



Energy Efficiency in the Building Sector: a Sustainable Future

Final Report

Public Part

Project information

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Executive Summary

The use of energy efficient technologies and products in the construction industry can make a significant contribution to Europe's economy by creating employment opportunities in areas such as renewable energy, energy efficiency products and services, waste management, recovery and recycling. The construction sector is one of the largest in Europe and a major engine for development. This project will contribute to cost effective energy efficiency, reduction of greenhouse gas emissions and cost savings to Member States.

The ENEF project aims to equip European construction SMEs with specific competencies, tools and skills so that they are better prepared to optimise potential opportunities in this space. Therefore the consortium developed innovative learning material, methods and tools to help organisations of the building sector to reduce emissions; improve comfort; improve air quality; improve construction quality; increase building energy rating and to improve the resale value in European houses.

EnEf project designed training modules and contents enriched by an e-learning platform, visual elements, simulations and interesting practices to be delivered to entrepreneurs and managers of the building industry.

The training focuses on energy efficiency in buildings: learning materials are available in seven different languages for continuous professional development cover different aspects of energy savings in buildings presented in seven modules in the area of marketing, facades, insulation, glazing, installation, roofs, legislation, and others.

In the first phase, the project analysed the gaps of the current training systems concerning energy efficiency in building as well as the lessons to be learned from the more developed systems in partner countries. This analysis has been reported and published and the training contents has been prepared on the basis of the results of the needs analysis.

The network of partners has been formed in order to accomplish the project tasks in the most appropriate way, including experts on environmental issues and entities with experience in European training projects: the consortium, in particular, is made of consulting companies, training organisations, regional development agencies, a national chamber of constructors, a University and a research centre specialised in virtual representations. The geographical composition has also been taken into appropriate account: the project in fact gathers together different partners from different European regions, not only to analyse various entrepreneurial situations, but especially to promote, from the beginning the widest diffusion of results possible. The countries involved are: Italy, Ireland, Slovakia, Germany, Greece, Spain and Bulgaria.

The major results achieved is a comprehensive training plan available online on a distant learning platform and enriched with quizzes and a 3D tool that gives instant feedback about the efficiency of energy-saving measures in a building that the learner can modify interactively. Dissemination and exploitation activities carried out during the project lifespan gave high visibility to project results and assured the integration of the developed material in several contexts of vocational training and valorisation of SMEs. EnEf has been presented in public events, information have been spread via internet, mail and paper materials, a wide network of stakeholders has been reached. Moreover, the results are the object of a transfer of innovation project proposal.

The project website address is www.enef-project.eu. Training contents, information, contacts and news are available on EnEf website.

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1. Project Objectives

The EnEf project aims at improving energy efficiency in buildings alleviating the lack of knowledge of entrepreneurs and managers of the building industry. Specific objective has been to set up new methodologies and build up training modules concerning energy efficiency in buildings, in accordance with European standards. This has been achieved by creating in partner countries, generally in Europe, an accessible training approach enriched by an e-Learning platform, visual elements, simulations and interesting practices for the building industry.

The project final aim is to change the habits in the use of energy efficient tools and methods also through a new vision of the topic. There is, currently, in the building industry a too much fragmented vision of the various components of the system (buildings' features, machinery, photovoltaic panels, systems control, lighting, etc) while EnEf wants integrated them into a single framework that considers the entire process of building up and renovate an edifice. Fragmentation of standards, languages and specializations, leaves on the ground most of the potential for energy efficiency and renewable sources that could be exploited. The overall approach must be redefined and must pass the idea of an efficiency linked to the replacement of the component towards the idea of developing a total energy efficient architecture.

The target is the construction industry and in particular managers and entrepreneurs interested in improving their knowledge on the topic. They have been directly involved in project activities: on one hand they took part in the initial analysis of training needs; on the other, they tested the developed modules and gave their feedbacks for the training plan final improvement.

The target group has the possibility to use the innovative training plan to adapt their activities to new standards of construction and refurbishment with an eye to energy efficiency. Besides technical information and training on the different tools and methods applicable for energy efficiency, the target group is trained also about the relevant legislation and the strategies to market such products. Among the most important needs emerged during the needs analysis, there is the capacity to sell energy efficient products and to convince the customers that they are the best choice for their houses, dwellings, offices and so on.

