



LIFE Project Number
< **LIFE14 ENV/IT/001050** >

Final Report
Covering the project activities from 01/09/2015¹ to 31/08/2018

Reporting Date²
< **30/11/2018** >

LIFE PROJECT NAME or Acronym
< **LIFE ECO-PULPLAST** >

Data Project

Project location:	Lucca
Project start date:	<01/09/2015>
Project end date:	<28/02/2018> Extension date: 31/08/2018
Total budget:	€ 1,244,978
EU contribution:	€ 746,986
(%) of eligible costs:	60%

Data Beneficiary

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¹ Project start date

² Include the reporting date as foreseen in part C2 of Annex II of the Grant Agreement

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2. Executive Summary

In the past few years, the problem of pulper waste management has become more severe: paper mills are facing reduced alternatives and rising costs for waste disposal. At the same time, LIFE Eco-Pulplast was increasingly acknowledged as the most promising long-term solution to the problem and expectations on the project are rising.

In this context, Eco-Pulplast has successfully reached the project goal: the demonstration of an innovative technology to recycle mixed plastics from pulper waste into new plastic pallets.

Since the beginning of the project, extra focus and efforts was put on industrial scalability and replicability of the project. For this reason, the technology update and validation was conducted with more details than foreseen and included the following additional work and subsequent technical, economic and environmental assessments:

- experimental activities and tests at suppliers' plants and laboratories, using pulper waste coming from different paper mills located in Lucca.
- based on results achieved, two main industrial tests on two promising pre-treatment technologies were conducted in Lucca at paper mills involved in the project, namey ICP and DS Smith.

The technology update conducted in Action A1 highlighted new mechanical technologies to separate the main materials composing pulper waste, allowing to partially reuse cellulose and water components directly into the paper mill process. Such reinforced pre-treatment phase reinforce the project objectives, as it reduces the total amount of pulper waste and reduce the amount of other plastics required in the compounds.

Based on these considerations, the first process phase of pre-treatment at the demonstration site was partially modified as compared to the preliminary design (no removal of metal impurities e reduced drying section). The central phase of treatment and the far more relevant injection moulding unit were built according to plan, with even better specifications than indicated in the approved project.

The delay of 7 months occurred in the implementation of the prototype line, was compensated by anticipating other project activities and by an extension of 6 months of project duration.

Since June 2017, an intense demonstration activity was conducted on the prototype line designed and installed at Selene premises. Demonstration activities mostly focused on:

- development of new compounds based on pulper waste mixed plastics with specific additives in order to confer the required physical/mechanical characteristics to the final pallets;
- optimisation of injection moulding process parameters;
- characterisation of plastic pallets obtained from pilot injection moulding line, also at certified laboratory to verify their compliance to technical regulations and standards;
- field handling tests of plastic pallets in actual working conditions, in collaboration with Versalis Spa and PRS (pallet return system).

Positive results were achieved in terms of prototype line operations. The line works well at low temperature and pressures and with short cooling time. After optimising process parameters, it was possible to mould pallet of good overall quality and with the desired productivity.

Pallets show good surface smoothness, handling and grip, as well as excellent compression strength and good static and dynamic bending strength. Pallets are ready to be used in controlled logistics circuits with load weights limited to some 800 kg.

There is still some room for improvement concerning bump and drop tests (stronger connection between top deck and blocks), creep after long term storage and weight. A project for a new pallet design is ongoing with academic experts.

In collaboration with Bocconi University of Milan and Scuola Superiore Sant'Anna of Pisa a Lyfe Cycle Assessment was conducted to evaluate the environmental impacts of pallets produced from pulper waste in comparison to wooden pallets. The results, that not include data from use in real working conditions, show significant environmental benefits of Ecopulplast pallets for almost all environmental parameters.

The achievements confirm the two main initial objectives of the project, namely:

- to drastically reduce the amount of pulper waste sent to incinerators and landfill;
- to reuse pulper waste in the production of plastic pallets at industrial scale.

To the latter, a complete business plan was made by Selene with a 3 years investments plan, for a total production capacity of 1.200.000 pallets/year.

More effort than planned is also being put on activities related to the study of pallet market for the market uptake. Moreover, the involvement of pallet poolers and pallet users will help evaluating the pallets technical quality, assessing project impacts and reaching the market more quickly (see Actions B4, C4 and D4 for more details).

In this respect, starting from the current situation analysis, a business model was developed, which addresses the commercial strategy, in terms of most promising customer targets and products, i.e. closed logistic circuits with specific applications and well defined pallets requirements, and highlights the importance of a strong brand identity and product customisation to emphasise products benefits, as well as policy actions to build an auspicious regulatory framework.

Concerning policies, the most relevant result was to establish a working group at the Ministry of Environment, with Selene and Lucense representatives, to elaborate a Ministerial Decree on end-of-waste for light plastics from pulper waste. The draft test is currently under technical evaluation.

Apart from the demonstration activities, the project is having a high visibility and a large involvement of stakeholders, both public and private, with relevant impacts on policy implementation, industrial scale-up and replicability. The project was awarded as LIFE project of the month of June 2017 by the Italian Ministry of Environment, and a dedicated page published on their web site.

Communication and networking activities and results were above expectations. All foreseen dissemination material was made, such as website, Facebook page, notice boards, newsletters, brochure, videos, etc., which helped to enhance disseminating the project results, with a focus on prototype line and plastics recycling into pallets.

The project had a very high visibility, with interviews on national radios and TVs as well as more local ones. Project partners were invited to several national and international events and participated to technical conferences, with publications on technical magazines. Project workshops and final conference were excellent opportunities for networking and all saw a large attendance.

Finally, all partners positively collaborated to project activities, contributing to its success according to their role and competences. For more information on project management and monitoring please refer to Section 5.

3. Introduction

Description of background, problems and objectives

Paper is the most recycled product in Europe, and Europe is the global champion in paper recycling with a rate of 74%. The paper industry has been a driving force in achieving that rate: today 54% of the paper industry's raw material comes from recovered paper and board, mostly for the production of paper for industrial use.

The use of recovered paper increases the paper making environmental and economic sustainability, as it limits the use of virgin raw materials and at the same time reduces the amount of material destined for disposal. Though the transformation chain of the recovered paper is highly optimised, recovered paper contains a share of materials that cannot be reused and are discarded. This scrap amounts to some 6-7% in weight of the recovered paper and constitute the pulper waste, which is mostly composed of mixed plastics.

The Lucca Paper District makes large use of recovered paper for the production of paper for industrial use, speciality paper and, to a lesser extent, tissue paper, and produces alone 125,000 ton/year of pulper waste (with an average water content of 40%). Since a long time the paper mills have been sending their pulper waste, which is classified as non-hazardous waste, to landfills and to incinerators, with significant and no more sustainable environmental and economic impacts.

Up to date, all pulper waste is disposed of in landfills or in incinerators, but in the past years, the problem of pulper waste management has become more severe: paper mills are facing reduced alternatives and rising costs for waste disposal and LIFE ECO-Pulplast represent the only long-term solution. The long-distance transport of pulper waste to disposal facilities is a significant part of the environmental problem.

The overall objective of the LIFE ECO-PULPLAST project is to drastically reduce the amount of paper mills' pulper waste sent to landfill and incinerators. In order to reach this goal, the technical and economic feasibility of an innovative technology to recycle pulper waste into new plastic compounds and pallets is demonstrated through the realization and testing of a demonstration production line at industrial scale, especially designed for the characteristics and peculiarities of pulper waste.

The main idea behind this project is to realize plastic euro-pallets to be reused by the same paper district that generates the material waste in the first place, creating industrial symbiosis between the paper and the plastic sectors.

Thanks to the local products manufacturing and reuse, the project also aims at reducing the environmental impact due to the current transportation of pulper waste to incinerators and landfills and the related disposal's impacts.

