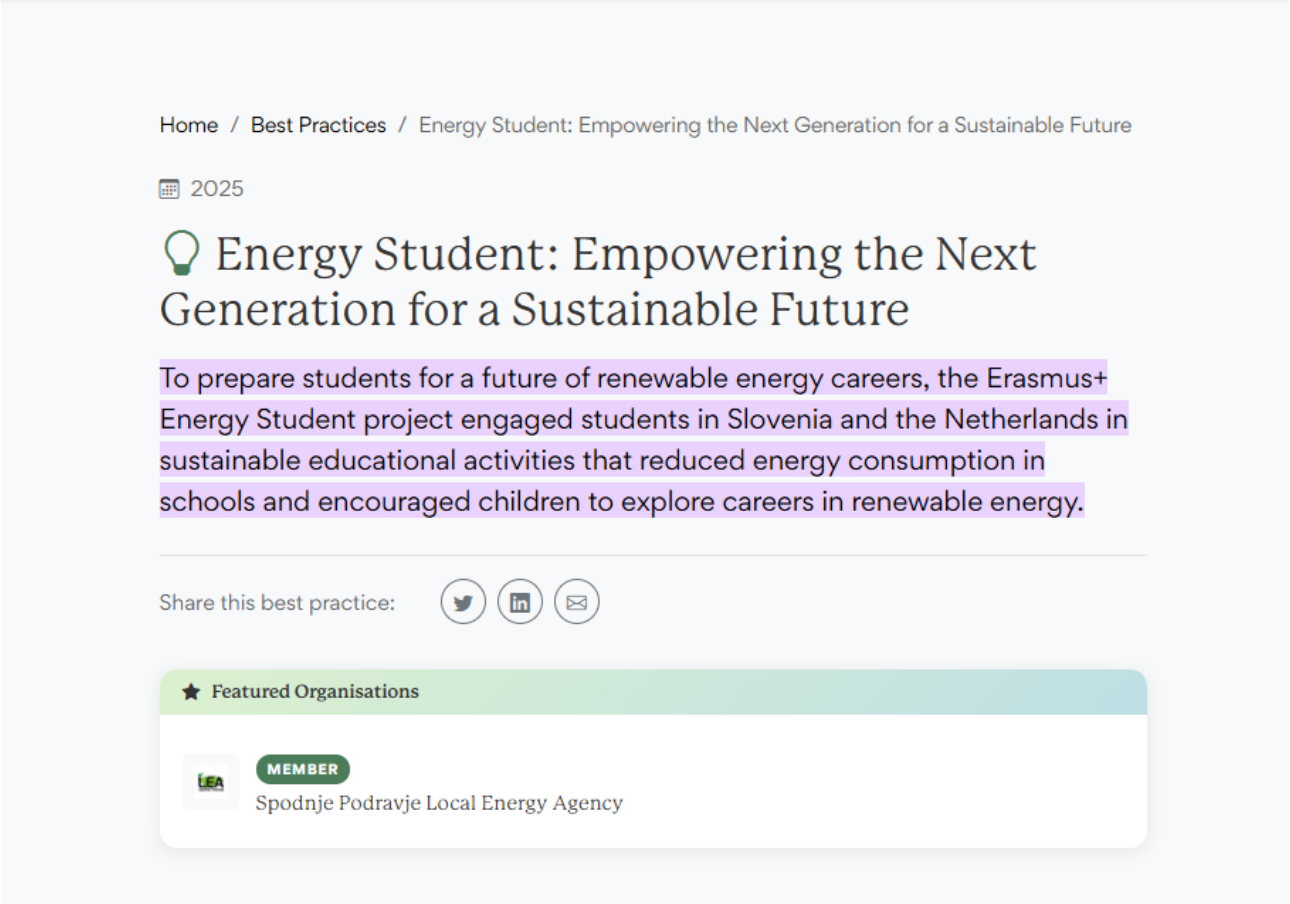

Figure 4: Source: https://fedarene.org/best-practice/energy-student-empowering-the-next-generation-for-a-sustainable-future/

Portugal - Energy School – EDP Energy School Foundation

Type: Digital learning platform
Target Group: Students aged 6–16
Educational Value: Gamified and interactive learning on sustainability and energy topics
Replicability: Very high – digital and scalable

"Energy School" is a program launched in 2023 by the EDP Foundation, in partnership with the Directorate-General for Education, which aims to raise awareness among students about the issues of sustainability, renewable energy, human rights and the Sustainable Development Goals. It provides a free platform with educational and playful content for students between 6 and 16 years old, using digital technologies and gamification (worksheets, interactive games, videos and practical experiences).

This programme is relevant for energy education in VET because it combines pedagogical innovation with a strong digital component, encouraging the active participation of students and integrating the theme of energy in school contexts.

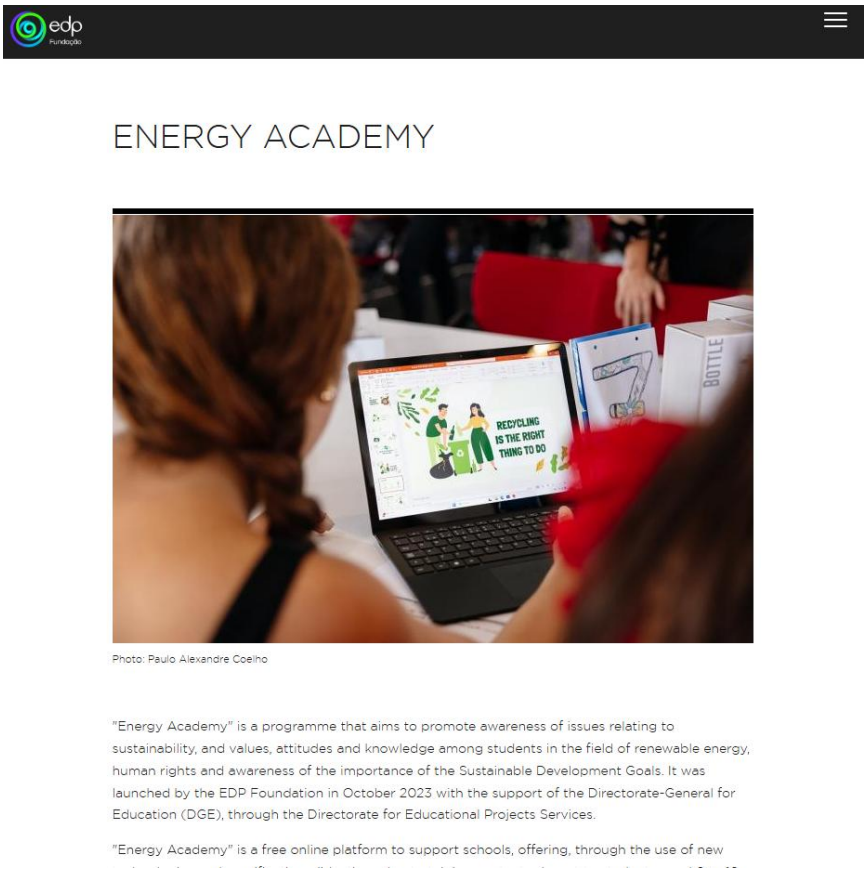

Figure 5: Source: https://www.fundacaoedp.pt/en/content/energy-academy

Portugal - Eco-Schools – Blue Flag Association for Environment and Education (ABAAE)

Eco-Schools is an international program of the "Foundation for Environmental Education", developed in Portugal since 1996 by ABAE (currently called ABAAE – Blue Flag Association for Environment and Education). It's an international program present in hundreds of Portuguese schools, which promotes education for sustainability through energy, water, waste and sustainable mobility management projects. Students actively participate in the implementation of measures within the school, with annual action plans, environmental monitoring activities and awareness campaigns involving students, teachers and local communities. The projects encourage interdisciplinarity and collaborative work. EPATV has been a school participating in the Eco-Schools program since the 2007/2008 school year, having renewed the Green Flag award every year. https://epatv.pt/escola/clubes-projetos/eco-escola/?utm_source

Within the scope of Eco-Schools, students from EPATV's Renewable Energy course participated in the project "Twist – your energy makes a difference!". They were invited to give a lecture on microgeneration and energy efficiency, convey their testimony about the implementation of the program in neighboring schools, and present an educational film. https://epatv.pt/noticias/1o-reuniao-das-escolas-profissionais-do-minho-63/?utm_source

This program stands out for its ability to involve school communities in a practical and participatory way, making students active agents in the implementation of energy efficiency and sustainability measures.

Figure 6: Source: https://epatv.pt/escola/clubes-projetos/eco-escola/?utm_source

Portugal - Greenvolt Communities

Type: Renewable energy community project
Target Group: Students, school communities
Educational Value: Real-life energy production, monitoring, and management
Replicability: High – depends on infrastructure support

Greenvolt Communities supports schools in the creation of Renewable Energy Communities (RECs), connected by self-production and clean energy sharing systems. In addition to the installation of solar panels, students participate in the monitoring and management of the energy produced, with complementary pedagogical activities such as workshops, technical visits and educational resources. The initiative reinforces energy self-sufficiency and brings the school community closer to the energy transition.

Students participate in the monitoring of energy production, workshops and technical visits, learning concepts of energy self-sufficiency and sustainable resource management. The community dimension also allows us to understand how households and businesses can benefit from clean and shared energy.

This project is relevant for energy education because it transforms schools into living spaces for energy transition, combining hands-on learning with real impact on energy consumption and production.

Figure 7: Source: https://comunidades.greenvolt.org/

Portugal - Ciência Viva at School Clubs – Portuguese National Network

Type: School-based research initiative
Target Group: Primary and secondary students
Educational Value: Experimental learning, prototyping, and connection to scientific community
Replicability: High

The Ciência Viva at School Clubs network promotes research and experimentation projects in different scientific areas, including renewable energy and energy efficiency. From primary to secondary school students, students develop prototypes (such as wind turbines or miniature sustainable houses) and studies on energy consumption, applying active methodologies and strengthening the connection to the scientific community. The methodology is based on experimentation, contact with the scientific community and interdisciplinary work. https://clubes.cienciaviva.pt/blog/?id_blog=1755&utm_source

This practice is relevant because it stimulates active learning, brings science closer to everyday school life and promotes the link between secondary education and scientific and technological careers.

Figure 8: Source: https://clubes.cienciaviva.pt/blog/?id_blog=1755&utm_source

Portugal - Escolas com Painéis Solares – Autarquias/PNAEE

Type: Public policy / infrastructure
Target Group: Students and school communities
Educational Value: Understanding energy production, consumption, and savings
Replicability: High with municipal support

As part of the Sustainable Energy Action Plans, several municipalities (Lisbon, Cascais, Oeiras, Porto, among others) have equipped schools with solar panels. In addition to the technological installation, students are involved in awareness campaigns and consumption monitoring activities, allowing them to understand the relationship between production, consumption and energy saving. https://www.cm-gaia.pt/pt/noticias/escolas-equipadas-com-centrais-fotovoltaicas/

This example is relevant for energy education because it combines local public policies with pedagogical practice, allowing schools to reduce their carbon footprint and involve students in concrete energy efficiency experiences.

Figure 9: Source: https://www.cm-gaia.pt/pt/noticias/escolas-equipadas-com-centrais-fotovoltaicas/

Portugal - Energy Up Award – Galp Foundation

Type: Competition / incentive programme
Target Group: Schools across all levels
Educational Value: Encourages innovation, project-based learning, and student engagement
Replicability: High

The Energy Up Award is an initiative of the Galp Foundation, with the institutional support of APA, ADENE, DGEG and DGE, aimed at schools throughout the territory of Portugal (mainland and islands).

The project challenges schools to develop and implement projects related to the energy transition in the school or community context — for example, innovative energy or environmental solutions, awareness campaigns, energy efficiency measures — involving students as active actors in changing behaviors.

The award distinguishes the best projects by level of education (1st cycle; 2nd/3rd cycles; secondary/vocational education). The winning school receives support for the installation of solar panels up to €20,000, plus monetary prizes for the best projects (€2,000 for 1st place, €1,000 for 2nd and 3rd place) in the other levels.

The relevance of this initiative for energy education is that it mobilizes students to be protagonists in the development of local solutions related to sustainable energy and behavior change; encourages the practical application of knowledge on energy efficiency and the environment (active methodologies, concrete projects, real impact on the community); It promotes healthy competitiveness between schools, which stimulates innovation and creativity and facilitates investment in real infrastructure (such as solar panels), bringing theory and practice closer together.