The project also addresses the specific objectives and priorities of the Lifelong Learning Programme:

- To help promote creativity, competitiveness, employability and the growth of an entrepreneurial spirit;
- To support the development of innovative ICT-based content, services, pedagogies and practice for lifelong learning;
- To support participants in training and further training activities in the acquisition and use of knowledge, skills and qualifications to facilitate personal development, employability and participation in the European labour market;
- To improve the quality and to increase the volume of co-operation between institutions or organisations providing learning opportunities, enterprises, social partners and other relevant bodies throughout Europe;
- To developing Vocational Skills considering the labour market needs, in line with the European Commission Communication "New Skills for New Jobs".

2. Project Approach

One of the first steps carried out by project consortium has been the development of the methodology of analysis, a framework of theoretical and practical hints on how to conduct the local analysis of the target group training needs concerning energy efficiency.

The goal of the methodological framework has been to create an infrastructure where the project team could identify barriers and challenges, analyse gaps in current training systems targeted at SMEs, understand and absorb lessons from state of the art systems.

The methodological framework also included the analysis tools (questionnaires) and the template for regional reports.

On the basis of the developed methodology, each partner launched a survey in its region, then analysed the results and produced a regional report, which also made an economic picture of the regions concerned, of the building sector characteristics and challenges and presented the preliminary findings emerged from the answers provided by interviewed.

Different methods were used to reach the companies, trying to involve a great number of representatives of the building sector in the seven European countries of the partners. In particular, managers and employees were contacted by email, telephone and in some cases they were visited in person.

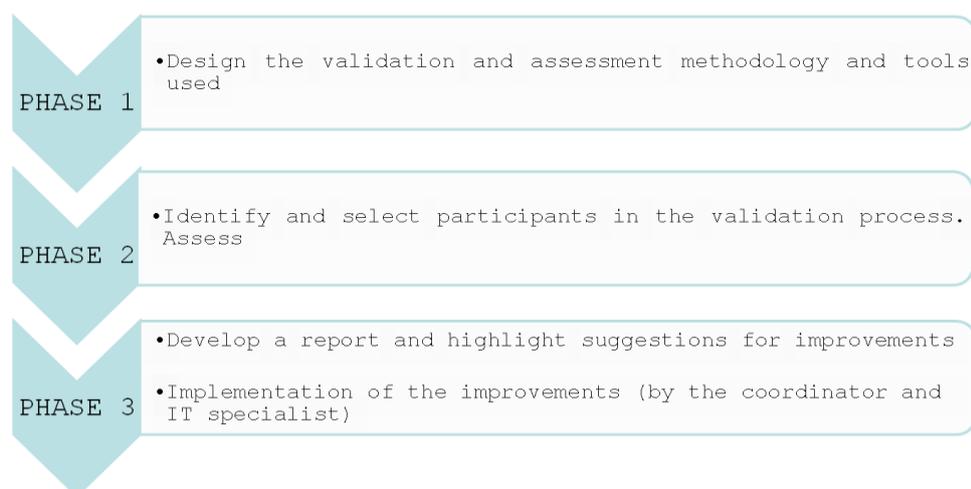
The total number of questionnaires surveyed by the seven partners is 185.

Last stage of the needs analysis has been the production of a Report on analysis of results, aiming to gather the results of the transnational survey, summarise the contents of Regional reports produced by each project partner and provide recommendations for the training modules development.

The final Data collection methods were quantitative and qualitative in nature and they included activities such as regional reports of each partner's region, interviews and questionnaires. A combination of these data collection methods was used to elicit information for the final analysis. By adopting this approach, the strengths of one data collection method compensate for the weaknesses of the other. In addition, the subjects were examined from different angles and a more complete picture of the situation was provided.

On the basis of the results of the survey, the consortium developed a training plan respondent to the target group needs for what concerns energy efficiency. A report on training Plan illustrated the path to be followed and the contents to be covered.

On May 2012 the Pilot test has been launched: following the instructions provided in a Report on the Definition of the methodology for the Pilot Test. The steps were as follows:



The pilot testing has been organised by each of the participating partners (in Italy, Spain, Germany, Bulgaria, Greece and Ireland). Each partner was responsible to organise one pilot testing. The partners could choose different approach depending on their relations with the target group and their specific needs and constraints.

