

Circular economy of commercial plastic packaging in urban environments.

LIFE RECYPACK

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ABSTRACT:

LIFE RECYPACK has been created to solve a global problem focus on how to manage commercial plastic packaging waste (CPPW).

The environmental problems associated come from the management of this waste, currently deposited in standard municipal waste containers, together with household waste.

The project is currently running in three countries, Italy, Hungary and Spain and the idea is to replicate the system in other UE countries creating and showing the environmental, social and economic benefit.

LIFE RECYPACK is a demonstration Project that addresses 4 different solutions to the current problems of managing Commercial Plastics Packaging Waste (CPPW), mainly Polyethylene (PE) and Expanded Polystyrene (EPS), in urban settings.

Dem1: Commercial Shopping Center (Toscana - Italy). The stores will collect this waste in a special plastic packaging containers, separating Polyethylene (PE) and Expanded Polystyrene (EPS).

Dem2: Urban Commerces (Lliria – Spain). A logistic system already established for the collection of paper and cardboard door to door, implementing the same for added plastic packaging collected will be used.

Dem3: Large Chain Distribution Companies (10 MILAR stores in Valencia - Spain). The plastic packaging generated by the sale of EEE (Electrical and Electronics Equipment) is usually deposited in container for mixed waste. In LIFE RECYPACK the proposed innovations based on a reverse logistics, in which stores target the distribution centre with a dual purpose, collect Electrical and Electronics Equipment (EEE) for sale and deposit the Waste Electrical and Electronics Equipment (WEEE) for recycling.

Dem4: Professionals and SMEs (Valencia – Spain). This aims to enable 8 available Civic amenity sites to collect commercial plastic packaging. For this, the already implemented system for waste separation at Eco Park, bringing incentives to the citizens, will be adapted for the inclusion of Commercial Plastic Packaging Waste (CPPW) and separated collection.

It estimates a reduction of 70,700 t/a of plastic waste, a production of 56,600 t/a of recycled plastic, a reduction of 83,500 t/a of CO₂ eq. and a creation of 487 direct and 731 indirect jobs.

To sum up, this project will demonstrate a technical, economic and environmental proper CPPW management in the whole EU. So, we can close the loop and make new products from commercial waste

which is very similar to domestic one we are used to.

Keywords: CPPW commercial plastic packaging waste; regranulation a type of recycling process, where during granulation regranulate will be made from waste (clear or pre-washed); end product the final result of recycling process, a finished, valuable article; MFI melt flow index

INTRODUCTION

Nowadays at general level in EU the Commercial Plastic Packaging Waste is not properly managed, and consequently this plastic waste is landfilled. This fact causes social, environment and economic problems.

From a purely legislative perspective, there are currently no regulations governing the management of commercial plastic waste. Nonetheless, the studies being carried out within the framework of the project have underlined the importance of achieving a change in the legislation in order to establish mandatory requirements for the management of this waste stream. This is considered a priority, not just because of the overall quantity of this waste generated daily, but also because it is material of high quality. In other words, unlike other waste, such as post-consumer packaging waste, this fraction is normally not mixed with or "contaminated" by organic matter or any other types of material that might lower its quality in terms of recycling potential.

LIFE RECYPACK project sets the basis of the correct plastic waste management from commercial sources in urban environments at EU level, by demonstrating that this waste is a valuable resource for the EU industry by providing new recycled added-value materials and products, generation of new jobs and economic benefits.

So, the project is a clear example of Circular Economy concept, pushing new stream to recycling, reducing the environmental impact and implementing a new business model.

The proposal is structured in different points, one preparatory action and seven implementation actions, allowing the project to reach the objectives, which are among others, as follows.

- 1- Implement an innovative public-private management model in CPPW.
- 2- Reduction of quantity of plastic waste landfilled.
- 3- Production of high-quality recycled plastic.
- 4- Creation of direct and indirect jobs.