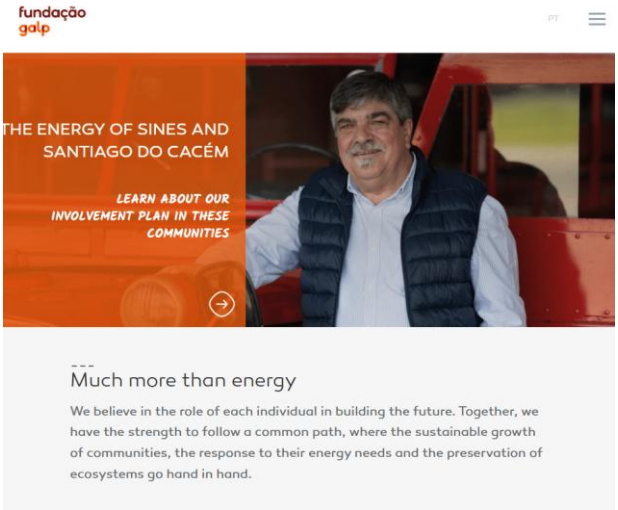

Figure 10: Source: https://www.fundacaogalp.com/en/

Efficient School – RUMOS Education

Type: Institutional initiative
Target Group: VET students and staff
Educational Value: Behavioural change and measurable energy savings
Replicability: High

Rumos Education is a vocational education group in Portugal, composed of several schools, including the Profitecla Professional School, the Braga Professional School, the Ruiz Costa Professional School and the Professional School of Digital Technology. These institutions have demonstrated a significant commitment to sustainability and energy efficiency.

As part of the **Efficient School** campaign, launched on Sustainability Day (September 25), Rumos Education schools managed to reduce their energy consumption by 22% during the first school term (September to December) of the years 2021 and 2022. This reduction corresponds to 62,063 kilowatt-hours (kWh), equivalent to the average annual consumption of 20 families of four. https://rumosexperience.pt/resp-escola-eficiente-reducao-energia.html?utm_source

The campaign involved several activities, such as webinars for students, awareness sessions for teachers and non-teachers, and the sharing of practical tips on how to save energy, both at school and at home.

Figure 11: Source: https://rumosexperience.pt/resp-escola-eficiente-reducao-energia.html?utm_source

Portugal - DECO Jovem – More Sustainable Schools

Type: Educational programme
Target Group: Primary, secondary, and VET students
Educational Value: Promotes responsible consumption and sustainability awareness
Replicability: Very high

DECO Jovem is a consumer education program promoted by DECO (Portuguese Association for Consumer Protection), aimed at schools. All schools or groups of schools, public or private, at different levels of education (from primary to secondary and vocational education) interested in the formation of future citizens and conscious and responsible consumers can, at any time, join the DECOJovem network of schools.

More Sustainable Schools is DECO Jovem's initiative that supports schools in the implementation of sustainable and responsible consumption practices, through educational activities, competitions and challenges, students learn to adopt more conscious habits in the management of energy, water and waste.

This program is relevant because it integrates sustainability education with active citizenship, raising awareness among young people about the impact of their individual choices on the use of energy and resources.

Figure 12: Source: https://decojovem.pt/

Portugal - SHOREWINNER – Polytechnic Institute of Porto and partners

Type: European project / VET excellence initiative
Target Group: VET students, teachers, industry stakeholders
Educational Value: Links education with industry and emerging energy sectors
Replicability: High

The **SHOREWINNER project** brings together 22 partners from five Southern European countries, led by the Polytechnic Institute of Porto, and has the participation of Portuguese partners EPATV, APREN (Portuguese Association of Renewable Energies) and Voltalia. The objective is to create Vocational Excellence Centers (CoVEs) in the offshore renewable energy sector, promoting the sharing of practices and the articulation between education, industry and research, with an impact also on vocational education by developing a course to better equip the workers of the future.

EPATV organized a workshop in partnership with ISEP in the context of the European project SHOREWINNER, integrated in the celebrations of World Energy Day. The event aimed to raise awareness of innovative energy models (such as offshore wind energy), promote professional training in the emerging energy sector, and integrate students and teachers in these topics and had the participation of relevant energy companies in the sector such as Greenvolt, Megajoule, Ocean Winds, Principal Power and Gazelle Wind Power.

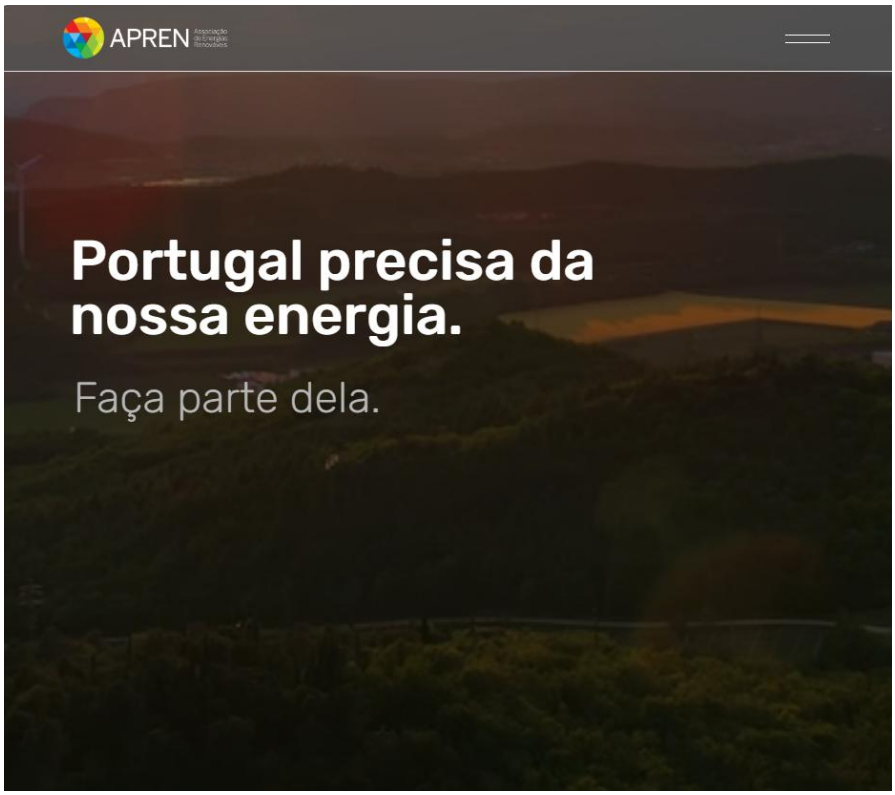

Figure 13: Source: https://www.apren.pt/

Italy - RiGenerazione Scuola – PCTO "Energia in Alternanza" with GSE

Type: National programme
Target Group: Secondary students
Educational Value: Combines theoretical knowledge with real-world applications and institutional expertise
Replicability: High

"RiGenerazione Scuola" is the national framework launched by the Italian Ministry of Education to integrate ecological transition and sustainability into all school levels, aligning education with the UN 2030 Agenda. It supports schools in developing projects on biodiversity, circular economy, energy efficiency, and sustainable lifestyles, encouraging collaboration with external partners to strengthen environmental competences. Within this framework, students not only engage in awareness-raising and school-based activities but also gain access to structured pathways of Percorsi per le Competenze Trasversali e l'Orientamento (PCTO), the Italian model of dual learning.

One of the most relevant opportunities is the PCTO "Energia in Alternanza", developed with Gestore dei Servizi Energetici (GSE S.p.A.), the national public body that promotes renewable energy, energy efficiency, and sustainability. Through this programme, secondary school students are introduced to the functioning of the Italian energy system, renewable energy incentives, and energy transition strategies directly from institutional experts. The pathway combines classroom modules, digital resources, and guided project work with mentoring from GSE professionals. By simulating real-life scenarios—such as designing small-scale renewable solutions or analysing energy efficiency measures—students acquire both technical knowledge and transversal competences in teamwork, problem solving, and green innovation. This dual approach strengthens the bridge between education and the labour market, giving young people a practical insight into future careers in the energy and sustainability sectors.

Figure 14: Source: https://www.gse.it/sostenibilita/storie-e-progetti/alternanza-scuola-lavoro

Italy - Moderatti

Type: Cross-border project
Target Group: Students, communities
Educational Value: Promotes renewable energy and community engagement
Replicability: Medium–high

Moderatti is an Interreg Alcotra project designed to accelerate the energy transition in four Alpine territories: Hautes-Alpes, Alpes-de-Haute-Provence, Cuneo, and Turin. It brings together French and Italian partners to create citizen renewable energy operators (OETC) as a replicable model for mountain regions. The initiative combines technical cooperation with cultural actions: experts and local actors share know-how through joint seminars, bilingual tools, and activities, while high schools students and cultural partners contribute to raising awareness with audiovisual works and a festival. By integrating cross-border expertise with strong community involvement, Moderatti stands out as an emerging good practice that promotes both renewable energy deployment and social acceptance in the Alps.

Figure 15: Source: https://www.interreg-alcotra.eu/it/moderatti-modellizzazione-degli-operatori-energetici-territoriali-transalpini

Italy - Energie per la Scuola – Enel School–Enterprise Training

Type: School–industry collaboration
Target Group: VET and technical students
Educational Value: Strong employability focus and practical training
Replicability: High

Enel, Italy's largest energy company, has developed an extensive school–enterprise collaboration model to support the transition toward new professional skills in the energy sector. The initiative responds to a structural challenge: the growing demand for technicians specialized in electricity grids, smart infrastructures, and renewable systems. By partnering with technical and vocational schools across the country, Enel ensures a close connection between formal education and the skills required by the energy industry.

Within this framework, the programme "Energie per la Scuola" offers students in their final year a dual learning pathway. It starts with a 120-hour training course during school time, introducing them to energy networks, renewable integration, and digitalisation of infrastructures. After graduation, selected students can continue with a specialised post-diploma module, often delivered in partnership with Enel's supply-chain companies. This structured pathway exposes learners to hands-on simulations, safety protocols, and energy system management, and it is explicitly designed to lead to employment opportunities in the sector. The programme stands out because of its strong energy education component—students not only study renewables and efficiency in theory but also gain workplace-level competences that accelerate their entry into green jobs.

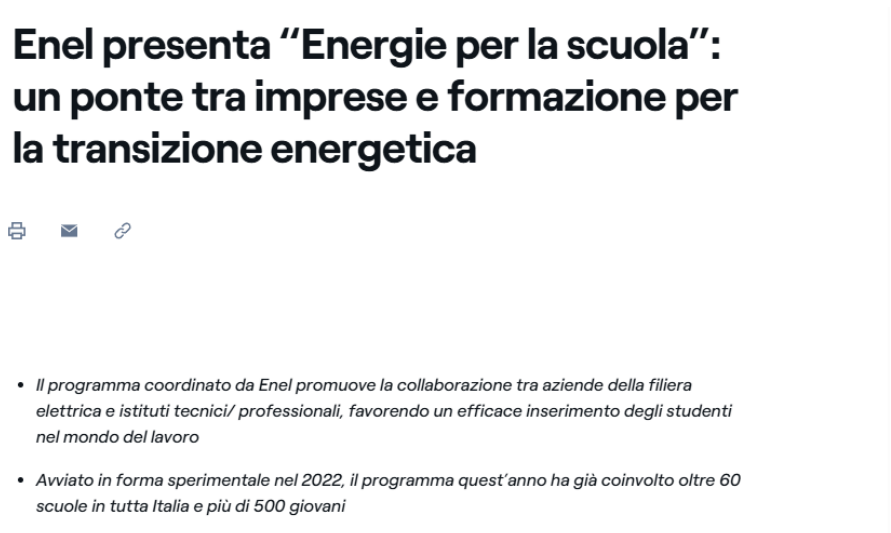

Figure 16: Source: https://www.enel.com/it/media/esplora/ricerca-comunicati-stampa/press/2023/02/enel-presenta-energie-per-la-scuola-un-ponte-tra-imprese-e-formazione-per-la-transizione-energetica

Italy - ITS Green Tech – Impianti Energetici

Type: Post-secondary VET programme
Target Group: Young professionals
Educational Value: Advanced technical training in energy systems
Replicability: Medium (requires institutional framework)

The Istituti Tecnici Superiori (ITS) are Italy's high-level, post-secondary vocational schools created to bridge the gap between formal education and industry. They focus on applied sciences and technology, with strong involvement of local enterprises. The ITS Green Tech Foundation in Piemonte is among the most active in the energy transition field, responding to regional and national strategies for renewable deployment and efficiency.