By replacing common wooden euro-pallets, that require a high consumption of raw natural materials, with reusable plastic pallets from recovered waste materials, the project addresses the European strategy towards an efficient use of resources.

The technical solution implemented in the prototype line is made of three main process steps: pre-treatment, mixing and injection moulding, as described in detail in D03.

More specifically, the objectives of the project are achieved through a number of activities:

- testing and evaluation of the different process phases of the production line and required upgrades and improvements;
- technical support during pilot operation, including quantitative analysis and testing on physical/mechanical and chemical properties of input materials, compounds developed and pallets manufactured in the demonstration line;

- development of a complete business plan to assess the economic viability of the application at full industrial scale and the market opportunities of the new industrial products;
- evaluation and periodic update of the LIFE ECO-PULPLAST environmental, economic and social impacts;
- development of a business model to assess the replicability of the technology on the Italian territory and its transferability to similar contexts in other European countries;
- dissemination and promotion of the project approach and outcomes at national and European level thanks to the partners network contacts.

A final objective of the LIFE ECO-PULPLAST project concerns the working method. The project, in fact, is promoted in synergy by different entities: industrial and technological partners working side by side with environmental organizations, all aiming at a common goal.

The main expected results of LIFE ECO-PULPLAST are the following:

- high percentage of pulper waste that can be used in the new compounds (around 70-80%, higher than the objective indicated in the approved proposal);
- productivity of at least 80% of the initial target value of 600 kg/h;
- low processing and manufacturing energy requirements, below the needs of conventional technologies;
- production efficiency above 90% (processing waste below 10%).
- production of plastic euro-pallets with the required physical/mechanical properties (in compliance to technical regulations);
- dissemination of the project approach and outcomes to at least 5 Italian paper mills (outside Lucca Paper District) and to overall 15 mills at European level;
- involvement of 10 main stakeholders, among those identified in Section B4, at regional, national and European level;
- interest demonstrated by at least 3 relevant plastic companies of Tuscany Region in the use of the new plastic compounds.

Expected longer term results

The prototype line will be used after the project end date to develop new, further optimized, compounds and plastic products, other than pallets, for a future market outlet.

Based on the current business plan, Selene has elaborated a market strategy to realize on the Lucca territory a plant a full industrial scale with a production capacity, in a 3 to 5 years scenario, 1.2 million pallets per year, correspondent to about 60-70.000 t/y of pulper waste.

The involvement of local and regional stakeholders (local authorities, Regione Toscana, Industrialists' association, environmental associations, etc.) will help to create all required social and regulatory conditions to realize on the Lucca territory the industrial plant.

The project is also expected to replicate the results to other Italian paper mills outside Tuscany and to transfer the methodological solution for the production of other plastic products (i.e. pots for floriculture, tubes and industrial boxes) or for recycling other types of mixed plastics.

Finally, the project is contributing at different levels (Regional, National and European) to environmental policy and legislation, i.e. with an End-of-Waste Ministry Decree. For more information please refer to Section 6b, Policy impact.

4. Administrative part

Along the whole project duration, the level of collaboration between partners concerning the overall progress of the project has been very high. All partners collaborated closely and each one offered its knowledge and expertise of in its field in order to successfully accomplish project tasks and activities.

The kick-off meeting of the project established a smooth and productive cooperation setting, as it specified the goals and expectations of the partners by the implementation of the project, among which:

- Management structure
- Signature of partnership agreement
- Main administrative and technical obligations
- Roles and responsibilities of partners on each action

A list of the main project meetings is reported hereafter. Many more technical and administrative meetings have been held on specific activities by smaller working groups.


Meeting	Location	Date
Press conference	Serveco	2015.09.04
Kick-off meeting	Selene	2015.09.22
Steering Committee meeting	Selene	2015.09.22
LIFE Kick off meeting	Brussels	2015.10.26
Meeting with Serveco associates	Selene	2015.02.12
Monitoring visit	Selene	2016.02.29
Consortium meeting	Lucense	2016.03.14
Steering Committee meeting	Lucense	2016.03.14
Consortium meeting	Serveco	2016.09.29
Steering Committee meeting	Serveco	2016.09.29
Project workshop n.1	Zero Waste (Lucca)	2016.09.30
Meeting with Serveco associates	Serveco	2016.11.07
Consortium meeting	Zero Waste (Lucca)	2017.03.24
Steering Committee meeting	Zero Waste (Lucca)	2017.03.24
Second Monitoring visit	Selene	2017.06.23
Consortium meeting	Selene	2017.12.04
Project workshop n.2	Lucense/Selene	2017.10.13
Joint monitoring visit	Selene	2018.05.28
Consortium meeting	Selene	2018.06.08
Steering Committee meeting	Selene	2018.06.08
Final Conference	Serveco	2018.07.13

Two main amendments were to the Grant Agreements were approved during the project. The first one regarded technical modifications to the prototype line to recycle pulper waste into new plastic pallets. A second amendment was provided to extent the project duration by 6 months and to include, among the project beneficiaries, two paper mills associated to partner Serveco.


5. Technical part

5.1. Technical progress, per Action

A	PREPARATORY ACTIONS
A1	Technology update and detailed design of demonstration site
Duration	Foreseen start date: 01/09/2015 Actual start date: 01/09/2015 Foreseen end date: 28/02/2016 Actual end date: 31/05/2016
Work done and output	<p>During this action, the project partners, based on their experience, conducted a comprehensive review of the available technologies for processing pulper waste and producing pallets in mixed plastics contaminated with cellulose and other impurities.</p> <p>The activity included meetings with technology suppliers and tests conducted at laboratory and industrial scale. The evaluation of the different technological solutions was done from technical, economic and environmental points of view.</p> <p>The review, as described in D02, confirmed the project approach, but at the same time outlined recent development of technologies concerning two important processing phases. The first one is related to the pre-treatment, of pulper waste, with the possibility to (partially) separate mixed plastics and cellulose contaminants. Such separation, achievable at relatively low processing costs, brings two important advantages. First, it allows recovering the cellulose content, to be reused in the paper making process. Second, thanks to the lower contamination of the mixed plastics, it eases the drying process (thereby making it less energy consuming) and it increases the amount of pulper waste in the plastic compounds (with lower need of additives and other plastics). Overall, it allows a higher recycling rate of pulper waste.</p> <p>The second recent development concerns the central phase and is related to the densification of the mixed plastics from pulper waste, contaminated with cellulose and other impurities. In this case, the additional process costs could be compensated by a better polymer homogenisation and an increased productivity of the injection moulding machine, therefore increasing the quality of plastic pallets and reducing the overall production costs.</p> <p>The main output of this action was the design of the prototype line, to be installed, set-up and tested during the project demonstration activities.</p> <p>As mentioned in the executive summary, in the past years the problem of pulper waste management has become more severe: paper mills are facing reduced alternatives and rising costs for waste disposal. At the same time, LIFE ECO-Pulplast is increasingly seen as the most promising (if not the only) long-term solution to the problem (see also Action D4).</p> <p>Considering the large expectations from stakeholders and paper companies, that in a short time a large amount of pulper waste would be recycled into plastic pallets, the design of the prototype line put special attention on the following aspects:</p> <ul style="list-style-type: none"> - possibility to rapidly scale up the project results to full industrial scale - selection of reliable technology suppliers - speed up the market uptake of plastic pallets (see Action B4 for more details)

	
Progress on deliverables	<p>All action objectives were achieved by the end of June 2017.</p> <p>D04 “Preparation of demonstration site report” – <i>completed</i>.</p> <p>M3 “Demonstration site set-up and prototype line tested” – <i>reached</i></p>
Continuation after Life	<p>Additional upgrade and update of prototype line will be possible after the end of the project, i.e. concerning new moulds for additional products.</p>