The sector of the target group was:

- **Construction**
- **Renovation or refurbishment of existing buildings**

The size of the enterprises to be reached was **small construction enterprises employing no more than 30 employees.**

The participants were mainly:

- Developers and engineers
- Focus on senior manager; key decision makers - those that have influence on strategic decisions

Each partner was free to choose one or more methods to publicise the pilot testing and select the participants. The goal was to involve 105 participants in all countries (15 participants each partner organization).

The final deliverable that derived from all the pilot activities is a Report of Training Evaluation. It illustrates the results of the Pilot Test in order to highlight all the detected incidences and the proposed improvements.

Criteria for assessment

The criteria used for the evaluation grouped by each evaluation object are listed below:

- Understand motivation for learning
- Does the content produce the desired effect?
 - Level of awareness
 - More knowledge and skills (guidelines, methodologies, tools and checklists)
- Is the content delivered well?
 - Overall impression of the training material
 - Relevance of the content
 - Clarity of technical issues
 - Level of innovation
- Learning system
 - Ease of access
 - User friendliness
 - Functionality

- Simulation tool
 - User friendliness
 - Functionality
 - Innovation | engagement

The evaluation tool used is a questionnaire, specifically designed for EnEf project by INNOVATE. All the people involved in the training filled in the questionnaire and the results has been elaborated by each partner at national level, then sent to INNOVATE for the overall evaluation and the production of the Report on Training Evaluation.

The consortium collected 135 questionnaires in total in the seven countries involved. Based on the results of Pilot test, the training system has been adapted for the final release.

The dissemination strategy is devised in order to:

- Raise awareness of the project and the issues relevant to EnEf activities in appropriate industrial and research circles.
- Foster acquaintance among European building SMEs of the emerging EnEf solutions so to favour access of the target public to project results and prepare the way for further exploitation
- Cluster with other similar projects in order to learn from them and to make EnEf know to them in turn.

The activities scheduled in the **Dissemination Plan** and realized by the partners include:

- Internet presence: project website, partners' and other relevant websites
- Elaboration of paper-based and web-based information and promotion materials: press articles, leaflets, newsletters, technical manuals
- Organisation of public events in each country involved (at least two per partner) and a closing conference in Bulgaria
- Presence in fairs, contribution to seminars and conferences relevant to the use of web project
- Networking and cooperation with organisations, associations and training networks of the building sector

Two dissemination levels are envisaged:

1. The overall strategy of the consortium, which includes actions and tools described in the present documents. At this level the consortium acts as a whole.
2. The national/regional/local level affected by the individual strategies developed by each partner, according to its specific type of organisation, businesses, activities, resources, etc.

The exploitation of results will take place in order to transfer what has been learnt into new practices . This task entailed above all an identification of target groups which are likely to find the products/outcomes of the project interesting and relevant to their needs, starting from the stakeholders who have been involved during the development of the project.

The **exploitation strategy** is based on few single principles:

- The results of EnEf projects need to achieve **maximum impact**: they should radiate as widely as possible so that the valuable lessons and experience gained by the consortium and the representatives of construction SMEs directly involved can benefit others.

- Moreover, what is learnt from EnEf should **inform future policy**. All this can happen only if connections are made between the organisers of the project and the wider community.
- The aim is to create a **virtuous cycle of influence** making results more sustainable, maximising their impact, optimising investment, improving systems, pooling knowledge to avoid overlap of effort, and then feeding back into policy-making.

The potential target of EnEf exploitation activities are all those groups and companies that can find interesting and useful the training, as for instance: schools, vocational training companies, public administrations, associations of construction industries, Chamber of Commerce, etc.

The steps to be followed by the partners towards the successful exploitation of EnEf products and ideas into the environmental sustainability domain are:

- Make EnEf Training system publicly available, as well as display during (commercial) events;
- Implement successful pilots and prove the concept, which will then be presented to potential buyers;
- Involve several sector-specific associations
- Subsequently enhance the resulted software in order to become more attractive;
- Make EnEf platform production-ready;
- Create strategic alliances with other key-vendors and service providers (training institutes and organisations, environmental consultancies, eLearning implementers, chambers of industry and commerce, environmental associations, etc.).