Within this setting, the ITS Impianti Energetici course trains Energy Plant Technicians capable of designing, managing, and maintaining complex energy systems. The programme combines advanced modules on renewable energy technologies, smart grids, energy storage, and efficiency measures with 700+ hours of internships in partner companies, ensuring immersion in real projects. Students carry out laboratory work and case studies on photovoltaic, wind, and bioenergy plants, as well as on energy auditing. The deep integration of technical competences with sustainability perspectives makes this pathway a strong example of energy education: it equips young professionals not only with up-to-date knowledge of energy systems, but also with the problem-solving skills required for Italy's green transition.

Figure 17: Source: https://its-greentech.it/corso/tecnico-impianti-energetici

Italy - IPSIA “Ostilio Ricci” Fermo – Sistemi Energetici e Energie Rinnovabili

Type: Vocational education programme
Target Group: Secondary vocational students
Educational Value: Hands-on training in renewable energy systems
Replicability: High

Italian Istituti Professionali play a crucial role in preparing students for direct entry into the labour market, particularly in technical fields. The IPSIA “Ostilio Ricci” in Fermo has developed a specialised five-year course under the national “Manutenzione e Assistenza Tecnica” framework, with a specific focus on energy systems and renewable technologies. This responds to the need for qualified technicians capable of operating at the intersection of mechanical, electrical, and environmental competences.

The “Sistemi Energetici e delle Energie Rinnovabili” programme gives students an integrated education covering design, installation, and maintenance of both traditional and renewable energy systems. Learning is strongly practice-oriented, with extensive laboratory sessions and project-based modules. Students acquire competences in photovoltaic and thermal systems, heating/cooling technologies, and energy efficiency applications, always framed within safety and sustainability standards. This deep specialization ensures that energy education is not just an optional subject, but the backbone of the curriculum—preparing graduates to contribute concretely to the diffusion of renewable energy in their communities and to pursue further technical qualifications if desired.

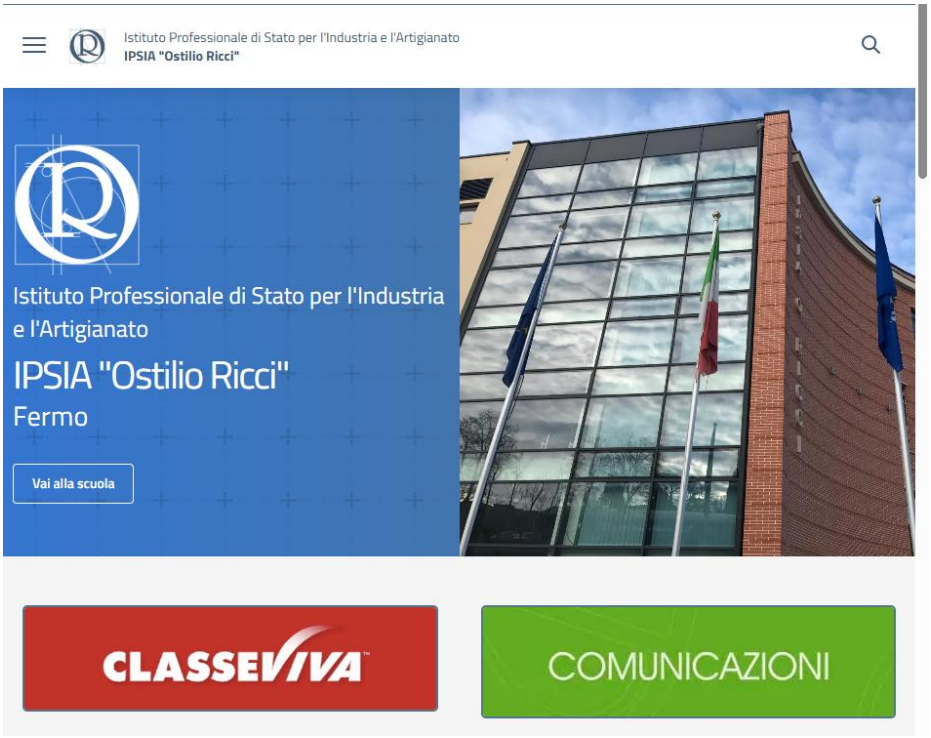

Figure 18: Source: https://www.ipsiafermo.edu.it/

Latvia - The GRETA initiative

Type: Policy and research framework
Target Group: VET institutions
Educational Value: Systemic integration of green skills
Replicability: High

Greening Responses to Excellence through Thematic Actions—explores how vocational education and training (VET) systems can be transformed to support the twin transitions of digitalization and environmental sustainability. Developed by the European Training Foundation in collaboration with the Danish Technological Institute, the study presents a whole-institutional approach to embedding green practices across curricula, teacher training, partnerships, funding, and strategic planning. Drawing on peer learning activities and case studies from Centers of Vocational Excellence (CoVEs) in EU and neighboring countries, the report identifies key challenges and opportunities in aligning VET with green transition goals. It emphasizes the importance of transversal and technical green skills, stakeholder collaboration, and policy coherence. GRETA's findings contribute to shaping future VET reforms and offer actionable recommendations for integrating sustainability into education systems to meet the demands of a climate-resilient and resource-efficient economy.

Figure 19: Source: https://www.etf.europa.eu/sites/default/files/2023-05/GRETA_Greening%20of%20VET.pdf

Latvia - Riga Technical University study "Increasing Sustainability in Vocational Education System: Latvia Case Study"

Type: Research study
Target Group: VET institutions
Educational Value: Data-driven approach to sustainability in education
Replicability: High

This study investigates the integration of energy education and sustainable practices withing Latvia's vocational education system, emphasizing institutional strategies for reducing environmental impact. Conducted across 23 professional schools, the research analyzes energy consumption patterns, renewable energy adoption, and environmental policies to identify best practices for green transformation. A composite sustainability indicator was developed to benchmark institutions, revealing that targeted mandatory and optional measures can reduce primary energy consumption by up to 32% and greenhouse gas emissions by 33%. The study highlights the importance of embedding energy efficiency principles into curricula, fostering stakeholder engagement, and implementing demonstration projects in schools specializing in renewable energy, mechatronics, and environmental technologies. These findings offer a replicable model for advocation climate neutrality through vocational education, positioning energy literacy as a cornerstone of sustainable development.

Figure 20: Source: https://ect-journals.rtu.lv/conect/article/view/CONECT.2023.014

Latvia - Community Energy Projects

Type: Policy initiative
Target Group: Communities, schools
Educational Value: Promotes energy democracy and local engagement
Replicability: Medium–high

This policy paper outlines strategic recommendations for fostering renewable energy communities (RECs) in Latvia, developed under the EU Interreg Baltic Sea Region Co2mmunity initiative. Despite limited national support and regulatory clarity, pilot projects in the Riga Planning Region demonstrate the potential of community-led energy initiatives to contribute to climate neutrality and energy decentralization. The study identifies key barriers—such as fragmented legislation, low civic engagement, and financial constraints—and proposes actionable solutions across four domains: regulatory reform, diversified funding, stakeholder engagement, and integrated planning. Recommendations include legal recognition of energy communities, expansion of net metering to collective entities, inclusion of RECs in EU and rural development funding, and enhanced public outreach and data transparency. The paper emphasizes the role of municipalities, NGOs, and citizen groups in advancing energy democracy and calls for stronger institutional support to scale community-based renewable energy projects across Latvia.

Figure 21: Source: https://rpr.gov.lv/wp-content/uploads/2020/04/3-Rekomend%C4%81cijas-Co2mmunity-ENG.pdf

Latvia - Interreg Baltic Sea Region project Energy Equilibrium

Type: Digital platform and infrastructure
Target Group: Municipalities, students
Educational Value: Simulation and real-world data application
Replicability: High

Showcases a strategic commitment to advancing renewable energy integration and energy education at the municipal level. Through the development of the Energy Equilibrium Platform—an interactive modeling tool—Latvian municipalities, including Valmiera, have gained access to data-driven planning resources that support informed decision-making on renewable energy deployment and storage solutions. The platform enables simulation of low-carbon energy scenarios and identification of optimal strategies for local energy transitions. Valmiera stands out for its pioneering role in battery energy storage system (BESS) implementation. In 2024, AJ Power invested over €6 million to install BESS units at solar power plants in Valmiera, Aizkraukle, and Ilūkste, with a combined capacity of 9 MW/18 MWh. These systems enhance grid stability and serve as practical learning environments for vocational and technical education, reinforcing energy literacy and sustainability competencies. Additionally, Riga Technical University collaborated with Latvia's transmission system operator AST to develop a custom battery management system using real-time grid data and advanced algorithms, further embedding research and innovation into Latvia's energy education ecosystem. Together, these initiatives position Latvia—and Valmiera in particular—as leaders in regional energy transition, combining infrastructure investment with educational innovation to foster climate resilience and energy independence.

Figure 22: Source: https://interreg-baltic.eu/project/energy-equilibrium/ , https://interreg-baltic.eu/project-posts/energy-equilibrium/latvias-path-to-energy-transition-expanding-renewable-energy-and-investing-in-storage-solutions/

Latvia - The Eco-School program in Latvia

Type: International programme
Target Group: VET students
Educational Value: Practical sustainability learning and projects
Replicability: Very high

A part of the international Foundation for Environmental Education (FEE) initiative, promotes sustainability and environmental literacy across educational institutions. Valmieras Tehnikums, a leading vocational education and training (VET) institution, has emerged as a model for integrating energy education into the Eco-School framework. By earning the Eco-School certificate, Valmieras Tehnikums demonstrates its commitment to fostering environmentally responsible practices and embedding sustainability into its curriculum and campus operations. The school implements hands-on learning activities focused on energy efficiency, renewable energy technologies, and resource conservation. Students engage in projects that explore alternatives to fossil fuels, energy audits, and circular economy principles, particularly within technical programs such as mechatronics and renewable energy systems. Participation in national forums like the Eco-School Winter Forum further enhances student awareness and collaboration on climate-related challenges. Through its active involvement in the Eco-School program, Valmieras Tehnikums not only cultivates green competencies among future professionals but also contributes to Latvia's broader goals of climate neutrality and sustainable development.

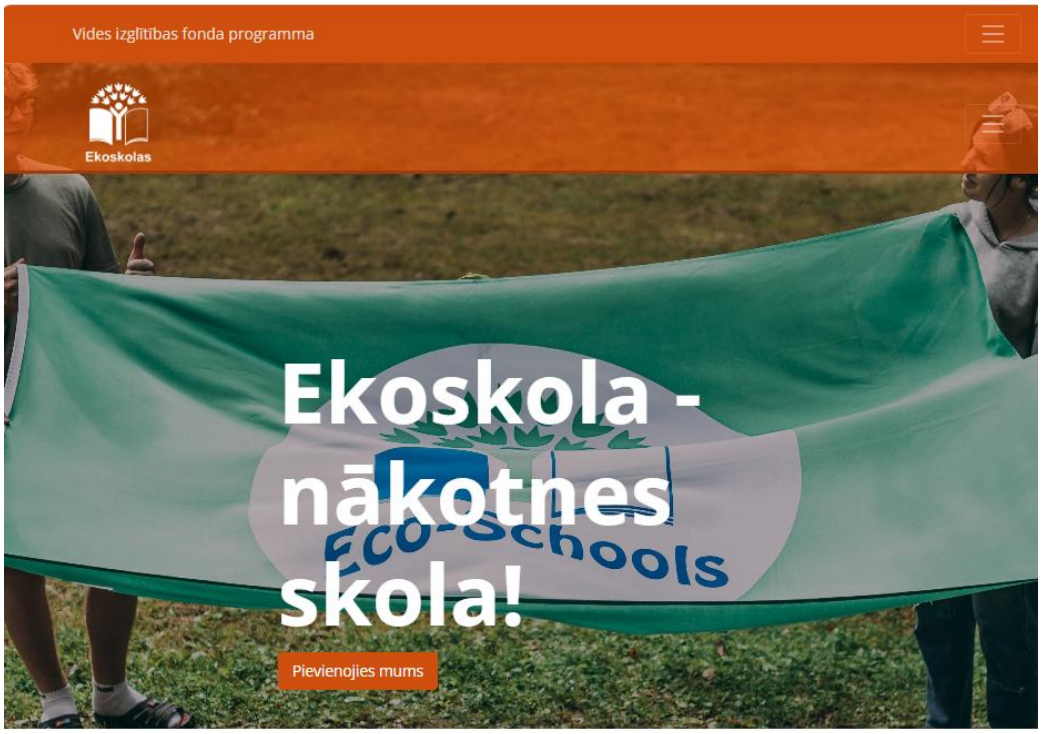

Figure 23: Source: https://ekoskolas.lv/

Türkiye - EVeP16 Project Bursa – Energy Efficiency in Schools

Type: Monitoring system
Target Group: Students, school staff
Educational Value: Real-time data awareness and behavioural change
Replicability: High

Within the scope of the EVeP16 Project, the consumption of electricity, natural gas, and water in schools can be remotely monitored through specially developed software. Accordingly, all meters in schools have been replaced with GPRS-enabled devices, and a software infrastructure has been established to enable remote data reading.