The countries involved on the project are Hungary, Italy and Spain but having a close relation and interest Poland, Croatia, Belgium and Turkey to replicate the demos developed.

1. Technical Actions.

2.1 Preparatory actions

The preparatory action in this project is related to updating of the initial situation of the commercial waste plastics managed on the geographical area of the project and Europe in general.

The result is a deliverable containing the most relevant information gathered. The objective of this document is to present several information related to plastic packaging productions and consumption in different countries, plastic packaging waste generation at national level, commercial plastic packaging waste collection in Italy and waste management options for commercial plastics. In addition, measures and instruments to foster recycling of commercial plastic packaging at national level were explored.

2.2 Technical actions.

The project is distributed in seven technical actions as we already mentioned. The first four described are related to the demo activities related to proper waste logistic management, which means.

B1: Commercial shopping centre (CSC).

The aim of the action is to perform a new and innovative model of commercial packaging plastic waste management in order to reach a higher rate of recycling of this stream. One of the main targets of this action is to collect PE from the CSC.

Regarding EPS, is a bit complicated because in these places is not easy to find it in big quantity but in fish boxes from food markets, which means that the final product obtained contains organoleptic properties which cause difficulties on the next recycling step and its price on the market.

The objective of waste collected is 0.126t of EPS and

B2: Commerce of urban centre.

The task of this point is focused in the municipality of Liria (Valencia-Spain). One of the characteristics to consider in terms of have a proper development of the system is if it is already installed a door-to-door system on the place where we want to test the new waste management of commercial packaging.

Several communication campaigns were carried out in order to inform society and in collaboration with the association of commerce and municipality of Liria.

A prior consultation was made with the 150 shops which generate commercial plastic, a total of 48 reported that they produce plastic daily.

The methodology once a store is involved on the project is strat to separate plastic packaging waste from their total generation, after that, the total amount of quantity is picked up from the stores using same method as the current door-to-door system for cardboard.

Task is developing as schedule on the proposal.

On one hand, get to the different stores and try to involve them in the new management system, seems a bit complicated in terms of approach the shops and explain them how to collaborate to the project. On the other hand, some of the stores reached, had responded very acceptable collaborating by sorting previously the plastic packaging waste generated day by day.

For doing that and get successful results, it is important to develop and control next points.

- Communications campaigns
- Teach employees for the commerce
- Have a door-to-door system establish

B3: Large chain distribution companies.

The aim of this action is to develop a reverse logistic system to collect CPPW. Progressing this fraction to a valuable end of life producing new recycled material. So, improving this system is a key point in the project in terms of quantity and quality recover from the different large chain distribution companies.

To have a proper development and to advance in the action, also a large quantity of meetings had been done among the different shops planned. The start project point was 10 stores to be involved and participate, but after more external meetings the participant increased up to 30 stores, which means more waste manage as LIFE RECYPACK system.

To develop the demo properly and because of the high density of the EPS, the partner COMELSA bought a press in terms of storage the material correctly, furthermore, doing this it reduces the pollution about the transport from its facilities to recycling ones. This equipment is capable to reduce the volume in a 40:1 proportion, obtaining large bricks of EPS. At the same time, there is a press to compact PE, however this equipment was already in COMELSA facilities.

B4: Professional SMEs. Civic amenity site per displacement of the professional.

The aim of this action is to separate collection of CPPW through direct deposit in civic amenity site (CAS), with an incentive.

To develop this action, it was very critical to contact to Valencia Consortium which are in charge of the coordination of domestic waste in this region.

One important point was including commercial plastics waste inside the common waste listed on the CAS, in terms of facilitate to the professionals the deposition of the materials as well as to get points every time they recycle. These points are converted into discounts on the waste tax. Furthermore, due to "My Environmental Account" (MEA) we were able to achieve and get the different discounts.

As a result of LIFE RECYPACK development, a separate area has been prepared to storage two main objective material (PE and EPS), with individual containers from other domestic waste. The quantity of waste recovered during the project, is transporting to Lliria facility plant in terms of control de quality of the materials and concentrate it in a one point.