B2	Prototype line operation and demonstration	
Duration	Foreseen start date: 01/06/2016 Foreseen end date: 30/11/2017	Actual start date: 01/06/2016 Actual end date: 31/12/2017
Work done and output	<p>The delay in the conclusion of Action B1 affected also the beginning of the prototype line demonstration activities. Nonetheless, the demonstration plan was defined according to schedule.</p> <p>The plan identifies activities, timetable and objectives of the prototype, divided in three main categories (for more details please refer to D05 Demonstration plan):</p> <ul style="list-style-type: none"> - Input materials and new plastic compounds - Functioning of the prototype line - Quality of plastic pallets <p>Preliminary activities and experimental tests were conducted at external industrial sites before the installation of the prototype line in Selene, in order to collect additional information and data concerning the technological solutions selected for the project. This activity was related to:</p> <ul style="list-style-type: none"> - the composition of pulper waste coming from different paper mills - the quality of cellulose and plastics after separation process with different technologies - plastics densification (and alternative) technologies and solutions - pallets requirements <p>Starting from the end of June, an intense experimental programme was carried out at Selene. This activity can be summarise as following:</p> <ul style="list-style-type: none"> - Testing and tuning of process parameters (injection pressure, mould pressure, temperature, cooling time, etc.) to guarantee good quality of surface, little/no odour, full mouldability. - Prototype improvement and optimisation: integration of suction hood, second moulding station, adjustments to injection moulding nozzles and material loading system, etc. - Development and characterisation of 7 different compounds, with concentrations of plastics from pulper waste always above 50%. 	

	<ul style="list-style-type: none"> - Small changes to the pallets moulds to improve processability and pallet performances (i.e. reinforcement of lower crossbars, larger blocks in CP7, stronger connection between top deck and blocks). - Several cycles of pallets moulding tests, with different blends, process conditions and pallet moulds. - Tests in Selene on pallets produced in the different moulding cycles: overall quality, static and dynamic tests, handling, anti-slip solutions, etc. - Additional tests at external certified laboratory on most relevant products conditions. <p>Additional tests were carried out by recycling in the line the moulded plastic pallets, via shredding them prior sending the material to the injection unit. These tests gave excellent results showing comparable pallet properties and an even better workability of the plastic material as compared to the original one, probably due to the better polymers homogenisation. This test, although preliminary, confirms the project objective to recycle the plastic pallets at the end of their life cycle.</p> 
Progress on deliverables	<p>All activities were completed by May 2018.</p> <p>D05 “LIFE ECO-PULPLAST demonstration plan” – <i>completed</i></p> <p>D06 “LIFE ECOPULPLAST pilot demonstration report” – <i>completed</i></p> <p>M4 Demonstration planning completed – <i>reached</i></p> <p>M5 Pilot demonstration completed – <i>reached</i></p>
Continuation after Life	<p>The prototype line will be used for further optimisation of plastic pallets and development of new plastic products from recycling.</p>

B3	Technical support during pilot operations: tests and analysis	
Duration	Foreseen start date: 01/06/2016 Foreseen end date: 30/11/2017	Actual start date: 01/06/2016 Actual end date: 31/05/2018
Work done and output	<p>Similarly to what written for Action B2, the delay in the commissioning of the prototype line affected the beginning of the tests and analyses at support of the pilot operations.</p> <p>Also in this case, preliminary activities and experimental tests were conducted at laboratory scale, in order to collect additional information and data. This activity mainly concerned the technological solutions selected for the project and it is related to:</p> <ol style="list-style-type: none"> 1. analysis of pulper waste coming from different paper mills, before and after pre-treatment 2. use of additives and tests on plastics compounds 	

3. tests on pallets physical and mechanical properties

The tests conducted at laboratory level on pulper waste before and after different pre-treatment technologies determined the different polymeric composition of mixed plastics, confirming the majority of polyolefin (mainly LDPE and PP) in all analysed samples.

While the amount of cellulose and impurities in pulper waste is quite relevant, normally around 25-45% of the dry material, depending on the paper mill, the different pre-treatment processes allow to reduce such amount to around 5-10%.

The lower level of cellulose also help reducing the water content, which can be recovered, by simple mechanical process, down from 40-50% to 15-20%. The cellulose separated from plastics also contained small impurities, mostly plastics, which amount to 20-50%. In addition, the cellulose contains some 10-20% of fillers. Nonetheless, these tests confirmed the possibility to reinsert this cellulose material in the paper production process, in particular for lower paper grades.

The formulation of compounds with the addition of other plastics from recycling or additives was done to help increasing the mechanical strength without heavy impacts on the material cost and density.

The different compounds, as well as pulper waste with different level of impurities, were also tested on laboratory test pieces in terms of physical/mechanical properties, such as density, bending module, maximum deformation. These tests show that larger impurities create weak points more vulnerable to breaks.

Finally, tests were also conducted on moulded pallets after each production cycle, for an estimate of the performances, as well as an evaluation of properties such as grip, odour, porosity, weight, etc. Pallets moulded with 100% plastics from pulper waste have performance below requirements and difficulties in filling completely the moulds, sometimes resulting in non-finished pallets. The addition of other plastics or additives increases pallet performances and fluency. The weight of the pallet is also slightly higher than the correspondent wooden pallet by some 15-20%. A combined optimisation of pallet design and plastic compounds was the focus of the second part of experimental and helped increasing the pallets performance. Static and dynamic load tests proved an excellent compression strength (almost 10t), good stability and good static and dynamic bending strength. Odour, instead, did not represent a problem for none of the selected compounds. Tests on grip and anti-slip solutions were carried out to select the best solutions.

More analytical and quantitative tests of the pallet performances were conducted at external accredited laboratories (CRIL) to verify the compliance with the standards for pallets (e.g. ISO EN 8611). The pallet is currently limited by the crossbar creep, as confirmed by long term storage at Versalis warehouse.

More details of activities and results are reported in Deliverable D07.

	
Progress on deliverables	All activities were completed by May 2018. D07 “Test and analysis report” – <i>completed</i>
Continuation after Life	Additional tests will be conducted mainly on pallets properties, both at accredited laboratories and in real life use conditions.

B4	Development of a business plan at full industrial scale
Duration	Foreseen start date: 01/09/2017 Actual start date: 01/03/2016 Foreseen end date: 28/02/2018 Actual end date: 31/08/2018
Work done and output	<p>The action start date was anticipated to the beginning of 2016 and conducted in parallel with Action A1.</p> <p>The evaluation of the different technologies concerning the main process phases (pre-treatment of pulper waste, injection moulding to produce plastic pallets, etc.) and the definition of the prototype line included economic evaluations and considerations concerning the scalability of the process to full industrial scale. Productivity, investments, processing costs, pallet design, requirements and final market are in fact crucial to guarantee sustainability after the end of the project.</p> <p>The evaluation showed that, based on current knowledge, the most critical parameters are line productivity and costs of additives and other plastics to be added to pulper waste (cost per unit and % needed). Cost of pulper waste and pulper waste processing are instead less relevant.</p> <p>A specific focus was put on the pallet market, in terms of pallet types and prices, physical/mechanical requirements and also concerning the overall pallet management system (pallet poolers, collection and maintenance, etc.). Several meetings were held with the most relevant pallet poolers, and with large enterprises and retailers interested in replacing their conventional pallets with sustainable pallets from recycled plastic.</p> <p>The results of this activity were used as input for the design of the prototype line and pallet moulds and the definition of demonstration plan, evaluation plan and monitoring indicators.</p> <p>A preliminary business plan of a plant at industrial scale was made already in 2016. The BP was since periodically updated according to new information available and refined market strategy, till the final version.</p>

	The current business plan considers three complete lines (from pre-treatment to injection moulding, for a total production of about 1.2 million pallets per year, equal to some 30 kton of mixed plastics. Pre-treatment and densification phases might be reduced to 2-3 processing lines with higher production capacity, feeding more than one moulding line, also depending on the quality of pulper waste received from paper mills. The business plan is reported as deliverable D08.
Progress on deliverables	All action objectives were achieved by the end of the action. D08 “Business plan at full industrial scale” – <i>completed</i> .
Continuation after Life	Selene industrial strategy and investment plan will continue to be updated while proceeding with the industrial scale up.