Through this software, called **"EVeP16"**, both consumption values and cost-based variations are regularly measured and reported. When abnormal consumption is detected, the system automatically generates an alert and immediately informs the school administration.

In addition, temperature and humidity sensors have been installed in classrooms, and large screens placed in visible areas of schools allow students to monitor classroom temperatures and water consumption in real-time. This practice aims to raise awareness and instill a culture of energy efficiency and conservation among students.

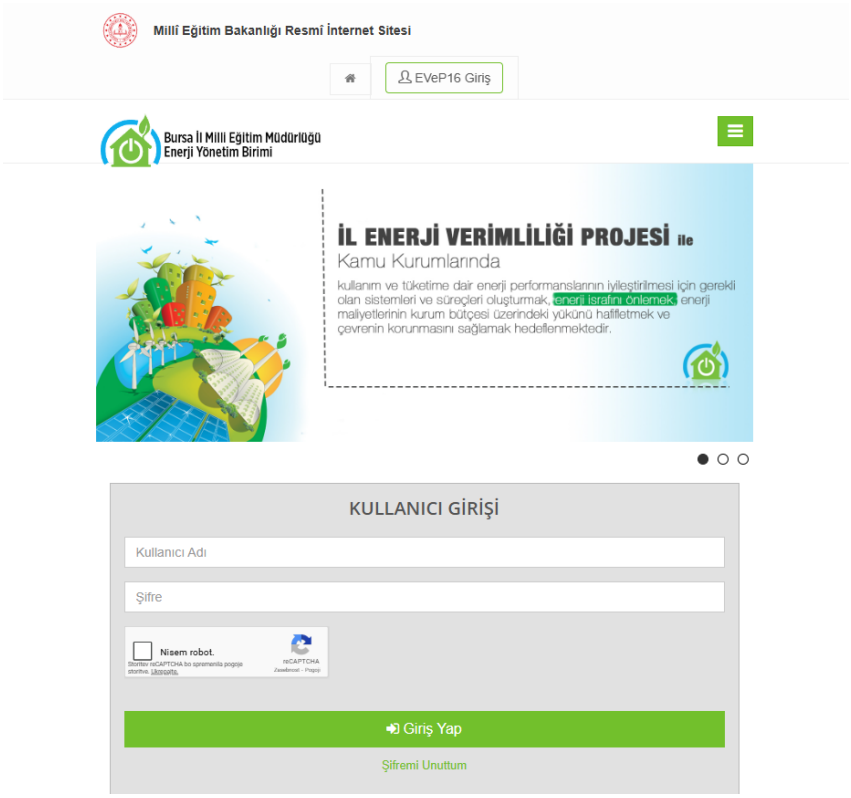

Figure 24: Source: https://bursa.meb.gov.tr/enerjiyonetimi/home.php?page=index

Türkiye - Energy-Friendly Blue-Green School

Type: Certification programme
Target Group: Schools
Educational Value: Promotes sustainable practices and awareness
Replicability: High

The project aims to promote energy conservation in primary and secondary public schools in Türkiye through various practices that ensure the correct and efficient use of resources, thereby contributing to sustainable environmental conditions. Within this framework, the initiative seeks to identify and certify schools under the title **"Energy-Friendly Blue-Green School"**, which implement fundamental actions of sustainable living.

A certification method has been developed to ensure the efficient use of natural and energy resources—particularly electricity, water, and fuel—in schools, to promote energy savings, and to raise awareness among school stakeholders on this matter.

Schools meeting the designated eco-friendly criteria are awarded the **"Energy-Friendly Blue-Green School Label."** The evaluation is carried out based on two main fields of practice:

1. **Consumption of Energy Resources:** Schools are scored based on their efforts to periodically reduce unnecessary energy consumption.
2. **Implementation of Energy-Friendly Blue-Green School Project Activities:** Schools earn points through initiatives across 12 different areas.

These activities include preparing magazines, posters, and brochures to raise awareness on energy efficiency, environmental protection, sustainable living, green and digital transformation; organizing nature trips; developing school action plans suitable for regional climate conditions; and implementing waste reduction as well as recycling and upcycling practices.

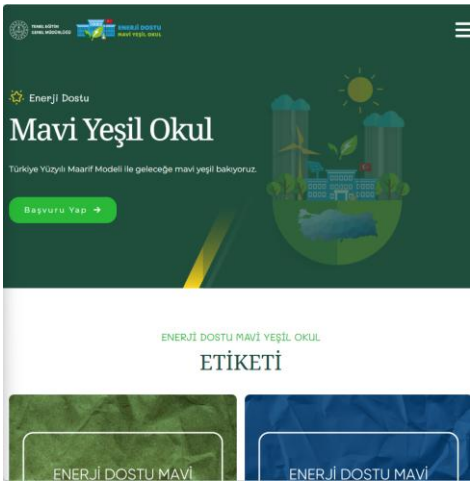

Figure 25: Source: https://maviyesilokul.meb.gov.tr/

Türkiye - Cezeri Green Technology Vocational and Technical Anatolian High School

Type: Model school / infrastructure
Target Group: Secondary students
Educational Value: Real-life renewable energy production and application
Replicability: Medium

Cezeri Green Technology Vocational and Technical Anatolian High School is one of Türkiye's pioneering schools in the use of energy in education. It produces its own energy, uses energy efficiently, and carries out industrial applications in the field of renewable technologies.

The school building was designed with high energy efficiency criteria: architectural and passive design principles were applied, considering factors such as building orientation, window/frame characteristics, façade materials, and minimizing heat losses. The school meets a large portion of its annual energy demand (around 90%) from renewable sources, while also placing strong emphasis on efficient energy use.

Based on the principle that **"Türkiye should be a hub for energy technology production,"** the school is recognized as a model, leader, and reference institution in renewable energy technologies, supported by its students who understand the importance of energy and energy efficiency.

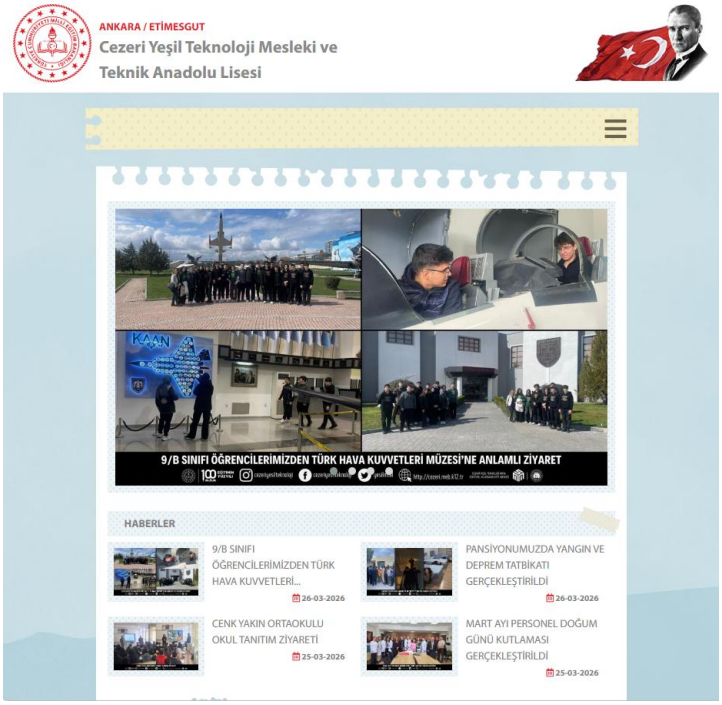

Figure 26: Source: https://cezeri.meb.k12.tr/

Türkiye - Eco-Schools Program

Type: International programme
Target Group: All school levels
Educational Value: Participatory environmental education
Replicability: Very high

The Eco-Schools Program is implemented in preschools, primary, and secondary schools to provide education on environmental awareness, environmental management, and sustainable development. With its participatory approach, students not only gain knowledge about environmental issues but also play an active role in raising awareness among their families, local governments, and non-governmental organizations (NGOs). The program also ensures the implementation of a strong environmental management system within schools.

The Eco-Schools Program significantly improves learning environments by creating greener, climate-resilient, and child-friendly outdoor spaces suitable for experiential learning. Additionally, through various projects, the program extends its impact to households, contributing to the development of greener communities.

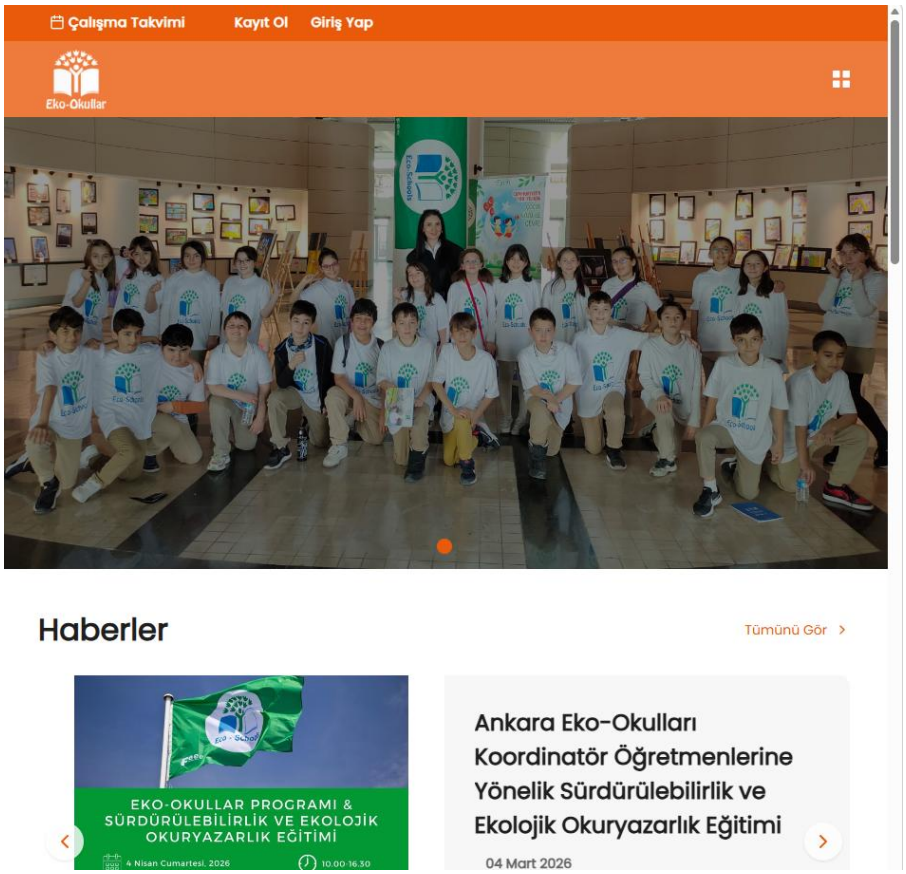

Figure 27: Source: www.ekookullar.org.tr

Türkiye - Eco-Friendly 1000 Schools Project

Type: National initiative
Target Group: Schools
Educational Value: Combines infrastructure and education
Replicability: High

The **"Eco-Friendly 1000 Schools Project"**, which is part of the **"Clean School and Clean Energy"** initiative, aims to maximize energy efficiency in 1000 schools across Turkey. This project includes the installation of solar panels, rainwater storage units, and other energy efficiency applications.