Table 1. Demos and how to collect the material

Demos_Id	Demos	Collection	Collection_cont.	Collection frequency
B.1	Commercial Shopping Center	Deposition in specific containers at CSC	Container 30-50m3	Day
B.2	Commerce of urban centre	Door to door	300 litres PE bags	Week
B.3	Large chain distribution companies	Reverse logistic	Big bags and PE bag	Month
B.4	Professional SMEs	Deposit in civic amenity site with an incentive	Container 30-50m3	By demand

2.3 Monitoring actions

C1: Local socio-economic monitoring

The socio-economic monitoring will allow assessing how much and in what way LIFE RECYPACK innovations will impact on the society, on waste plastic management and recovery industry, on users of recycled material in the plastic industry, as well as retailers, citizens, wastes consortium, or others.

The direct method implies the elaboration and submission of a questionnaire in order to gather quantitative and qualitative data. The questionnaire will be elaborated by SSSUP. The other partners will support SSSUP in collecting data.

The questionnaire will address some key quantitative indicators, at least the ones described below:

- Total of plastic commerce selected in the LIFE RECYPACK model in the project areas.
- Number of municipalities that have incorporated green procurement in their ordinances.
- Number of commercial plastics recycled into new products during the project.
- Number of new products made in recycled plastic put on the market
- Number of professional users in civic amenity site.
- Reduction of transport costs in the management of waste.
- Minimization of landfill disposal costs for local authorities.

The questionnaire will contain also some qualitative questions in order to complete the analysis of the impacts of the innovation introduced by the RECYPACK. In particular, the perception and the opinion about the new system will be analysed in terms of impacts on the business models, impacts on the purchase behaviour and in the store.

C2: Environmental Monitoring (LCA)

The aim of this action is to check the environmental goals described through the proposal and try to reach them and get a decrease of the impact at the end of the project.

Having into account the situation of the project and seeing the different countries involved, four demos which implies logistic transport, we consider developing the LCA in three different hypotheses.

Hypothesis 1: describe the LIFE RECYPACK project as the proposal, which means separate in the four demos, having the environmental monitoring of each of the pilot demonstrators. Considering also the transport of the wastes to Hungary to be recycled.

Hypothesis 2: Describe a local LIFE RECYPACK, the way that it would have to work when the system will be implanted on the different countries. A real waste management of this stream.

Hypothesis 3: The actual system of this kind of materials in terms to compare the quantity which goes to landfill to the one recycled in the frame on the project.

C3: Control of the project indicators.

The aim of this action is monitoring of the project performance indicators for measuring the actual impact in the project. Main tasks related are to collect and process data from the other project partners, complete the Excel table of the KPI and analyse the data and possible deviations.

Once we could gather more information of the different processes related to the proposal the Performance indicators will be close to the real scenario.

Table 2. Key performance indicators of LIFE RECYPACK project.

	Begin Value	End Value	Beyond 3 years	Unit
Project area lenght	4.668.912,00	4.668.550,00	4.411.348,00	m2
Humans influenced by the project	0.00	30.00	250.000,00	-
Plastic waste management	1.026.000,00	1.025.920,44	969.400,00	tn/year
Energy efficiency (Consumption)	24.259.724,00	24.257.844,00	22.921.420,00	kwh/year
Resource efficiency (Soil)	4.668.912,00	4.668.550,00	4.411.348,00	m2
CO2	79.024,00	79.017,00	74.664,00	Tons of CO2 /year
Involvement of NGOs	23	30	70	number of stakeholders involved due to the project
Website (unique visitis)	400	800	850	
Website (individuals)	600	1.000,00	1.200,00	
Website (downloads)	3	5	5	
Website (visit duration)	1,5	2	2	min
Jobs	0	1,7	1.218,00	No. of FTE
Running cost of the project	0	984.466,00	10.600.000,00	€
Private investors forecast			3.500.000,00	€

2. Other actions

3.1 Waste control and validationat industrial level.

In this action we wil study the recyclability and processability of the different materials recovered from the four demos performed. Although the action will properly start next June 2019, we had performance some test of material received from COMELSA (Demo 3).

