The LIFE Programme: good practices on sustainable solid waste management

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Abstract

The LIFE programme, which was established in 1992, is the EU's funding instrument for the environment. The general objective of LIFE is to contribute to the implementation, updating and development of EU environmental policy and legislation by co-financing pilot or demonstration projects with added value.

With regards to waste management, LIFE has continuously co-funded innovative projects that upgrade waste recycling technologies and processes in a wide range of industrial sectors all over Europe. Out of the 4 489 initiatives supported by LIFE to date, over 700 have been exclusively on waste. In fact, waste management is the theme most widely tackled by the programme.

In particular, LIFE has focused on demonstrating innovative technologies that recycle specific materials from waste streams, such as hazardous, agricultural or municipal waste. Linking waste management to other environmental topics, such as climate change or the protection of water resources has been another issue much covered by the programme. Finally, LIFE has also actively contributed to waste prevention by raising public awareness, promoting the exchange of knowledge and developing information tools for better waste management.

Below you can find some examples of LIFE projects on specific waste streams such as municipal solid waste, medical waste and residues from different industrial sectors.

Keywords

waste management, circular economy, European Union, recycling, re-use, funding tool

Projects

GREEN SINKS:

The LIFE GREEN SINKS project created a new range of green innovative kitchen sinks manufactured from 100% recovered materials. These materials originate both from closed loop recycling (using the beneficiary's production scraps and the wasted sinks) and from open loop recycling (using the production waste from other national industries).

The main achievement of the project was demonstrating the technological feasibility of replacing 100% of the raw materials with recycled raw materials on an industrial scale. In particular, the beneficiary succeeded in producing green formulations with around 22% of the total recovered fillers derived from reusing the beneficiary's scraps, the rest originating from other industries. The total quantities of recycled materials during the project were: 7 849.3 kg of PMMA (also known as acrylic glass), 1 611 kg of MMA (methyl methacrylate) and 27 548.6 kg of quartz. It is estimated that by the end of 2018 the three green sink models developed by the project will help avoid some 140 tonnes of waste material (corresponding to 10 000 sinks) that is usually landfilled, with quartz accounting for more than 60% of this amount.

The full recycling of raw materials allowed the beneficiary to reduce its use of extracted raw materials, such as quartz and cristobalite, which are typically transported long distance. As a result, the company was able to lower its energy consumption and carbon emissions, thereby limiting the environmental impact and economic cost of its industrial production process. It is estimated that it achieved a 56.3% reduction in CO_2 emissions and a 64.5% reduction in energy consumption. Additionally, the amount of scraps and waste to be landfilled is also significantly reduced. Moreover, 490 tonnes of CO_2 and 5 130 000 MJ equivalent of energy would be saved due to the use of recycled MMA and PMMA in comparison to current sink production.

PRISCA:

PRISCA designed a highly replicable waste reuse centre model that can significantly decrease the amount of reusable goods sent to landfill. In particular, the project established two waste reuse centres, in Vicenza and San Benedetto del Tronto (IT), that reduced the disposal of waste and goods by reusing more than 60% of the incoming material at both sites. In each centre, goods and waste material arrive in the reception area for initial evaluation and selection, and are then sent to the workshop for small repairs and disinfection. The material is then catalogued and stored in the warehouse, equipped with ample shelving. A prior market analysis facilitates sorting and grouping of goods for distribution, according to seasonal and market requirements. There are various options for the sale of goods such as direct retail, shops, second-hand shops, itinerant traders, etc.

The project also created a software traceability tool able to read characters on labels to replace the manual input of codes and make the traceability process for intercepted goods both easier and faster. This monitoring system provides useful information, and verifies the project's target in terms of intercepted waste flows and management efficiency of the overall process from interception to marketing.

Apart from the environmental benefits produced – in terms of waste reuse and savings in GHG emissions – the project was also able to generate sustainable jobs in both reuse centres. The concept developed by PRISCA can be adapted and replicated in every single city in Europe.

EcoWASTES:

This project managed to create value from various industrial wastes (ash from power plants, oil drilling sludge and metallurgical slags) by using them for the production of construction materials. After sampling and analysing the three waste streams the project found that:

- Bottom ash can be used to replace 70-100% of lightweight granular aggregates (perlite, calcined diatomite and expanded vermiculite).
- Oil drilling sludge can be used to replace up to 30% of feldspathic clay in brick production.
- Metallurgical slags present high content of calcium oxide and calcium silicates can be used as potential hydraulic binders for structural concrete.
- Fat grey clay from uncovering works during lignite extraction (not initially foreseen by the project) can be reused as plasticizer and ceramic binder.

The project used these materials to develop four groups of products:

- Heat-resistant lightweight concrete, that showed better performance in terms of lower heat losses and better adhesion than common concrete.
- Lightweight fired bricks: 20% lighter (lower transport costs) and less energy intensive (lower burning temperature and shorter combustion period).
- 'Embossing table' for road and sidewalks construction.
- Structural concrete products (e.g. moulded resistance structures, etc).

All these products hold high replicability and market uptake potential as they can be manufactured with existing equipment.