"Rainwater will be used in the schools' gardens and other areas. Additionally, the libraries in all 1000 schools will be transformed into **zero-waste libraries**. In this way, students will experience how unused materials from their homes or schools can be repurposed and will engage with the practical applications of recycling. Moreover, organic waste from cafeterias and canteens will be turned into compost through composting machines. Children will use this compost to grow plants in the school gardens. The schools will be transformed into environmentally friendly institutions where the culture of zero waste is widespread. As part of the project, continuous training will be provided to all school administrators and teachers on **environmental awareness** and **climate change**."

T.C. MİLLİ EĞİTİM BAKANLIĞI

Ana Sayfa > Haberler

ÇEVRE DOSTU 1000 OKUL PROJESİ BAŞLADI

Çevre Dostu 1000 Okul Projesi, Millî Eğitim Bakanı Mahmut Özer ile Çevre, Şehircilik ve İklim Değişikliği Bakanı Murat Kurum'un katıldığı törenle kamuoyuna tanıtıldı.

28 Mart 2022 14:54

Millî Eğitim Bakanı Mahmut Özer, OSTİM İlköğretim Okulunda düzenlenen "Çevre Dostu Bin Okul Projesi" tanıtım programında projeye desteklerinden ötürü Çevre, Şehircilik ve İklim Değişikliği Bakanı Murat Kurum'a teşekkür etti.

Antalya'da 9 Aralık 2021'de düzenlenen Akdeniz'in Kirlenmeye Karşı Korunması Sözleşmesi'nin 22. Taraflar Konferansı'nda (COP22) caretta carettaların denize bırakılması sürecine Millî Eğitim Bakanlığı olarak dâhil olduklarını anımsatan Özer, şöyle konuştu:

"Orada bir sürü konuyu mütalaa etme fırsatı bulduk. Çok hızlı bir şekilde çevre bilinciyle ilgili adım atabilme imkânımız oldu. Bunun ilk adımını, 2015'ten beri 7 ve 8. sınıflarda seçmeli ders olarak okutulan 'çevre eğitimi' dersinde attık. Önce müfredatı güncelledik ve dersin adını 'çevre eğitimi ve iklim değişikliği' dersi olarak değiştirdik. 7 ve 8. sınıfların yanında 6. sınıflara da seçmeli ders olarak dâhil ettik. İkinci adımı olarak öğretmenlerin uzaktan eğitim platformuyla eğitimlerini tamamlaması için geliştirdiğimiz Öğretmen Bilişim Ağı'nda (ÖBA) 2021-2022 yılının ara tatilinde öğretmenlerimize ilk defa çevre eğitimi ve iklim değişliğiyle ilgili eğitim verdik. Bunun içeriğinin oluşturulmasında da Çevre, Şehircilik ve İklim Değişikliği Bakanlığımızın çok büyük katkısı oldu. Zorunlu olmamasına rağmen bu eğitimlere 100 bine yakın öğretmenimiz katıldı."

Source: https://meb.gov.tr/cevre-dostu-1000-okul-projesi-basladi/haber/25695/tr

Serbia - Technical school in Valjevo - solar power plant

Type: School infrastructure
Target Group: Secondary students
Educational Value: Practical application of renewable energy
Replicability: High

The technical school in Valjevo is an example of the multiple benefits of investing in energy efficiency, primarily through lower energy consumption, lower bills and lower emission of harmful gases. By taking care of energy saving, they also set an example for young people to be energy conscious, to take care of both energy and a healthy environment when they become adults and to pass this on to their children one day. In this school, solar panels will serve as a teaching tool at the same time, since the school also has a cabinet for renewable energy sources, and some of the students will work in our energy system in the future.

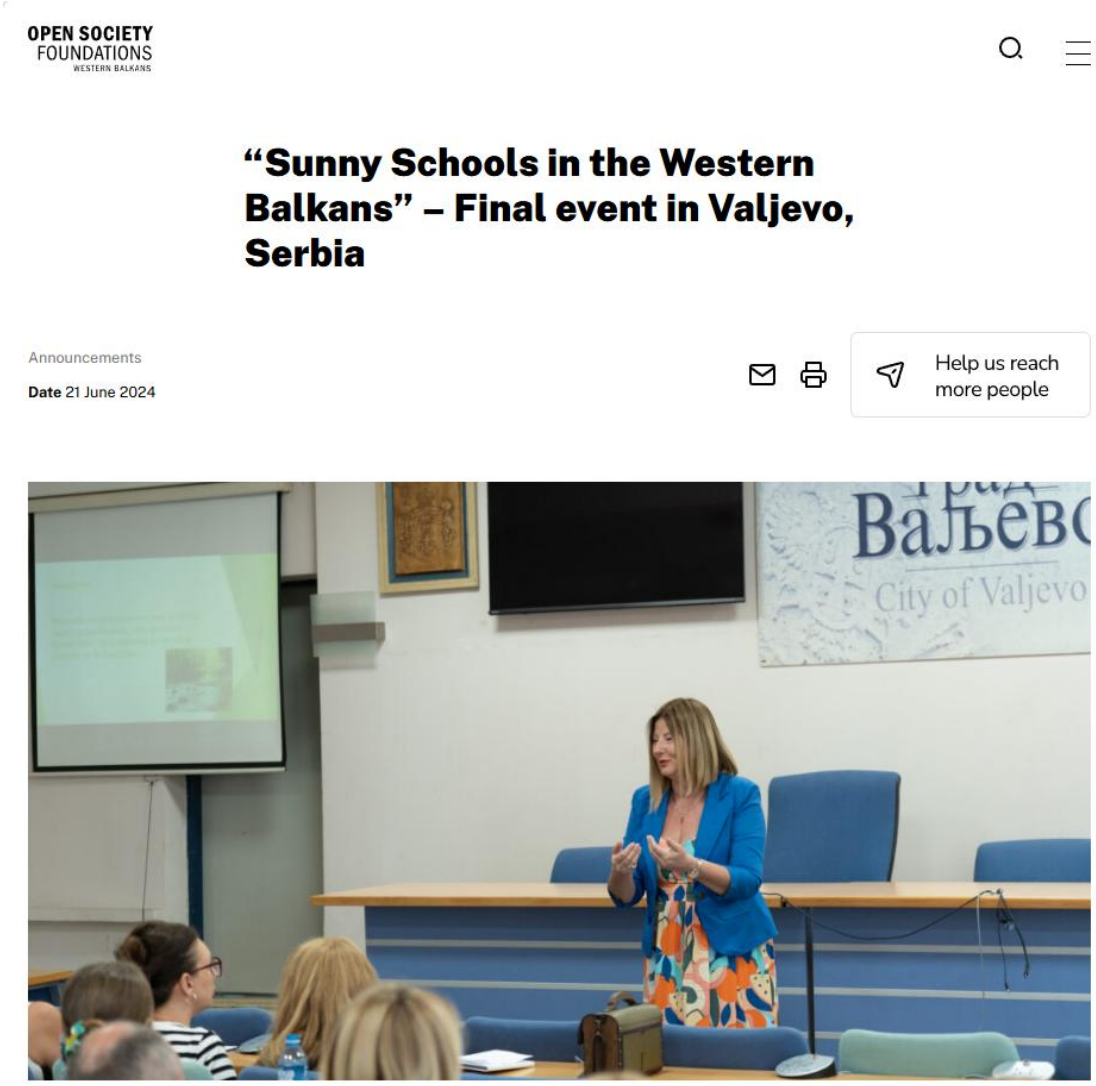

Figure 28: Source: https://osfwb.org/sunny-schools-in-the-western-balkans-final-event-in-valjevo-serbia/

Serbia - Project "Solar panels in schools of the Western Balkans"

Type: Regional project
Target Group: Primary schools
Educational Value: Energy independence and awareness
Replicability: High

By signing the Open Society Foundation Donation Agreement, six primary schools will use renewable energy sources from 2025. In this way, schools will be able to invest the funds that they would have spent on electric energy in improving and improving working conditions for students. Practically, this means that schools will, in a way, have energy independence from the system. Solar power plants are designed to cover the year-round need for energy, said Milosavljević, emphasizing that the project also has an educational component for students, teachers and parents as to how it is possible to generate electricity in a sustainable and environmentally friendly way. The project "Solar panels in the schools of the Western Balkans" is one of the ways to encourage as many citizens as possible to this type of energy efficiency so that the subsidies get their full meaning and the whole program of "greening" the production of electricity.

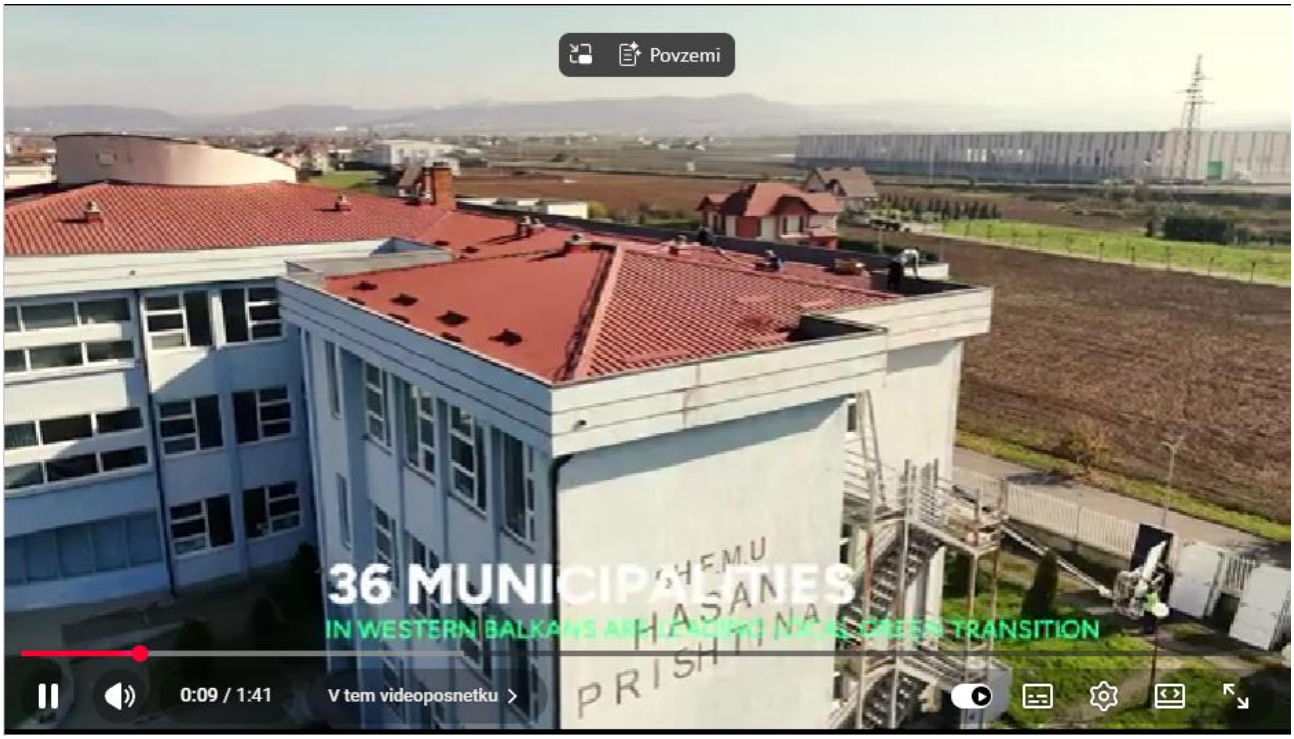

Figure 29: Source: https://www.youtube.com/watch?v=Opk9A-yTFfM&t=6s

Serbia - Education of elementary school students

Type: Educational programme
Target Group: Primary school students
Educational Value: Awareness raising and basic knowledge
Replicability: Very high

On World Energy Efficiency Day 2024, the first of 45 workshops in the field of energy efficiency and renewable energy sources, which will be held in 20 schools of Južnobački District, was held at the "Vasa Stajić" Elementary School in Novi Sad.
The educations are intended for students of the eighth grade of elementary schools, with the aim of getting to know renewable energy sources and their use and energy efficiency, that is, energy efficiency measures and the necessity of their application.
About 1,200 students will be included in the education.
The workshops last an hour and a half and are organized individually for each class of the eighth grade as part of regular lessons in the subject of Technology and Technology. During the hour and a half workshop, the most attention was devoted to solar energy and systems for its exploitation, as well as energy efficiency and measures for its implementation.