The partners also developed individual exploitation plans, concerning the actions they plan to take at local level and related to the specific expertise, network

3. Project Outcomes & Results

The final result of the project is a comprehensive training plan for energy efficiency in buildings, customised to the training needs of managers and owners of the building industry, available online as distant learning and enriched with a simulation tool.

The training resources are accessible via project website www.enef-project.eu.

The Training Plan contains the following modules:

1. CONCEPTS OF ENERGY EFFICIENCY
2. NATIONAL LEGISLATION OF
3. EU LEGAL FRAMEWORK ON ENERGY EFFICIENCY OF BUILDINGS
4. MARKETING TRAINING MODULE EnEf
5. MODULE: HEAT INSULATION OF EXTERNAL WALLS /FACADES/ OF BUILDINGS
6. GLAZING TRAINING MODULE EnEf
7. INSTALLATIONS TRAINING MODULE EnEf
8. IMPROVING THE ENERGY EFFICIENCY OF FLAT ROOFS

Each module is linked to an assessment exercise to test the acquired knowledge.

Besides the contents, an innovative 3D simulation tool has been developed, that gives instant feedback about the efficiency of energy-saving measures in a building that the learner can modify interactively. The simulation tool is accessible from project website by this link: <http://www.enef-project.eu/index.php/en/the-3d-simulation-tool>

The general **goals of the EnEf training** are:

- To improve the level of awareness about energy efficiency in small construction firms in Europe
- To optimise knowledge, competencies and skills relating to energy efficiency in building in construction SMES in Europe
- To develop guidelines, methodologies, tools and checklists to help small construction firms become more green
- To encourage people and companies to think differently and laterally
- To reduce emissions; improve comfort; improve air quality; improve construction quality; increase building energy rating and improve resale value in European houses

We learnt that the majority of the 135 people who completed our survey worked in small companies employing less than 10 people. The majority of respondents either developed new buildings or made small changes to existing buildings and most of the respondents were either owner managers of the organisation or engineers. The respondents were very experienced; the majority of them either worked in the company for between 5 and 10 years or more than 10 years. On analysis of the completed questionnaires we learnt that the key reasons for taking part in the training programme was to improve knowledge; participants were also interested in the topic and they wanted to improve their skills and competencies.

Analysis of the survey revealed that the vast majority of respondents thought that the

training material was very interesting. We learnt that that the modules that were the most relevant are (a) Marketing: Offer and bill of quantities; (b) Glazing and (c) Façade systems.

The findings of our study revealed that the vast majority of participants found that the technical issues relating to energy efficiency in buildings are clearly explained and that the training programme delivers new and innovative material. The pilot test results provided some suggestions for improving the quality of the learning materials: some respondent suggested to have less text and more step by step methods to help practical implementation: others to increase the level of interaction during the modules and improve the user interface, making supporting materials more easily accessible (videos, ppt presentations, etc).

Our findings reveal that the vast majority of respondents found the simulation tool to be very good or good in terms of user friendliness. The majority of respondents stated that they would use the tool to demonstrate potential energy efficiency solutions to clients and that they would use the tool to train staff in energy efficiency. However we also learnt that the simulation tool did not work with all browsers and so some people could not access the tool.

Our analysis found that the vast majority of respondents thought that the learning system was either very good or good. We also discovered that the respondents were pleased with the functionality of the web site. The majority of respondents stated that they thought that the functionality of the web site was either very good or good. Respondents were then given the opportunity to provide suggestions for improving the learning environment. Most of the open ended comments focused on either navigation or appearance.

All in all the vast majority of respondents were very happy with the overall training programme. They thought that it was either very good or good. The ENEF team received many compliments on the training programme; the majority of respondents would recommend the programme to others. We received very few negative comments.

On the basis of the results listed above, the consortium improved the training system especially for what concerns the accessibility and the user-friendliness of the distant learning resources.

In general, the quality of the results has been quite high and respondent to the promoters' and target groups' expectations.

4. Partnerships

The project is implemented by various European entities with a long experience in European projects, offering a multidisciplinary and multicultural character that provides significant added value to the project.

Those partners have different profiles, including experts on environmental issues and others with experience in European training projects.

The geographical composition has also been taken into appropriate account: the project in fact gathers together different partners from different European regions, not only to analyse various entrepreneurial situations, but especially to promote, from the beginning, the widest diffusion of results possible.