C	MONITORING OF THE IMPACT OF THE PROJECT ACTIONS	
C1	Evaluation criteria and planning	
Duration	Foreseen start date: 01/03/2016 Foreseen end date: 31/05/2016	Actual start date: 01/03/2016 Actual end date: 31/05/2016
Work done and output	<p>This action was completed according to plan. The steering committee appointed the members of the Evaluation team, composed of partners Serveco, Selene and Lucense. The evaluation plan was defined and includes:</p> <ul style="list-style-type: none"> a) the definition of main indicators, from different headings: environmental, technical, economic and industrial scale-up. b) format for data collection during demonstration activities c) evaluation criteria, subdivided in three categories: technical evaluation of demonstration results; impact assessment at project level; impact assessment through replicability and transferability of project results. <p>Please refer to D09 for more details.</p>	
Progress on deliverables	All action objectives were achieved. D09 “LIFE ECO-PULPLAST Evaluation Plan” completed according to schedule and periodically updated.	
Continuation after Life	Not relevant	

C2	Data collection and pilot monitoring	
Duration	Foreseen start date: 01/06/2016 Foreseen end date: 30/11/2017	Actual start date: 01/03/2017 Actual end date: 31/05/2018
Work done and output	<p>Activities started in March 2017, with the first tests on the euro-pallet moulds and then got up to speed, following the demonstration activities, as described in action B2. Data from the demonstration site were collected using the form for data acquisition shown at the end of D09. Additional data comes from laboratory analyses, tests on pallets, etc. The data collected was used for a continue monitoring of the demonstration activities and its results, as well as to provide feedbacks to the tune demonstration activities, in particular concerning the quality of input material, compounds and pallets.</p>	
Progress on deliverables	D10 “LIFE ECO-PULPLAST Data Collection Logs” (datasets, report) – <i>completed</i>	

Continuation after Life	Not relevant
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C3	Pilot evaluation and environmental, economic and social impacts assessment
Duration	Foreseen start date: 01/09/2016 Actual start date: 01/09/2016 Foreseen end date: 28/02/2018 Actual end date: 31/08/2018
Work done and output	<p>This action started according to schedule, with a preliminary draft of D12 Monitoring protocol and indicators. Likewise Action C2, due to the delay in the installation of the prototype line, the activity related to the actual pilot evaluation and impact assessment started in March 2017, after the first tests on the euro-pallet moulds and then got up to speed, following the demonstration activities described in action B2.</p> <p>Concerning the pilot evaluation, apart from the initial delay, experimental activities were carried out during pilot demonstration according to schedule. Small problems occurred to machineries and were promptly repaired, without causing any extra delay.</p> <p>A large amount of demonstration activities were conducted during the project both at the prototype line (estimated total working time of 2.200 hours) and with external analyses and tests. Data was collected quite regularly even though the data form was not always filled in completely by the technicians. For almost all indicators indicated in the monitoring protocol and used for the evaluation of pilot demonstration, the results exceeded the expectations:</p> <ul style="list-style-type: none"> - number of different pulper waste used and characterised: pulper waste from 5 different local paper mills was characterised before and after pre-treatment and used in the prototype line; - number of compounds developed: 7 different plastic compounds were made and used to produce pallets; - removal of impurities and processing waste: mixed plastics from pulper waste were separated with a better quality than initially planned and so reduced the amount of process waste to below 5%; - amount of pulper waste in compounds: plastics from pulper waste are between 60% and 75%, depending on the pallet specifications; - pallet quality: several properties of pallets were measured and tested. For more details please refer to action For more details please refer to action B3. <p>During the last project months, an impact assessment was performed at project level, according to the monitoring protocol. In synthesis,</p> <ol style="list-style-type: none"> 1. Thanks to new technologies to partially separate cellulose from mixed plastics, it is possible to recover and reuse up to 80-90% of cellulose fibres in the process of paper mills, thereby reducing at the source, by an estimate 30-40%, the amount of pulper waste produced by the paper industry, with the additional advantage to reduce transport related pollution. 2. A lower level of impurities in mixed plastics increase the recyclability of pulper waste. The amount of pulper waste used in the compounds increased from 50-60% to 60-80%. 3. The results from LCA analysis confirmed the lower carbon footprint of pallets from pulper waste as compared to conventional wooden pallets.

	<p>Nonetheless, the study still does not include the use phase, because of lack of data.</p> <ol style="list-style-type: none"> 4. Moulding line confirmed the use of low temperatures and pressure, below those of conventional moulding plants, thus reducing operating costs and pollutant emissions. No relevant maintenance of the machineries was required during demonstration, although additional data will be required for accurate estimates. 5. Pallet performance were positive, but still need additional improvement (please refer to action B3 for more details). This can be achieved with a better pallet design, which is currently a focus for further market development. 6. The tests conducted confirmed the possibility to recycle plastic pallets to mould new ones, without visible deterioration of performances or processability. 7. A large number of paper mills, as well as pallet stakeholders and potential customers were involved during the project. <p>Finally, concerning longer term impacts:</p> <ol style="list-style-type: none"> a) The business plan (see Action B4) detailed estimated projection costs and confirmed the sustainability at industrial level. b) Much effort was put to open market opportunities, establishing contacts with pallet poolers, large retailers and potential customers, with a focus of local reuse in the paper industry (see Action C4 for more details) and closed logistics circuits, which would allow to choose the pallets field of use and create a simple management system to collect and recycle them at the end of their life cycles. c) In a 3 years scenario, the volume of pulper waste produced in the Lucca area is estimated to decrease from 120.000 to 50.000 t/y thanks to the combined effect of recovering cellulose fibres and recycling mixed plastics. The NO₂/NO_X emissions related to pulper waste road transport are estimated to decrease from 38 to 15 kg/day. d) the Business plan estimates 25 new employees for the industrial plant.
Progress on deliverables	<p>All action objectives are expected to be achieved by the end of the project.</p> <p>D12 “Monitoring protocol and indicators” – <i>completed</i>.</p> <p>D11 “Evaluation of LIFE ECO-PULPLAST environmental impacts: pilot demonstration findings assessment – <i>completed</i></p>
Continuation after Life	<p>Impact assessment will be periodically updated according to new results and further project development</p>

C4	Business model development, social recommendations and transferability evaluation	
Duration	Foreseen start date: 01/09/2017 Foreseen end date: 28/02/2018	Actual start date: 01/05/2016 Actual end date: 31/08/2018
Work done and output	<p>The beginning of this action was anticipated to May 2016, due to the large interest about the project.</p> <p>Several contacts have been established with paper mills outside Tuscany and outside Italy: Netherlands, Germany, Slovenia, during Zero Waste Towns network conference in Ljubjana). A strong interest was shown by Comieco, which could support the replication at national scale.</p>	

	<p>In addition, Conai and Corepla also expressed strong interest. The results of this project could in fact foster the recyclability and market uptake of other mixed plastics waste both from urban collection and industrial waste. Based on the experience gained during demonstration and the networking activities with companies and stakeholder, project partner came out with an increasingly more refined business model. Starting from the current situation analysis, the business model addresses the commercial strategy, in terms of most promising customer targets and products, i.e. closed logistic circuits with specific applications and well defined pallets requirements. The business model also highlights the importance of a strong brand identity and product customisation to emphasise products benefits. Even more important for replicability and transferability of project results are consensus building with relevant public stakeholders and policy actions to build an auspicious regulatory framework.</p>
Progress on deliverables	D13 Business model, recommendations and transferability report – <i>completed</i>
Continuation after Life	Transferability evaluation will be further refined according to actual opportunities rising in the coming months.