Serbia - Installation of a solar power plant, "Ivan Sarić" Technical School – Subotica

Type: Infrastructure / policy example
Target Group: Students
Educational Value: Demonstrates public investment in sustainability
Replicability: High

„Our goal was to establish the energy efficiency of public buildings through the application of power plants on renewable sources, as an example of an energetically sustainable and environmentally friendly public policy, which raises awareness of the importance of environmental protection and the potential of renewable sources. Today we can say that we have achieved everything we set out to do within the project. We made a significant saving of energy, and thus of public funds, and traced the path we need to continue in increasing the energy efficiency of large public buildings. With such projects, we are leading the way in implementing a healthy green policy in our country“.

Serbia - Mechanical-Traffic School from Čačak

Type: Infrastructure project
Target Group: Secondary students
Educational Value: Integration of renewable energy into technical education
Replicability: High

The Mechanical and Traffic School is one of three institutions from Čačak that will receive financial resources for the construction of solar power plants. The project is implemented by the NIS company within the "Communities Together" program in 13 local governments, including Čačak. The total value of the project is 144.5 million dinars.
Institutions that perform their activities in the fields of education and science, health, social protection, culture and sports applied for the installation of solar panels on the roofs of buildings in order to produce their own electricity. Čačak is one of the 13 local governments covered by the "Communities Together" program, which will finance a total of 40 projects for the construction of solar power plants with a capacity of 10 - 50 kW. In the School of Mechanical Engineering, a solar power plant will be built on the roof of the gymnasium and will have an inverter power of 30 kW. It aims to reduce the consumption of electricity in the school and in the workshops, but it is optional for the machines to be connected to renewable sources in order to fully utilize those capacities.

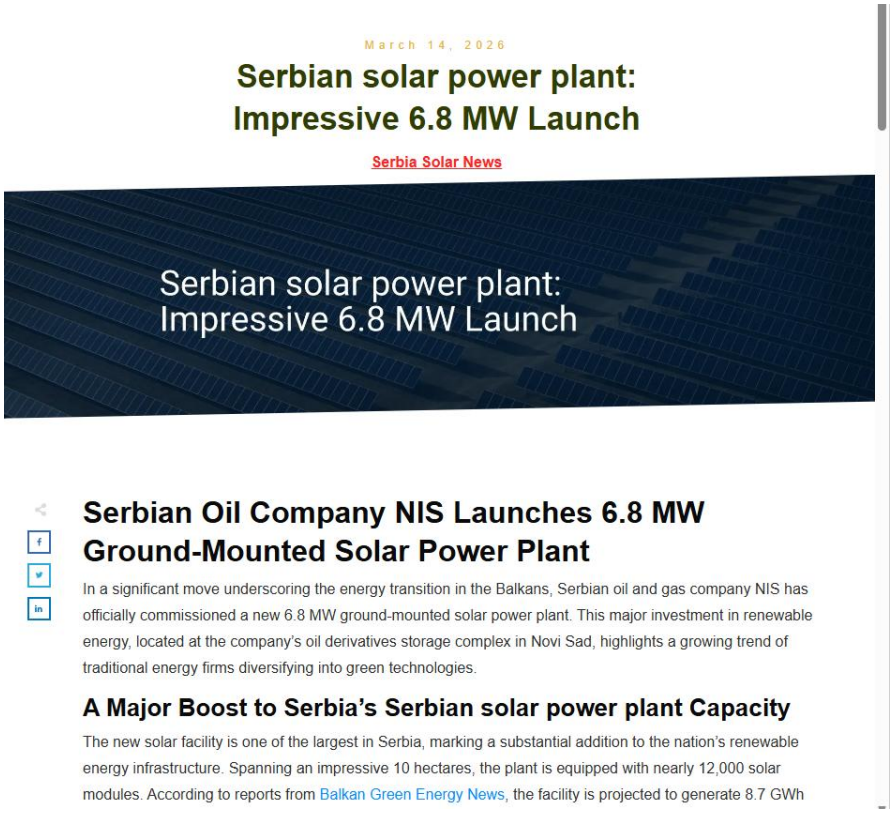

Figure 30: Source: https://www.pvknowhow.com/news/serbian-solar-power-plant-impressive-6-8-mw-launch/

Global - KEEP (Wisconsin, USA)

Type: Teacher training programme
Target Group: Teachers
Educational Value: Builds capacity for energy education
Replicability: Very high

The Wisconsin K-12 Energy Education Program (KEEP) is a professional development initiative aimed at equipping teachers with the tools and knowledge to educate students about energy literacy. It includes workshops, teaching models, and lesson resources that integrate energy topics into existing curricula. KEEP emphasizes real-world applications of energy efficiency, renewable sources, and sustainability. This model demonstrates how localized teacher training can scale national energy awareness.

Figure 31: Source: https://www.uwsp.edu/wcee/wcee/keep/

Global - NEED Project (USA)

Type: Educational programme
Target Group: All school levels
Educational Value: Comprehensive curriculum and resources
Replicability: Very high

The National Energy Education Development (NEED) Project is a nonprofit initiative that provides comprehensive educational materials and training for schools. It covers all education levels and offers resources on energy sources, conservation, and environmental impacts. The program's strength lies in its teacher training workshops, curriculum-aligned content, and data-driven evaluation strategies.

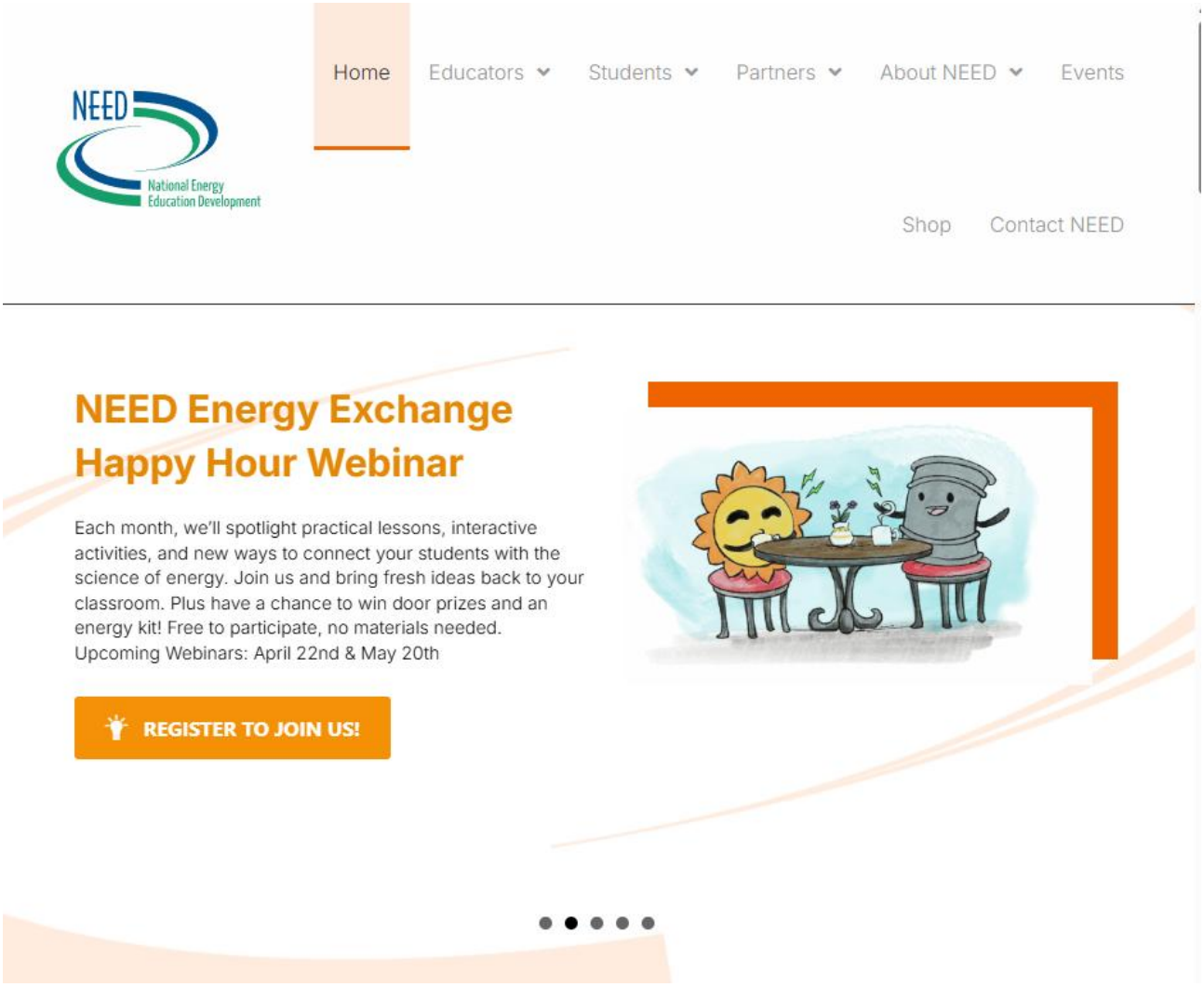

Figure 32: Source: https://www.need.org/

Global - ENERGE – Systemic Energy Efficiency in Schools (Western Europe)

Type: European project
Target Group: Schools
Educational Value: Combines monitoring, behaviour change, and learning
Replicability: High

The ENERGE project was implemented across 13 schools in six countries in Northwestern Europe. It focuses on systemic energy efficiency by combining real-time energy monitoring, behavioral change, technical improvements, and student engagement. Students and staff collaboratively work on reducing consumption through structured interventions and project-based learning.

Figure 33: Source: https://vb.nweurope.eu/projects/project-search/energe/

Global - Schools for Goal 7 (Global – SDSN + Siemens Energy)

Type: Educational framework
Target Group: Teachers and students
Educational Value: Aligns with SDGs and energy literacy
Replicability: Very high

The 'Schools for Goal 7' initiative, developed by the Global Schools Program and Siemens Energy, provides a teacher's guide focused on SDG 7 (Affordable and Clean Energy). It includes digital and offline resources, lesson plans, and activities promoting awareness of energy transition. The guide emphasizes real-world connections and encourages local adaptation.