Biorewit:

The Biorewit project developed a series of soil eco-activators, soil-less substrates, and subsoils from textile and agricultural waste (e.g. wood waste, straw, dry biomass). The proposed technology involves a series of prototype units consisting of a grinder for producing eco-activators; installation for impregnation; installation for esterification (chemical synthesis of esters); two lines of mechanical consolidation for producing biodegradable agro-nonwovens, soil-less substrates and pellets as organic fertilisers; a subsoil robot to automatically aggregate the material to produce soil-less biodegradable substrates; and an installation for processing waste organic subsoils.

One of the main added-values of the technology is its flexibility: it is possible to operate the units either independently or all together as one full technology line. In particular, the project developed eight effective and environmentally beneficial agriculture products: two fertilisers (Ekofert K and L); two biodegradable N-enriched bio non-wovens (Covelana K and L); a subsoil (Biopot); two mineral-organic soil improvers (AgroFert D and W); and a biodegradable substrate for greenhouse production (FertiVeg). The project tested the products in agriculture and they provided many benefits in terms of crop yield and improvements in water and soil quality, among others. Indeed, the beneficiaries have already patented two of the products (Biopot and Covelana) in Poland.

Wooldryscouring:

The Wooldryscouring (WDS) project demonstrated an innovative and cost-efficient wool scouring cleaning process to remove impurities and to recover lanolin and other by-products in the early stages of wool manufacturing. The new technology uses organic solvents instead of the hot water with alkalis and detergents used in conventional wool scouring. The processed wool was whiter, cleaner, smoother and had larger fibres, than conventionally scoured wool.

In terms of quality, the project's wool was practically free of grease content, with 95% of wool grease (lanolin) being recovered for use as a valuable by-product for the cosmetic industry. In addition, nearly 100% of the wool dust was recovered, which could then be used as an agricultural fertiliser. The project produced other environmental benefits such as a significant reduction in water, energy and chemicals consumption (70%, 30% and 70% respectively), making it also cost-efficient. The Economic Assessment conducted by the project team showed that the WDS process should be economically viable in Europe and holds a high replicability potential. The project's technology represents a significant step towards achieving a closed loop concept where all the current wastes streams are recovered as by-products, in line with EU circular economy policy and the Europe 2020 Strategy for smart, sustainable and inclusive growth.

MEDWASTE:

The MEDWASTE project demonstrated the efficiency of microwaves as a technically, economically and environmentally feasible alternative to traditional methods for disinfecting medical waste. In particular, the project used industrial generators of microwaves – magnetrons to destroy the pathogens.

The device, which has a capacity of 60L/45 minutes, treated the waste at a temperature of 100 degrees. Once the pathogens are destroyed, the final product can be safely handled and treated by traditional waste management methods. The business plan confirmed that the prototype is financially attractive compared to the other methods of treatment currently used in medical units and is ready to reach the market. For example, if one compares the cost of using a microwave disinfection device with that of an incinerator and its processes, the difference is significant: a one-off cost of €7 200 for the microwave disinfection device versus a cost of €52 800 a year for an incinerator.

Waste3 :

The Waste3 project converted waste (slag) from the copper metallurgy process into environmentally-friendly heating elements and semi-conductor glazes to be used in residential applications. After collecting and characterising the slag, the project constructed a pilot plant for treating the waste via two techniques: sintering and melting.

The project managed to green the production process of a wide variety of items including: microwave-absorbing panels, casserole dishes and heating tiles, which all contain a high amount of recycled slag. In particular, recycled slag amounted to approximately 450/700 grams per auxiliary microwave absorber (depending on the product's features), about 7 000 grams per square meter of tile/floor heating element, and 700 grams per kg of ceramic enamel. This process brought both environmental and economic benefits as the new products led to energy savings thanks to the substitution of raw materials. In addition, the physical properties of the recycled slag –which can be processed at lower temperatures-, make the fabrication process less energy intensive.

DIM-WASTE:

The DIM-WASTE project built and tested a full-scale prototype to transform sewage sludge and mineral waste (silica and glass dust) into various types of lightweight aggregate to be used in the construction sector. The up-scaled mobile line developed by the project involved heat treating a combined mixture of sewage sludge, silica mineral waste and powdered glass cullet, and adding water to produce granules of various sizes (in a granulator). This material is then dried and passed through a rotary furnace, with the exhaust gases being treated in an exhaust installation. The burnt aggregate is sorted and sold as lightweight aggregate.

The prototype was tested and monitored under different operational conditions of known parameters. A total of 10 tests were performed to assess aggregate quality and 16 other tests were carried out to assess post-reaction gas emissions. Monitoring of environmental performance showed that the emission levels were in compliance with legal standards and the technology does not produce any solid waste (ash). The main characteristics of the produced aggregates were as follow: bulk density of 663 g/cm3 (+/-13%); impregnability 24.5% (+/-28%); crushing or compressive strength 2.9 MPa (+/-40%); and frost resistance 0.5 (+/-30%). All samples of the aggregates met Polish standards regarding lightweight aggregate products used in the construction sector.

This innovative technology holds high replicability potential and if commercialised and widely used, could support the transition to the circular economy in Poland and other EU countries.

References:

All the information in this abstract has been extracted from the LIFE programme project database: http://ec.europa.eu/environment/life/project/Projects/index.cfm