The partners involved are:

1. Eurocrea Merchant srl, Applicant Coordinator. It is a consulting company operating for over 20 years in Italy, with a loyal base of customer and a rooted presence both in Milan and Naples. Eurocrea has a long experience in the sectors of project management and coordination, consulting, advising and European Projects.
2. Innovate an Irish Business and Information Technology department of Niugalway University with a long experience in developing training programmes and contents;
3. Dirección General de Arquitectura y Vivienda, Consejería de Fomento, Vivienda, Ordenación del Territorio y Turismo, within the Regional Government of Extremadura (Spain). This Regional Ministry has the competences in the area of transport, infrastructure, housing, urban planning and management in the Territory;
4. SRDA, a Slovak regional development agency, focused on boosting the economic development in the region by networking public and private sectors together with NGO, through coordinative support to the development and investment activities;
5. ILI - Institut für Lern-Innovation a German Nurnberg University department involved in applied research, development, consultancy, and evaluation in the field of new technologies in education, training and e-learning;
6. IDEC, a Greek consultancy company specialist in management training. Clients of IDEC are both SMEs and the larger Greek companies, Entrepreneurs' Associations, Universities and Chambers of Commerce/Industry, non for profit Organisations;
7. VICOMTECH, an applied research centre for Interactive Computer Graphics and Multimedia;
8. BULGARIAN CONSTRUCTION CHAMBER, the biggest employers' organization of 1800 companies, mainly SMEs, covering all areas of the Bulgarian Construction sector. The member companies employ personnel close to 100.000, and represent about 65 % of the total national construction output;

The project relied on the combination of different expertises and synergies, and the quality of the results is directly proportional to the level of interaction among those different competences.

All these entities already worked and still do on various projects and programmes also national and/or regional coming from different countries.

The added value of working in a multi-actor and transnational consortium is the possibility to exchange visions and experiences in all the phases of the project.

In particular, the pilot test conducted in the 7 countries revealed that there are important differences in the awareness and practice of energy efficiency in buildings, depending on the country but also that a shared approach at European level is needed. Moreover, the results revealed that there is a common need to improve knowledge and tools available. The possibility to take into account the relative and specific lacks of knowledge emerged in the different countries brought an added value to the final training plan.

Furthermore, for the concrete people involved in the project, i.e. the partners' staff, the opportunity to confront and exchange their points of view in project meetings or also in the frequent communication, assured an high level of collaboration.

5. Plans for the Future

The coordinator, in collaboration with the partners, provided a detailed Exploitation Plan, aiming to define the activities that will kick off the results of the project and lead to their continuation.

The **exploitation strategy** is based on few single principles:

- The results of EnEf projects need to achieve **maximum impact**: they should radiate as widely as possible so that the valuable lessons and experience gained by the consortium and the representatives of construction SMEs directly involved can benefit others.
- Moreover, what is learnt from EnEf should **inform future policy**. All this can happen only if connections are made between the organisers of the project and the wider community.
- The aim is to create a **virtuous cycle of influence** making results more sustainable, maximising their impact, optimising investment, improving systems, pooling knowledge to avoid overlap of effort, and then feeding back into policy-making.

Target groups of dissemination and exploitation activities

The potential target of EnEf exploitation activities are all those groups and companies that can find interesting and useful the training, as for instance: schools, vocational training companies, public administrations, associations of construction industries, Chamber of Commerce, etc

Mechanisms for exploitation of results

In the current section we will describe the potentially exploitable project results. The training System, made of distant learning contents and simulation tool is the main result to be exploited, through the following mechanisms.

Transfer.

Transfer enhances good practice by spreading results. The transfer can take place at all levels and the results can be used into new contexts or other organisations can customise the results to suit their conditions. In the specific case of EnEf project, it is possible to transfer the results as follows:

- A Leonardo da Vinci Transfer of Innovation project could transfer the results in other countries and sectors all over in Europe; EnEf results have been already selected for a Transfer of Innovation projects in France and Spain: projects

proposals are currently under development and will be submitted under 2013 LLP Call for Proposals.

- The training system could be used to train different types of groups and in different contexts, as for example, the training developed for managers and owners of the building industry can be used by consumers associations in order to train their staff or to inform the general public.