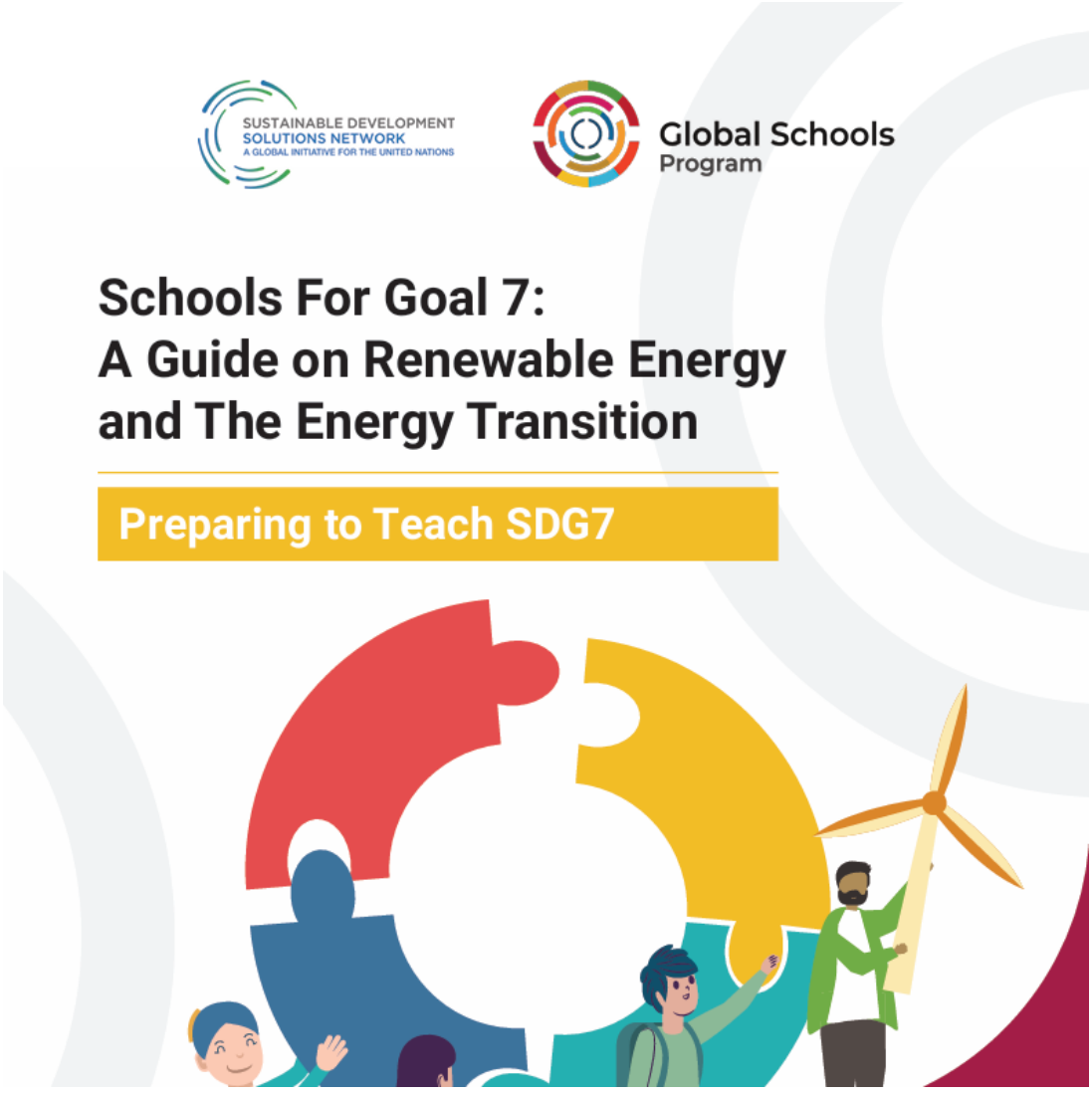

Figure 34: Source: https://files.unsdsn.org/Schools%20for%20SDG7-%20Part%20One%20Final.pdf

Global - GAIA: IoT Lab Kit + Gamification for Energy Awareness (Europe)

Type: IoT + gamification
Target Group: Students
Educational Value: Data-driven learning and engagement
Replicability: High

The GAIA project integrates IoT sensor kits and gamification tools in school environments to promote energy awareness. Students collect and analyze real-time energy data, participate in challenges, and monitor changes in school energy use. This initiative engages learners in data-driven decision-making and strengthens their understanding of smart energy systems.

Figure 35: Source: https://gaia-project.eu/index.php/en/homepage-3/

Global - GreenComp – European Sustainability Competence Framework

Type: EU framework
Target Group: All education levels
Educational Value: Defines sustainability competencies
Replicability: Very high

GreenComp is a reference framework launched by the European Commission in 2022, which defines the essential competences for sustainability, applicable at all levels of education. Structured in four areas – values, systems thinking, vision and action – it offers guidance for integrating sustainability into school curricula and extracurricular activities, including the topic of energy.

1. GreenComp in Practice: A case study that explores how GreenComp is being applied in different educational contexts, including secondary education, to develop sustainability competencies. https://www.danitacom.org/wp-content/uploads/2024/07/greencomp-in-practice-NC0524331ENN.pdf?utm_source
2. GreenComp: Educational Resources for Green Combs: Kit that includes guidelines for implementing open spaces, microlearning videos, workshops, and project-based learning experiences for students, covering the sustainability competencies addressed by GreenComp. https://www.greenhiveproject.eu/en/results

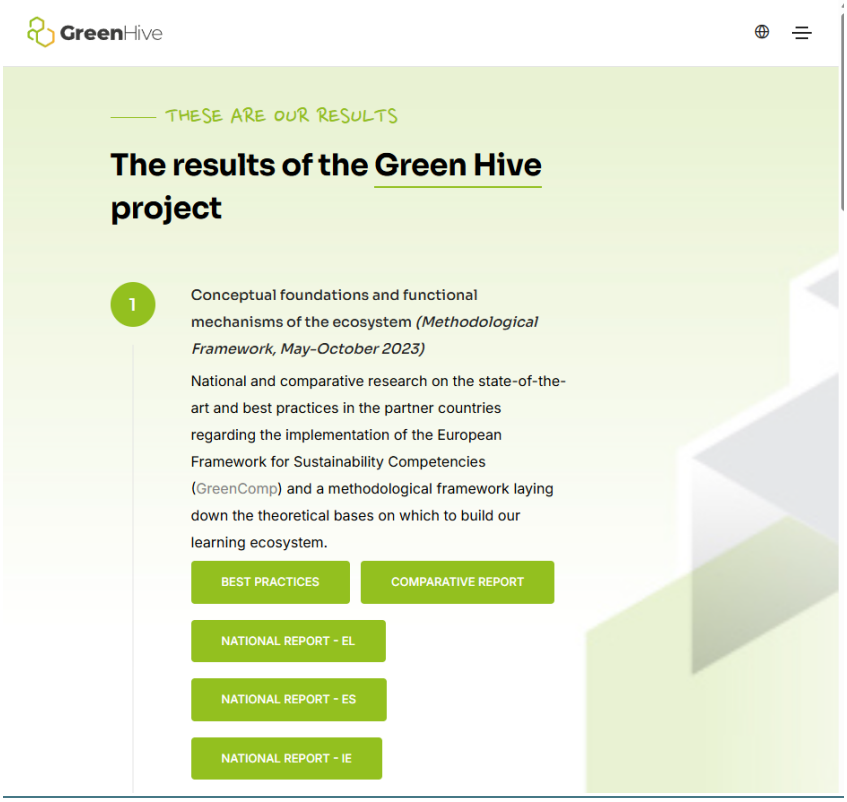

Figure 36: Source: https://www.greenhiveproject.eu/en/results

Global - T-Shore (Europe)

Type: Erasmus+ project
Target Group: VET students
Educational Value: Skills development in offshore energy
Replicability: High

T-Shore is a European project funded by Erasmus+ that involves 13 partners from five countries (Belgium, Denmark, Ireland, Norway and the Netherlands). It aims to address the shortage of technical skills in the offshore wind energy sector, through the creation of harmonised training modules, libraries of educational resources and networks of Vocational Centres of Excellence.

This type of projects, thanks to its review and analysis of the "state of the art" in various countries, is valuable for possible applications and adaptations for other VET that want to make use of the materials created and apply the modules in their renewable energy or energy and electricity courses.

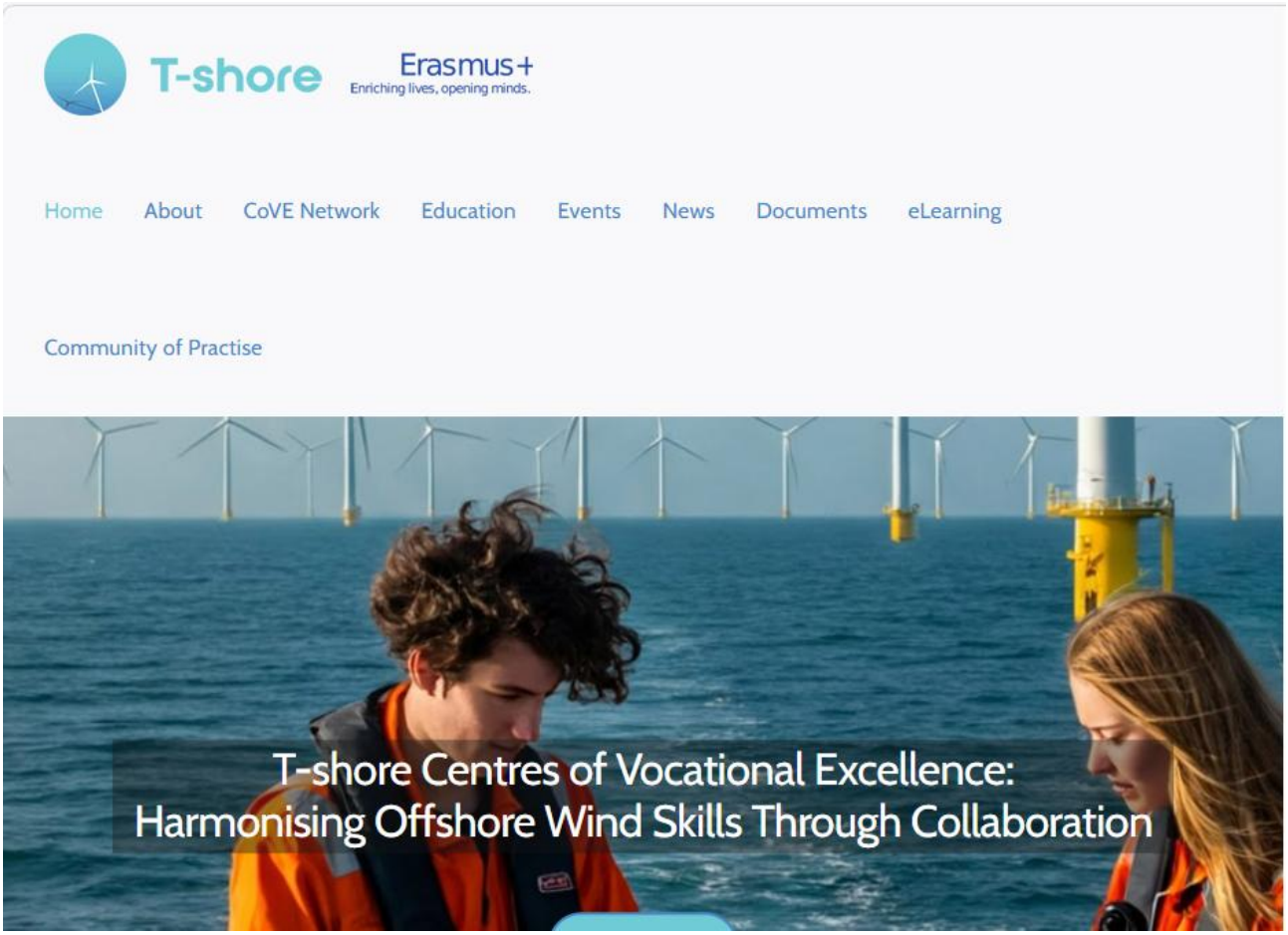

Figure 37: Source: https://t-shore.eu/?utm_source=chatgpt.com

Global - UNESCO – Education for Sustainable Development (ESD) and Energy Literacy

Type: Global framework
Target Group: Schools and communities
Educational Value: Holistic sustainability education
Replicability: Very hig

The UNESCO Education for Sustainable Development (ESD for 2030) programme integrates energy education as a key component of sustainability learning, aligned with the Sustainable Development Goal 7 (Affordable and Clean Energy). Within this framework, schools and communities are encouraged to address renewable energy, energy efficiency, and responsible consumption through project-based learning and cross-curricular approaches.

One of the initiatives is the UNESCO Green Academies, where schools are supported to become hubs of sustainable practice in four key areas: energy, water, waste, and biodiversity. In the energy dimension, students install and monitor renewable systems (such as solar panels) on campus, manage energy use, and explore links between energy, climate action and equity.

The relevance of these UNESCO initiatives for energy education lies in their global reach and interdisciplinary approach, empowering young people as active agents of change. They integrate energy literacy with civic responsibility, stimulate student-led projects with real-world impact, and align school practices with the European Green Deal and international sustainability goals.