D	COMMUNICATION AND DISSEMINATION ACTIONS	
D1	Definition of dissemination and promotion plan	
Duration	Foreseen start date: 01/09/2015 Foreseen end date: 30/11/2015	Actual start date: 01/09/2015 Actual end date: 31/01/2016
Work done and output	<p>This action was completed according to plan. The communication strategy of the project was described in details in the Dissemination and Promotion Plan (DPP), which provides an overview of the most important targets, defines the most suitable communication channels, and an implementation procedure to set up these channels and to generate and maintain the contents. The LIFE ECO-PULPLAST profile was created based on the DPP, including logo, image, contact points and electronic presence.</p>	
Progress on deliverables	<p>The objectives of this activity were achieved as planned. D14 - “The ECO-PULPLAST Dissemination and Promotion Plan” <i>completed according to schedule.</i></p>	
Continuation after Life	Not relevant	

D2	Set up and running of LIFE ECO-PULPLAST website and dissemination material	
Duration	Foreseen start date: 01/12/2015 Foreseen end date: 28/02/2018	Actual start date: 01/12/2015 Actual end date: 31/08/2018
Work done and output	<p>This action is in progress and is proceeding according to plan. All dissemination material was produced as scheduled, including:</p> <ul style="list-style-type: none"> - Logo, brochure, lapel pin - 3 videos, include animated and video with interviews - Template of presentation, documents, etc. - Web site (life-ecopulplast.eu) and Facebook page (@ecopulplast) - Periodic newsletters (#6) 	

The project visibility has been very high throughout the project duration, as demonstrated by the following activities.

Participation at events and meetings

- 7th November 2018, Presence at Ecomondo 2018, at EASME stand
- 17th May 2018, Presentation at Aticelca Conference 2018
- 15th May 2018, Study visit of University of Genoa and Zero Waste of Genoa activists
- 24th April 2018, Study trip to Italy of the “LIFE Capacity Building in Hungary” (LIFE14 CAP/HU/000010) Hungarian Team
- 25th January 2018, Visit of Luigi Di Maio and Movimento 5 Stelle in Lucense
- 29th October 2017, Visit of LIFE LT - Building LIFE capacities in Lithuania” project team composed by members of the Ministry of Environment
- 13th October 2017, Presentation at MIAC 2017 at Comieco Workshop
- 27th July 2017, Visit of Conai and Corepla representative at demonstration site in Selene
- 13th June 2017, presentation at event organised at the University of Mantua
- 10th March 2017, Master Carta, Thesis on Ecopulplast project
- 22nd November 2016: final workshop FP7 Leguval, Pisa
- 10th December 2016: 2nd Educational training Rifiuti zero, Lucca
- 20-22 May 2016: European Zero Waste meeting, Lucca
- 22nd April 2016, Zero Waste Towns conference, Lubjana
- 26th March 2016, Educational training Rifiuti Zero, Lucca
- 23rd January 2016, Zero Waste Conference, Bastia
- 20th January 2016, Workshop CQC-Comieco, Lucca
- 04th September 2015, Ecopulplast Press Conference, Confindustria Lucca

Participations at trades, such as MIAC, Ecomondo, Aticelca conference, K-trade, IFAT, Fakuma.

Publications:

- Technical publications on magazine “Industria della Carta, issue 5 – October 2015, issue 3 - June 2016, issue 5 - October 2018; FCRL magazine, issue 9 2016, Paper industry world – Sept 18.
- Articles on Eco dalle Città, 27.07.2017, book "100 Italian Circular Economy Stories", etc.

Interviews and TV appearances:

- TV programme DIDO on NOI TV, 18 May 2018
- TV report on Rai TG 3, October 12th 2017
- TV report on Rai 1, programme “Speciale TG1”, 12nd February 2017 (www.raiplay.it/video/2017/01/Speciale-Tg1-608f9246-594c-46fb-a4c5-520a752243d3.html).
- Interview on Rai – Radio 1, programme “Manuale d’Europa”, 12th March 2016 (www.radio1.rai.it/dl/portaleRadio/media/ContentItem-911a527e-66a3-43c2-9d58-1061f082d56a.html).

In June 2017, Life Eco-pulplast was the first project of the new programme 2014-2020 awarded as LIFE project of the month by the Italian Ministry of Environment (www.minambiente.it/pagina/progetti-del-mese-0)

More details are in Attachment 5 to this report and on the project website.


Progress on deliverables	D15 “The LIFE ECO-PULPLAST project web site” 01/2016 D16 “LIFE ECO-PULPLAST - n. 1 short dynamic video for dissemination on the web and printed on DVD, 02/2016 D17 “LIFE ECO-PULPLAST - n. 1 project brochure 02/2016 D18-1 “LIFE ECO-PULPLAST Newsletter n. 1” 02/2016 D18-2 “LIFE ECO-PULPLAST Newsletter n. 2” 08/2016 D18-3 “LIFE ECO-PULPLAST Newsletter n. 3” 03/2017 D18-4 “LIFE ECO-PULPLAST Newsletter n. 4” 07/2017 D18-5 “LIFE ECO-PULPLAST Newsletter n. 5” 11/2017 An additional newsletter was sent at the end of the project.
Continuation after Life	Communication activities and dissemination materials will continue according to the After LIFE Dissemination plan defined in Action E5

D3		LIFE ECO-PULPLAST Notice Boards	
Duration	Foreseen start date: 01/03/2016 Foreseen end date: 28/02/2018	Actual start date: 01/03/2016 Actual end date: 31/08/2018	
Work done and output	Informative notice boards for the Life Eco-pulplast project were realized and placed at partners’ location, in conformity with LIFE requirements. Photos of notice boards installed at partners premises are shown in D19 and on the project website.		
			
Progress on deliverables	D19 - “LIFE ECO-PULPLAST Notice boards”, <i>completed</i> .		
Continuation after Life	Notice boards might be held at partners venues after the project end, according to partners choices.		

D4		Consensus building and Stakeholders’ involvement	
Duration	Foreseen start date: 01/12/2015 Foreseen end date: 28/02/2018	Actual start date: 01/12/2015 Actual end date: 31/08/2018	
Work done and output	Thanks to the consortium composition and the relevance of the topic, the project achieved great consensus and large interest by both public bodies and private stakeholders. Very good results were accomplished also concerning policies on pulper waste management, in particular thanks to: <ul style="list-style-type: none"> - a protocol signed between the Regional Government of Tuscany, Lucense and the North Tuscany Industrialist association. The protocol identifies the Life Eco-pulplast project as the long term main solution to the problem of pulper waste management. - a working group at the Ministry of Environment, with Selene and Lucense representatives together with Assocarta (Paper Industry trade organisation), to elaborate a Ministerial Decree on end-of-waste for light 		


	<p>plastics from pulper waste. The draft test is currently under technical evaluation by ISPRA.</p> <p>A strong interest was also expressed by Conai (the National Consortium for Packaging) at the national consortia for recycling packaging in paper (Comieco), plastics (Corepla), aluminum (CiAl), which see in the Life Eco-pulplast a way to increase the recycling rate of these materials.</p> <p>Meetings and discussions were held with MISE (Ministry for industrial development), Tuscany Regional Government and, in several occasions, local public bodies (for more details please refer to D20 Networking Activities report).</p> <p>Project partners established connections with industrial stakeholders: relevant private companies working on waste recycling and circular economy.</p> <p>The scale up and replicability of the project was also fostered by contacts with and the involvement of pallet pooler, pallet potential end users (PRS, Versalis, etc.) and other paper mills outside Tuscany.</p> <p>Furthermore, interest in the project was expressed by paper industry stakeholders (RISI, Assocarta, Aticelca, enterprises) and environmental organisations (i.e. Legambiente Toscana).</p> <p>Finally, a broad public was also reached by the project and showed great interest, as demonstrated by the attendance to the events organised.</p>
Progress on deliverables	This action has no deliverable. Please find more details in D20 Networking Activities report.
Continuation after Life	Consensus building and stakeholders' involvement will continue after the project end, to facilitate industrial development and market uptake.