Commercialisation

Commercialisation is especially appropriate to tangible products and is suitable for the end users. The consortium will need an **entrepreneurial streak** to persuade manufacturers, publishers or other commercial concerns to take up the product. But it is necessary to beware, because there can be complications for results that involve complex intellectual property rights or where a lack of clarity in product ownership exists.

Sustainability

Just because a project is completed does not mean its results disappear. It is important to keep it visible and available, especially through websites, so that target audiences can access them, learn from them, adapt them to their own needs and even build on them and take them to the next level. And of course both transfer and commercialisation aid sustainability.

Besides, the e-learning system will remain online for three years.

ILLI will be responsible to maintain the training available online.

Another strategy can be to influence high-level change in policy and systems if project managers learn how to co-operate effectively and at the right levels. This is essentially a process of networking with all relevant stakeholders, so building contacts and attending meetings is vital – which is hard work but the only way.

The European Commission, National Agencies, National Committees and Programme Committees organise events to facilitate such co-operation.

Attending events, such as conferences, seminars and debates, provides an ideal opportunity to showcase the results and also leads to fruitful contacts to enhance networking.

Steps

The steps to be followed by the partners towards the successful exploitation of EnEf products and ideas into the environmental sustainability domain are:

- Make EnEf Training system publicly available, as well as display during (commercial) events;
- Implement successful pilots and prove the concept, which will then be presented to potential buyers;
- Involve several sector-specific associations
- Subsequently enhance the resulted software in order to become more attractive;
- Make EnEf platform production-ready;
- Create strategic alliances with other key-vendors and service providers (training institutes and organisations, environmental consultancies, eLearning implementers, chambers of industry and commerce, environmental associations, etc.).

The approach to be followed is to present the conceptual features and capabilities of EnEf, providing online demo environments for interested parties to experiment, providing full demos with technical/functional discussions, emphasising on learning aspects and requirements, and focusing on the open source and open content approach (vs. conditions of ownership and production readiness cost).

The IPR Agreement signed by the partners states that:

The intellectual property rights cover

- All products produced under the project: written materials, including teaching materials
- Multimedia products (Internet based): the project website and training materials will be accessible via www.enef-project.eu for three years after the project end, 3D simulation tool included.
- Teaching methods and approaches developed and tested during the project

As being developed in a joint partnership, the copyright over the training system is borne by the partner's organisations as legal bodies.

- Each of the partners has the rights of using the training system, reproduction rights and adaptation rights in its own country, without having to pay any fee to the other partners.
- The partners are free to act in terms of the subjects mentioned above (meaning that no further partnership agreement is required) with regard to the own country as well as to countries apart from those in the partnership.
- If partners sell the rights or publish or distribute or the like they are asked to respect the author rights and mention the EnEf partnership members as producer of the product.

The copyright is regulated under the law of the country of the promoter (Italy). All the contradictions should be addressed to the Italian court according to its regulations.

6. Contribution to EU policies

Sustainable environment is the major problem globally, nowadays. Energy savings and energy efficient buildings are considered a key way for reduction of green house gas emissions, taking into consideration that in fact buildings are responsible for over 40% of Europe's greenhouse gas emissions. The EU Directive 2010/31/EC defines concrete goals for energy savings and for the use of renewable energies in buildings. On the other hand, the construction sector in Europe is a very big sector, with a huge impact on development. It consists of about 34 sub-sectors and, according to EUROSTAT, it employs 14.8 million persons (11.5% of the non-financial business economy workforce), while generating an estimated EUR 562 billion of value added (9.3% of the non financial business economy's total value added). Most construction enterprises serve a local market and consequently the sector is characterised by a high number of small companies (employing less than 50 persons), which according to EUROSTAT employ 72.1% of the sector workforce, many of them migrants, and provide 64.7% of the sectoral value added (compared with an average 50.2% and 39.2% respectively for the whole non-financial business economy).

The project is also in line with the Europe's 2020 strategy for growth, which, among others, has set a specific priority to be reached by 2020: 20% gas emission reduction, 20% of energy from renewable, 20% increase in energy efficiency

Finally, the project contributes to the Lisbon Strategy, which aims to make Europe "the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion' . The project aims to address this priority by improving the sustainability of the European economy and contribute to the growth of a sector, that of renewable energies, which is expected to expand in the future.

7. Extra Heading/Section

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