To be able to get valued regranulate after recycling process there are visual guides at service for supplying department of Remat. Based on these visual guides and lots of year practice they can supply the suitable CPPW.

Based on the analysis report our result are as follows:

1. EPE foam white (transparent) – OK (recyclable)
2. Bubble wrap PE foil transparent – OK (recyclable)
3. HDPE foil transparent slightly printed – OK (recyclable)
4. LDPE foil transparent slightly printed – OK (recyclable)
5. LLDPE foil transparent – OK (recyclable)

Based on the sample we can confirm that these CPPW materials are recyclable and the regranulate will be useful for PE film production.

3.2 Replicability

Action B7 is divided into three levels of execution. The first level of replicability and transferability begins, according to the approved proposal, in the month of October 2018. It is about analysing the best way to implement the actions carried out by the Demonstrators (Actions B1, B2, B3 and B4) in the areas of the partners where they have not been developed.

The first step is to obtain the information that is being generated as a consequence of the implementation of Actions B1-B4. These practical tests are key to analyse them and draw valid conclusions when trying to replicate these experiences in other locations under similar circumstances.

The four demonstrators have been launched with more or less success. Three of the four (D2, D3 and D4) are developed in Spain, in the Valencian Community. Four coordination meetings were held during 2018 with the aim of coordinating actions, sharing experiences, solving problems encountered and sharing progress. After each meeting RCS has drafted a MoM with the intention of collecting all the comments in these meetings and have this information available for the future replication of the model and the preparation of the Good Practice Guide.

With the information generated in the practical experiences of the Demonstrators, a first draft of Good Practices Guide has been prepared that should be qualified and specified in the coming months and that any entity that intends to replicate the proposed model should have available.

The following are the first practical conclusions that have been reached:

- Know the current situation of urban environments where it is intended to be transferred and replicate the management model of industrial plastic.
- Identify the contextual conditions under which it is possible to reproduce the proposed management model.
- Check if these conditions are met.

- Define a strategy of personalized action for each context, taking into account the resources available, as well as the legal and economic environment.
- Consider the new packaging management model as a potential source of income or other benefits (image...)
- Establish networks of collaboration among shops-public entities-recyclers-waste managers.
- Try to get the environments in which the model is intended to be self-sufficient and not dependent on significant investments to implement it.
- Design manuals of unique procedures for each context, which are clear and straightforward.
- Create an effective communication platform to share experiences and solve problems.

3. RESULTS AND DISCUSSION

As a principal results of the project development at the moment, we can consider as follows:

- 1- Several informative campaigns developed in order to awake the interest on the society.
- 2- Large quantity of shops involved. A total of 120 involved on the project.
- 3- A total of 15 tonnes of EPS recovered and 6 tonnes of PE, among all the demos.
- 4- First tests of recyclability are positive form project material samples.
- 5- Diverse communication and dissemination event have been developed with the objective to spread away the new management system for commercial plastic.

Project will end next March 2020, so we don't have extended results at the moment.

4. CONCLUSIONS

As we mention in the beginning of the document, there are different problems related of the not management of this fraction. Numerous quantities of Commercial Plastic Packaging Waste are ending up to the landfill and causing many negative consequences to the environment and the planet.

It is mandatory to create a legislation considering this kind of waste and doing its management under the obligatory of the European Commission.

Regarding the project, we consider that on one hand put a new system from the beginning could be a slow process and bring some difficulties, but after having the experience of the different demos performed, we realized that most of the system is already working in terms of equipment, logistics and knowledge. We just need to put all from a one perspective and make this to happen.

For journal title abbreviations see: <http://www.liferecypackproject.eu/>