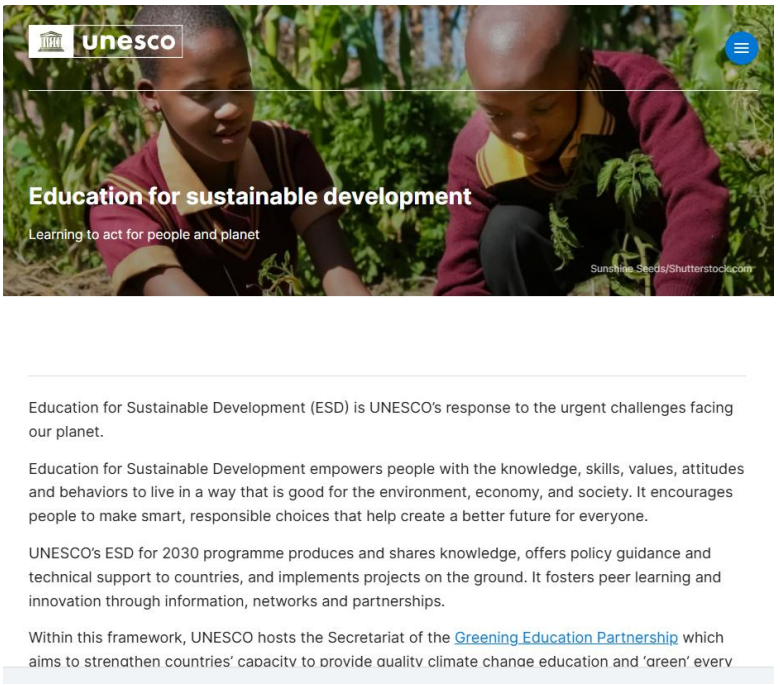

Figure 38: Source: https://www.unesco.org/en/sustainable-development/education

4 Comparative Analysis

The analysis of best practices collected across partner countries reveals both strong common trends and context-specific differences in the implementation of energy education. Across all countries, the most effective approaches are based on experiential and hands-on learning. Initiatives that involve real-life applications—such as solar panels installed in schools, energy monitoring systems, or demonstration buildings—consistently show higher levels of student engagement and a deeper understanding of energy-related concepts. Schools that function as "living laboratories", where students can observe, measure, and manage energy production and consumption, provide a significantly more impactful learning experience compared to purely theoretical approaches.

The integration of real-world infrastructure into the educational process is complemented by the increasing use of digital tools and data-driven learning. Practices that incorporate real-time monitoring systems, simulations, and interactive platforms enable students to develop analytical skills and better understand complex energy systems. In addition, successful initiatives are often interdisciplinary, combining elements of science, technology, environmental education, and social responsibility. This holistic approach supports not only the acquisition of technical knowledge but also the development of transversal competences such as critical thinking, collaboration, and problem-solving.

Another key factor observed across all countries is the importance of collaboration between schools and external stakeholders, including energy companies, municipalities, research institutions, and non-governmental organisations. These partnerships enhance the relevance of energy education by connecting it with real-world challenges and providing access to expertise, infrastructure, and practical applications.

Despite these common trends, the implementation of energy education varies depending on national context, climate conditions, policy frameworks, and available resources. In countries such as Slovenia and Latvia, there is a strong emphasis on integrating education with local projects and infrastructure, allowing students to directly engage with energy systems in their immediate environment. In Portugal and Italy, more structured programmes and institutional frameworks play a significant role, often supported by national initiatives and strong collaboration with industry. In Türkiye and Serbia, many practices are linked to large-scale national or regional initiatives focused on infrastructure development, particularly the installation of renewable energy systems in schools, which serve both educational and practical purposes.

The analysis also identifies several key success factors that contribute to the effectiveness of energy education initiatives. These include the integration of practical, real-world experiences into learning environments, access to energy infrastructure and monitoring tools, the use of innovative

and digital teaching methods, strong institutional collaboration, alignment with curriculum objectives, and active student participation through project-based learning.

At the same time, several challenges were identified, including limited access to infrastructure in some schools, differences in national curricula and policy support, financial constraints, varying levels of teacher training, and inconsistencies in data availability. These challenges highlight the need for continued support at both policy and institutional levels to ensure the broader implementation of effective practices.

Overall, the findings demonstrate that many of the identified practices are highly transferable, particularly those based on adaptable methodologies such as experiential learning, digital tools, and community engagement. However, successful replication requires careful adaptation to local conditions, including climate, available resources, institutional capacity, and educational frameworks. This reinforces the importance of flexible, context-sensitive approaches to energy education that can support long-term impact and sustainability.

5 Evaluation Framework

The evaluation framework was developed based on a qualitative review of the collected best practices and their implementation contexts. As part of this process, students were actively involved in exploring selected energy education initiatives, including reviewing online platforms, educational tools, and project websites, as well as visiting selected examples in real-life settings where possible.

In addition, guided discussions were conducted with students to gather their perspectives on the effectiveness, clarity, and engagement level of the analysed practices. These discussions provided valuable insights into how different approaches are perceived by learners and which elements contribute most to their understanding and motivation. This participatory approach ensured that the framework reflects learners' experiences and perspectives, thereby increasing its relevance and practical applicability.

The development of the framework was informed by students' feedback, particularly in relation to the following guiding questions:

Which activities or examples helped you understand energy concepts the most?

What made certain projects more interesting or engaging than others?

Did you feel actively involved in the learning process, and how?

Which tools or approaches (e.g., digital platforms, real-life installations) helped you learn best?

Can you imagine applying what you learned in real life?

Which activities would you like to see more often in school?

These insights, combined with the comparative analysis of best practices, formed the basis for defining the key dimensions and indicators included in the evaluation framework.

Dimension	**Description**	**Key Indicators (such as)**
Educational Value	Contribution to knowledge and understanding of energy and sustainability topics	Understanding of renewable energy concepts, ability to explain energy efficiency principles, interdisciplinary links such as combining science and environmental studies
Student Engagement	Level of active participation and involvement of students	Participation in energy-related activities, involvement in projects such as school energy monitoring or campaigns, collaboration and student-led initiatives
Practical Application	Use of hands-on learning and real-world examples	Use of solar panels in schools, energy monitoring systems, experiments, project-based learning activities such as building models or analysing real data
Curriculum Integration	Degree of integration into formal education	Inclusion of energy topics in lesson plans, cross-curricular activities such as linking physics and sustainability, integration into VET programmes
Sustainability Impact	Influence on attitudes and behaviour	Increased awareness of energy consumption, behavioural changes such as reducing energy use in school, participation in environmental actions or campaigns
Replicability & Scalability	Potential for transfer to other contexts	Implementation in other schools, adaptability to different age groups, use of low-cost solutions such as simple monitoring tools or educational kits

7 Assessment of Effectiveness of Energy Education Practices

Based on the proposed evaluation framework, a qualitative assessment of the selected practices was conducted. The assessment shows that practices involving real-world infrastructure, such as solar installations and energy monitoring systems in schools, perform strongest across key dimensions, particularly in terms of practical application, student engagement, and sustainability impact. These initiatives enable students to interact directly with energy systems and observe real-time data, which significantly enhances understanding and motivation.

Practices that incorporate digital tools and interactive platforms also demonstrate high effectiveness, especially in supporting data-driven learning and the development of analytical skills. However, their impact is greatest when combined with hands-on activities and real-life applications.

In contrast, practices that are primarily theoretical or based on passive learning approaches show lower levels of student engagement and limited impact on behavioural change. While they contribute to knowledge acquisition, they are less effective in developing practical skills and long-term awareness.

Furthermore, initiatives that involve collaboration with external stakeholders, such as energy companies, municipalities, and local communities, show strong performance in terms of curriculum relevance and real-world applicability. These partnerships enhance the overall learning experience and provide valuable context for understanding energy-related challenges.

Dimension	**Assessment Result**
Educational Value	High across most practices, especially those combining theory with real-world applications, such as the GEN-i Energy School and structured programmes like Energy School – EDP Foundation
Student Engagement	Highest in hands-on and participatory activities, such as energy monitoring projects and student-led initiatives; for example, school-based projects in Türkiye and Slovenia show strong active involvement
Practical Application	Very strong in practices involving real infrastructure, such as solar panels in schools in Serbia and Portugal, as well as real-time monitoring systems (e.g. EVeP16 in Türkiye)

Dimension	Assessment Result
Curriculum Integration	Varies between countries; strongest in structured national programmes and school–industry collaborations, such as initiatives in Italy and Portugal
Sustainability Impact	High in practices that promote behavioural change, such as energy-saving campaigns and community-based initiatives; for example, Eco-Schools programmes across countries
Replicability & Scalability	Generally high, especially for digital platforms and project-based approaches; more resource-dependent in infrastructure-based initiatives such as school solar installations in Serbia and Slovenia

The assessment shows that the most effective energy education practices are those that combine hands-on learning, real-world application, and active student participation. Approaches supported by real infrastructure, digital tools, and stakeholder collaboration demonstrate the highest impact on student engagement, understanding, and behavioural change across all partner countries.

8 Recommendations for Integration

Based on the analysis of best practices, the comparative analysis, the developed evaluation framework, and the assessment of effectiveness, a set of recommendations is proposed to support the integration of energy education into the European Green Deal framework and to inform policy development and educational strategies at both national and European levels.

A key recommendation is to strengthen the integration of energy education into formal curricula across secondary and vocational education systems. Energy-related topics should be embedded within interdisciplinary learning, combining science, technology, environmental education, and social responsibility. This approach supports the development of green competences, critical thinking, and systems thinking, which are essential for addressing complex sustainability challenges.

Furthermore, education systems should prioritise experiential and hands-on learning approaches. Schools should be encouraged to adopt “living laboratory” models, where students can actively engage with real energy systems, such as renewable energy installations, smart technologies, and energy monitoring tools. These approaches have been shown to significantly improve understanding, engagement, and long-term behavioural change.

At both national and European levels, it is recommended to increase investment in school-based energy infrastructure. The implementation of renewable energy solutions, such as solar panels and energy monitoring systems in schools, serves a dual purpose: contributing to climate and energy targets while simultaneously enhancing educational quality. Financial support mechanisms, including EU funding instruments, should be leveraged to support such initiatives.

In addition, stronger collaboration between education and external stakeholders should be promoted. Partnerships with industry, local authorities, research institutions, and civil society organisations provide access to expertise, real-world applications, and innovation ecosystems. These collaborations also help bridge the gap between education and the labour market, particularly in the context of green jobs and emerging energy sectors.

Digitalisation should also play a central role in energy education. The use of digital tools, real-time data platforms, simulations, and interactive learning environments enables students to better understand complex energy systems and supports the development of analytical and problem-solving skills. These tools should be systematically integrated into teaching practices and supported through teacher training and resource development.

At policy level, it is essential to ensure alignment between energy education initiatives and European strategic frameworks, including the European Green Deal and competence-based approaches such as GreenComp. This alignment supports coherence across education systems, facilitates the transferability of best practices, and contributes to the development of a common European approach to sustainability education.

Moreover, continuous evaluation and improvement of energy education initiatives should be encouraged. The evaluation framework developed within this report provides a practical tool for assessing effectiveness and guiding future programme development. Educational institutions and policymakers are encouraged to adopt and adapt this framework to monitor progress, identify areas for improvement, and ensure long-term impact.

Finally, it is recommended to further promote student participation and a participatory approach in the design and implementation of energy education initiatives. Engaging learners as active contributors not only increases motivation and ownership but also ensures that educational approaches are relevant, meaningful, and aligned with students' needs and perspectives.

These recommendations contribute to building a more energy-literate, sustainability-oriented education system that supports the transition towards a climate-neutral Europe and aligns with the long-term objectives of the European Green Deal.

9 Conclusion

The compilation and analysis of best practices in energy education demonstrate that effective approaches are those that combine practical experience, innovative teaching methods, and strong collaboration between educational institutions and external stakeholders. The examples collected across partner countries confirm that energy education is most impactful when it is connected to real-life applications and supported by access to infrastructure, digital tools, and interdisciplinary learning environments.

The findings highlight the importance of transforming schools into active learning spaces, where students can engage with energy systems, sustainability challenges, and technological solutions in a meaningful way. Such approaches not only improve knowledge and awareness but also contribute to the development of essential skills required for the green transition, including critical thinking, problem-solving, and responsible decision-making.

At the same time, the analysis underlines the need for continued support at policy and institutional levels to ensure wider adoption and long-term sustainability of effective practices. Investment in infrastructure, teacher training, and curriculum development remains crucial for strengthening energy education systems across Europe.

Overall, this report contributes to the objectives of the Erasmus+ programme by promoting the exchange of knowledge, supporting innovation in education, and fostering the development of green competences. The identified best practices provide valuable inspiration and guidance for schools, educators, and policymakers seeking to integrate energy education into formal and non-formal learning contexts, in alignment with the European Green Deal and broader sustainability goals.

The findings and recommendations developed within this work package will be further implemented and tested in subsequent project activities, particularly within Work Package 4. Based on the identified best practices and evaluation framework, educational resources in the form of learning situations are being developed to support the practical integration of energy education into teaching and learning processes.

This approach enables the monitoring of adoption and implementation of the proposed recommendations in real educational contexts, contributing to their validation, refinement, and long-term impact on energy education curricula and practices.