D5		LIFE ECO-PULPLAST Networking with other project	
Duration	Foreseen start date: 01/03/2016 Foreseen end date: 28/02/2018	Actual start date: 01/03/2016 Actual end date: 31/08/2018	
Work done and output	<p>This action proceeded according to plan, with an increase of contacts and networking activities in the course of the project. Networking was done at several occasions, mostly at events organized by project partners or where partner were invited as speakers or attended (see Action D2 for additional information).</p> <p>The most relevant occasions for networking were the following events:</p> <ul style="list-style-type: none"> - Study trip to Italy of the "LIFE CAP HUN - LIFE Capacity Building in Hungary", 24th April 2018 - Lithuania's "LIFE LT - Building LIFE capacities in Lithuania" team study visit to Italy, 29th March 2018 - Platform meeting on Plastic Recycling in Athens, 21-22 September 2017 - International Networking Conference on "Environment needs LIFE for the next 25 years", Ljubjana, 25-26 May 2017 <p>A partial list of other similar projects and initiatives contacted during Ecopulplast implementation is the following: LIFE Prefer (www.lifeprefer.it/), LIFE Multibiosol (multibiosol.eu/en/), FP7 Dibbiopack (www.dibbiopack.eu/), FP7 Wheylayer2 (www.wheylayer.eu/), FP7 Leguval (www.leguval.eu), Eco Innovation Recycled pallet system, H2020 NewInnoNet (http://newinnonet.eu/), H2020</p>		

	<p>ImpactPaperRec (http://impactpaperec.eu), FP7 Bioboard (www.bioboard.eu), Funghi espresso (www.funghiespresso.com), Kanesis (www.kanesis.eu), Contarina Pad recycling.</p> <p>Additional networking was conducted with projects funded by Assocarta, Comieco, Conai and other private entities.</p>
	
Progress on deliverables	No changes to action objectives. Deliverable D20 due at the end of the project.
Continuation after Life	Selene industrial strategy and investment plan will continue to be updated while proceeding with the industrial scale up.

D6	LIFE ECO-PULPLAST annual workshops	
Duration	Foreseen start date: 01/07/2016 Foreseen end date: 30/09/2017	Actual start date: 01/07/2016 Actual end date: 31/10/2017
Work done and output	<p>The first project workshop was held at the end of the first year of activities, as planned. The workshop focused on policy on circular economy and plastic waste, as well as a visible platform for dissemination of the project approach and solutions.</p> <p>The workshop was very successful, with a high quality of speakers, large attendance (around 60 participants, above expectations) and large visibility on media, mostly at local level. It was also an excellent occasion for stakeholders involvement and to exchange views and experiences with other initiatives addressing similar problems.</p> <p>The second project workshop was organised on October 6 2017 in Lucca. The workshop targeted companies producing waste materials and potential customers of plastic pallets, as well as public institutions and environmental organisations. The programme included a morning sessions with presentations of invited speakers, followed by a visit to the demonstration site in Selene.</p>	
Progress on deliverables	<p>No changes to action objectives.</p> <p>D21 “LIFE ECO-PULPLAST Annual Workshop n. 1”, <i>held on 30th September 2016</i></p> <p>D22 “LIFE ECO-PULPLAST Annual Workshop n. 2”, <i>held on October 6th 2017</i></p>	
Continuation after Life	Not relevant	

D7	Final International LIFE ECO-PULPLAST Conference	
Duration	Foreseen start date: 01/01/2018	Actual start date: 01/01/2018

	Foreseen end date: 28/02/2018	Actual end date: 15/07/2018
Work done and output	<p>The final conference was held in Lucca on July 13th 2018 at Serveco venue. The final conference focused mostly on the project results and perspective for industrial developments, as well as on other best practice of circular economy.</p> <p>The conference was opened by the welcome of the Mayor of Lucca and the President of Confindustria Toscana Nord.</p> <p>The conference had large visibility and dissemination thanks to a press release, interviews on TV and a broad press review.</p>	
		
Progress on deliverables	D23 - “The Final LIFE ECO-PULPLAST International Conference” – held on July 13 th 2018	
Continuation after Life	Not relevant.	

D8	Production of LIFE ECO-PULPLAST Layman’s Report	
Duration	Foreseen start date: 01/12/2017	Actual start date: 01/12/2017
	Foreseen end date: 28/02/2018	Actual end date: 31/08/2018
Work done and output	<p>This action was conducted in the last project months.</p> <p>The LIFE ECO-PULPLAST Layman’s Report was produced and provides a comprehensive easy-to-consult dissemination document for the general public.</p> <p>The report has the following structure:</p> <ul style="list-style-type: none"> - Environmental problem targeted - Project objective - Project actions - Main project results and evaluation of benefits - Future perspectives - Description of consortium <p>The Layman’s report was produced both in English and in Italian, starting from the graphics used for the project animated video and including tables, graphs, etc.</p>	
Progress on deliverables	D24 - “LIFE ECO-PULPLAST Layman’s Report” – completed	
Continuation after Life	The Layman’s Report will be used after the project end for dissemination purposes.	

E	PROJECT MANAGEMENT AND MONITORING OF THE PROJECT PROGRESS	
E1	Administrative and Technical Project Management by SELENE	
Duration	Foreseen start date: 01/09/2015 Foreseen end date: 28/02/2018	Actual start date: 01/09/2015 Actual end date: 31/08/2018
Work done and output	<p>The activity continued during the whole project duration, according to plan. The overall project management framework was established at the beginning of the project, including management structure and definition of main roles, such as project coordinator, financial coordinator and steering committee members.</p> <p>The project Partnership Agreement was signed by all partners by September 22th 2015.</p> <p>Consortium meetings, as well as Steering Committee meetings, have been held according to plan.</p> <p>All partners are actively contributing to project activities according to their role and competences.</p> <p>Additional information is reported in D25.</p>	
Progress on deliverables	<p>No changes to action objectives.</p> <p>D01 - "LIFE ECO-PULPLAST Consortium Agreement" signed.</p> <p>D25 - "LIFE ECO-PULPLAST Project Handbook" completed according to schedule and periodically updated</p>	
Continuation after Life	Project management will continue till the end of required administrative compliances.	

E2	LIFE ECO-PULPLAST Project Monitoring	
Duration	Foreseen start date: 01/09/2015 Foreseen end date: 28/02/2018	Actual start date: 01/09/2015 Actual end date: 31/08/2018
Work done and output	<p>The activity continued during the whole project duration, according to plan. The project monitoring handbook was established at the beginning of the project and included procedures to monitor both the financial and the technical progress of the project.</p> <p>The financial monitoring is based on internal quarterly reports provided by the associated beneficiaries to the coordinating beneficiary, with the documentation at support of all expenses.</p> <p>In addition to CM and SC meetings, monitoring of technical quality of project activities and related reports and deliverables is conducted during the formal and informal periodic technical meeting among project partners. Monitoring is also supported by action leaders, the technical demonstration team, the technical support group and the evaluation team.</p> <p>In addition, activity updates have been provided to the project monitor, usually every other month.</p> <p>Additional information is reported in D26 Monitoring handbook.</p>	
Progress on deliverables	<p>No changes to action objectives.</p> <p>Deliverable D26 – LIFE ECO-PULPLAST Project Monitoring Handbook, completed according to schedule and periodically updated.</p>	
Continuation after Life	Project monitoring will continue till the end of required technical and administrative compliances.	

E3	LIFE ECO-PULPLAST Indicators	
Duration	Foreseen start date: 01/01/2017 Foreseen end date: 28/02/2018	Actual start date: 17/03/2016 Actual end date: 31/08/2018
Work done and output	Update of LIFE project outcome indicators on the LIFE online tool on regular basis. At the end of the project, final indicators were submitted. The final data show better results than originally indicated concerning project communication and visibility. Environmental benefits due to the project are in line with previous data.	
Progress on deliverables	No changes foreseen for the action objectives. This action has no deliverable.	
Continuation after Life	Indicators will be monitored during the 5 years scenario.	

E4	Project Auditing	
Duration	Foreseen start date: 01/01/2018 Foreseen end date: 28/02/2018	Actual start date: 01/01/2018 Actual end date: 31/08/2018
Work done and output	According to the letter of amendment n. 3 the threshold for submission of the certificate on the financial statements has been increased to EUR 750.000, therefore we believe that the certificate is not necessary, being the EU contribution requested lower. Nonetheless, the auditor was previously selected by Selene, as indicated in the mid-term report.	

E5	After LIFE ECO-PULPLAST Communication Plan	
Duration	Foreseen start date: 01/12/2017 Foreseen end date: 28/02/2018	Actual start date: 01/12/2017 Actual end date: 31/08/2018
Work done and output	<p>After-LIFE communication activities are basically a continuation of the most relevant and effective communication and dissemination activities carried out during the project. The LIFE ECO-PULPLAST beneficiaries are all interested to continue dissemination actions after the end of the project, as all beneficiaries have interests in achieving wide dissemination and transferability of the project innovative solutions, results and best practice at national and European level. In particular:</p> <ul style="list-style-type: none"> - Selene is willing to continue with the industrial development and to open market opportunities - Lucense is willing to promote technology transfer to its reference market territory - Serveco is willing to support the implementation of the demonstrated technologies to affiliated companies - ZWE is willing to disseminate circular economy good practices to stakeholders and general public. <p>The defined after LIFE communication strategy is based on all standard dissemination actions undertaken in the project, including:</p> <p>(a) the updating of the website with the latest news on the project technological aspects and solutions, environmental impact, social acceptance, economic sustainability, etc.;</p> <p>(b) the dissemination of project results at the institutional level;</p>	

	<p>(c) the presentation of project results at each appropriate occasion (conferences, workshops, etc.),</p> <p>(d) the exchange of correspondence with the Commission on any project follow-up.</p> <p>Two are the main drivers to continue dissemination activity:</p> <ul style="list-style-type: none"> - Follow up of the project, submitted to the LIFE Call 2018, Phase I. - New brand identity, for commercial purposes <p>Specific activities for the coming months were already identified and included in the dissemination plan:</p> <ul style="list-style-type: none"> - Participation to ECOMONDO 2018, in November 2018: Ecopulplast will be hosted at the EAME Stand, with the opportunity to illustrate project results. - Participation at MIAC 2018, the international exhibition of the paper industry, in Lucca in October 2018, at Lucense boot. - Participation to K-Trade and Fakuma Trade. <p>The plan includes target indicators, among which the LIFE KPI in a 5 years timeframe:</p> <ul style="list-style-type: none"> - Number of stakeholders involved due to the project: 20 Public bodies, 10 NGOs and 20 Other civil society organisations - Project website: 250.000 No. of individuals, 15.000 No. Downloads and 150.000 No. of unique visits 15000 - 13 Publications/reports - 100 Print media - 34 Events/exhibitions - 18 Video/broadcast - 5.000 No. of individuals members of interest groups.
Progress on deliverables	D27 After Life Dissemination plan – <i>completed</i>
Continuation after Life	This action will be conducted after the project end date.

Effectiveness of the dissemination activities and comment on any major drawbacks

The project is having a very high visibility, with strong interest at different levels (see Actions D2 and D4 for more details): from institutions and public bodies (Regione Toscana, the Italian Ministry of Environment, Italian and European Municipalities, etc.), to citizens and organisations (Conai, Corepla, Comieco, Assocarta, RISI, Aticelca, Legambiente Toscana, Symbola, environmental interest groups, etc.), to companies and entrepreneurs of both paper and plastics sectors (mostly paper mills, technology suppliers and potential pallets users).

The project has also had large presence on media. The project appeared on several online and printed newspapers, technical magazines, TV and Radio. Of particular relevance are the interviews and reports on national TVs and Radio channels: TV report on Rai TG 3, October 12th 2017; TV report on Rai 1, programme “Speciale TG1”, 12nd February 2017; Interview on Rai – Radio 1, programme “Manuale d’Europa”, 12th March 2016.

Since the completion of the demonstration site, a number of visits was organised to better disseminate the work done and the results achieved so far (please visit project web site and Facebook page for more details).

Overall the project exceeded the expected results of dissemination activities reported hereafter:

- dissemination of the project approach and outcomes to at least 5 Italian paper mills (outside Lucca Paper District) and to overall 15 mills at European level;
- involvement of 10 main stakeholders at regional, national and European level;
- interest demonstrated by at least 3 relevant plastic companies of Tuscany Region in the use of the new plastic compounds.

Policy impact

The main contributions of the project to policy were the following:

- at local level, the Regional Government of Tuscany, Lucense and the North Tuscany Industrialist association signed a protocol that identifies the Life Eco-pulplast project as the long term main solution to the problem of pulper waste management. No significant action was implemented by Regione Toscana as follow up of this protocol;
- at national level, a working group was established at the Italian Ministry of Environment, with Lucense and Selene representatives, together with Ispra, Arpa and Versalis, to define the ‘minimum environmental criteria’ for the end-of-waste classification of materials composing pulper waste and to elaborate a Ministerial Decree on end-of-waste for light plastics from pulper waste. The draft test is currently under technical evaluation.
- at European level, ZWE promoted the project during the discussions on circular economy which have taken place since 2015. LIFE Ecopulplast was used to prove to policy makers that what it was not recyclable in the past can be recyclable in the future. This message was conveyed repeatedly during the several meetings that ZWE staff held with MEPs, the member states and the European Commission to promote the adoption of ambitious recycling targets. This took place during the preparations of the vote in the ENVI committee of the European Parliament which happened in January 24 which resulted in 70% recycling target and continued during the several meetings we held to inform MEPs before the vote in the plenary of the EP held in Strasbourg on 14th of March. Also the Ecopulplast LIFE project was promoted during the AGM of ZWE which was held in Madrid on 1-3/4/17 and which inspired the policy makers of the city of Madrid.

EU added value of the project and its actions”

The project addressed the strategic requirements of the Sub-programme LIFE Environment and Resource Efficiency, and contributed to the following European policies, which were identified in the approved project:

1. To promote resource efficiency and develop new businesses focused on the implementation of the Roadmap to a Resource Efficient Europe: through the demonstration activity, the project aim at proving the feasibility of a new green technology impacting on two different sectors: paper and plastic industries.
2. To implement a circular economy through actions spanning the value-chain or ensuring the use of secondary resources, according to the circular economy package approved by the European Parliament, which establishes common EU targets for recycling by 2025 and 2030.
3. To promote waste reduction. The project goes in the directions indicated by the European Commission in the Directive 99/31/EC of 26 April 1999 on the landfill of waste and in the Directive 2008/98/EC on waste (Waste Framework Directive).

5.2. Analysis of benefits

Ecopolplast is, above all, a project about development of technologies and competences to promote and foster the implementation of circular economy and plastics recycling. In this respect, Ecopolplast was very successful, having designed, constructed and validated a unique and innovative prototype line, at semi-industrial scale, to process and mould by injection mixed plastics from material waste, still contaminated by residual impurities, to produce new plastic products.

Even more, Ecopolplast connected in the project the whole supply and value chain, from waste treatment to machinery producers, from product designers to logistics operators, from decision makers to environmental activists. For this reason project results go beyond the contingent problem of pulper waste disposal; the project is a model of inclusive collaboration between different actors that has become a best practice and that can be successfully replicated to different waste materials and in different contexts.

The innovative approach used in ECO-PULPLAST, in which entities with very different background collaborate and contribute with their roles and competences, as well as the focus on industrial symbiosis between two different economic sectors (paper and plastics), has confirmed to be an added value of this project and methodology that should be transferred elsewhere.

The results achieved confirm and reinforce the project objectives to steadily reduce the amount of pulper waste sent to incinerators and landfill and to recover and reuse the material composing pulper waste for a more efficient use of resources.

The project proved that it is technically possible and economically sustainable to make quality plastic products by recycling low quality mixed plastics from industrial waste streams. The experimental activities demonstrated the technology implemented in the prototype line and validated the so called “Eco pallet”, a euro-pallet for light industrial usage (up to 800 kg load), i.e. tissue products of local paper converting companies. In addition, the moulding technology operates at lower temperatures and injection pressure than conventional technologies, thereby with reduced operating costs and pollutant emissions

In addition, a LCA study compared plastic pallets from pulper waste to conventional wooden pallets, showing their lower ecological footprint for almost all one environmental indicators. Nonetheless, the study still does not include the pallets use phase, because of lack of data.

Based on the results achieved, it was elaborated a detailed business plan for the industrial developed of the project, with investments, in a 3-5 years scenario, in 3 production lines for a total moulding capacity of 1.4 million pallet a year, corresponding to some 30.000 tons of mixed plastics, and the creation of about 25 new jobs.

At the same time, thanks to new material separation technologies tested in the project, in a shorter term scenario a reduction of pulper waste volumes by an estimate of 30-40% could come from the installation, at paper mills, of machineries to recover and reuse up to 80-90% of cellulose fibres in the paper mill process. Currently two paper mills associated to Serveco are investing in such technologies and another one is conducting industrial tests.

Thanks to the combined recovery and recycling of cellulose and plastics, by 2023 we estimate a reduction from 120.000 to 50.000 t/y of pulper waste conferred to landfills and incinerators. The concurrent reduction of transport related NO₂ emissions would decrease from 38 to 15 kg/day.

From an economic point of view, the reduction of current costs related to pulper waste management would contribute to increase the competitiveness of paper mills on the European market and to further reinforce their commitment to use paper for recycling, which is the primary force driving the urban paper collection and its reuse.

The project has a strong potential for replicability in other regions that are currently dealing with pulper waste production and management, starting from other European production sites of local paper mills.

Recommendations are reported in the business model for the transferability of the results to other plastic materials from different industrial waste or economic sectors and to different market applications. In fact, beside pallets, target products are other accessories for logistics and transport (spacers, cradles, custom-shaped objects).

Thanks to the consortium composition and the relevance of the topic, the project achieved great consensus and large interest by both public bodies and private stakeholders, as well as large visibility to the general public.

The project has also contributed to the following policy measures:

- a protocol between the Regional Government of Tuscany, Lucense and the North Tuscany Industrialist association identifying Life Eco-pulplast as the long term main solution to the problem of pulper waste management.
- a working group at the Ministry of Environment, with Selene and Lucense representatives, to elaborate a Ministerial Decree on end-of-waste for light plastics from pulper waste. The draft test is currently under technical evaluation by ISPRA.

ANNEX 1: LIST OF DELIVERABLES

D01 “LIFE ECO-PULPLAST Consortium Agreement”, Action E1

Partnership agreement signed by all project beneficiaries.

D02 “Technology analysis report”, Action A1

Report of the activity related for the update of technologies to process pulper waste and the technical and economic evaluations of the different solutions identified.

D03 “Final design of demonstration site”, Action A1

Description of the main process phases and design of the prototype line.

D04 “Preparation of demonstration site report”, Action B1

Report describing the works conducted at the demonstration site for the installation of the prototype line.

D05 “Demonstration plan”, Action B2

Definition of the demonstration activities and partial objectives, defined according to the expected results.

D06 “Pilot Demonstration report”, Action B2

Report of demonstration activities conducted at prototype line and main results achieved, with reference to the expected results.

D07 “Test and analysis report”, Action B3

Report of tests and analysis conducted at partners laboratories and at prototype site, as well as at external laboratories, at support of demonstration activities.

D08 “Business plan at full industrial scale”, Action B4

Business plan for the industrial development of the project and the market uptake.

D09 “Evaluation plan”, Action C1

The Evaluation plan defines the guidelines to carry out the evaluation during the pilot demonstration, including a set of indicators, data collection and criteria.

D10 “Data Collection Logs”, Action C2

Report of data collected during pilot demonstration.

D11 “Evaluation of environmental impacts: pilot demonstration findings assessment”, Action C3

Evaluation of project results and environmental, social and economic impacts assessment of the projects.

D12 “Monitoring protocol and indicators”, Action C3

Monitoring protocol of the experimental activities, aimed to guarantee that the pilot evaluations conducted at different moments during the demonstration activities are replicable, comparable and correctly managed.

D13 “Business model, recommendations and transferability report”, Action C4

Business model describing the strategy for industrial scale up and market uptake, including recommendations for transferability and replicability of project results.

D14 “The ECO-PULPLAST Dissemination and Promotion Plan”, Action D1

This deliverable describes the main lines of the adopted project communication, dissemination and promotion strategies, to be conducted throughout the project duration.

D15 “The LIFE ECO-PULPLAST project web site”, Action D2

The project web site (www.life-ecopulplast.eu) is a major source for all dissemination materials and information.

D16 “LIFE ECO-PULPLAST - n. 1 short dynamic video for dissemination on the web and printed on DVD”, Action D2

Project videos made for dissemination purposes.

D17 “LIFE ECO-PULPLAST - n. 1 project brochure, Action D2

The project brochure is one of the main communication materials. A second project brochure will be realized after completion of the prototype line.

D18-1 “LIFE ECO-PULPLAST Newsletter n. 1”, action D2

First project e-newsletter, after 6 months from the start of the project, also available on the project website.

D18-2 “LIFE ECO-PULPLAST Newsletter n. 2”, action D2

Second project e-newsletter, after 1 year from the start of the project, also available on the project website.

D18-3 “LIFE ECO-PULPLAST Newsletter n. 3”, action D2

Third project e-newsletter, after 18 months from the start of the project, also available on the project website.

D18-4 “LIFE ECO-PULPLAST Newsletter n. 4”, action D2

Fourth project e-newsletter, after 22 months from the start of the project, also available on the project website.

D18-5 “LIFE ECO-PULPLAST Newsletter n. 5”, action D2

Fifth project e-newsletter, after 33 months from the start of the project, also available on the project website.

D19 “LIFE ECO-PULPLAST Notice boards”, action D3

Notice boards are installed at the revenues of project partners.

D20 “Networking Activities report”, action D5

Report of main networking activities with similar projects and initiatives, as well as with relevant private and public stakeholders.

D21 “LIFE ECO-PULPLAST Annual Workshop n. 1”, action D6

First project workshop, held in Lucca on September 30th 2016.

D22 “LIFE ECO-PULPLAST Annual Workshop n. 2”, action D6

Second project workshop, held in Lucca on October 6th 2017.

D23 “LIFE ECO-PULPLAST Final Conference”, action D7

Final Conference of the project, held in Lucca on July 13th 2018.

D24 “LAYMAN’S REPORT”, action D8

Layman’s report of the project, to be used for dissemination to a broad audience.

D25 “LIFE ECO-PULPLAST Project Handbook”, action E1

Management handbook defining a set of rules and instructions for the coordination of the actions of each partner during the project lifecycle.

D26 “Project Monitoring Handbook”, action E2

The monitoring handbook provides guidelines and instructions for the project monitoring, providing information on procedures, rules and formats.

D27 “After LIFE Dissemination plan”, action E5

Dissemination plan to continue the dissemination of project objectives and achievements after the end of the project.