eco-systèmes récylum

Recycled plastics

Practical guide for integrating recycled plastics into the electrical and electronic equipment

ESR

ESR is a non-profit collective take-back scheme accredited by the French Public Authorities, covering the activities of both Eco-systèmes and Récylum. Within ESR, Eco-systèmes coordinates the collection, depollution and recycling of used household electrical and electronic equipment. Récylum coordinates the collection, depollution and recycling of lamps, professional electrical and electronic equipment, and small fire-extinguishing devices reaching end of life.

Why this guide?

France currently generates 3 million tons of plastic waste per year. Of this, between 250-300 000 tons only is recycled and integrated into new products[1]. Increased integration of recycled plastics would constitute a real environmental benefit in terms of CO_2 emissions and energy consumption.

The recycling of plastics and their integration into new products have become an essential part in the transition to a circular economy, and represent a common stake for all electrical and electronic equipment, household as well as professional. For the manufacturers of these products, increased integration of recycled plastics into new equipment has several strategic intrerests: reduction of environmental impact of the product, potential financial savings, satisfying customer expectations and market demand, or even anticipation of regulatory considerations. However, the specificities of the plastics used in electrical and electronic equipment – diversity of resins used, high technical and regulatory requirements, long lifetime, etc. – call for adapted answers. The purpose of this handbook is to accompany manufacturers of household and professional electrical or electronic equipment in their projects of integration of recycled plastics as soon as their strategy and motivations are defined beforehand in a clear regulatory framework.

This guide is intended particularly for Environment or Sustainability Managers, Eco-design Experts, Design Department as well as Plastics Experts and Plastics Purchasers.

This guide has been written by ESR with the contribution of FIEEC.

1. National recycling report 2005-2014, ADEME 2016

CONTENTS

Integrating recycled plastics: where to begin?

To integrate recycled plastics obtained from WEEE or other types of waste, you are advised to apply the following three rules:

1 ABOLISH PRE-CONCEIVED IDEAS

The first thing to do is to get rid of your pre-conceived ideas on this subject, and consider launching these projects in a spirit of pragmatism and objectivity. How? By consulting experts opinions concerning all the obstacles already identified by producers **(see pages 6 to 17)**.

2 GET SUPPORT

We can support you throughout your project and arrange for you to meet qualified experts from the recycling industry and plasturgy. You can work in partnership with them to test your integration of recycled plastics.

To help you convince people internally and communicate externally, we can even help you calculate the environmental benefits related to the integration of recycled plastics obtained from WEEE or other waste.

3 PROCEED STEP BY STEP

STEP 1: **Acquire an initial experience** with limited investment and risk.

The first step is to identify the parts that could most easily be manufactured with recycled plastic: not too many technical (mechanical, electrical, thermal, etc.) or aesthetic constraints, easy moulding, high tolerances, etc. All products have some of these!

This approach, which is often a modest one, provides an initial experience that will prove essential for what follows. It lets you achieve the following, without major investment:

- **Mobilise and motivate** a restricted team on the project (a Design Department technician, a Production Technician, and a Purchaser).
- **Make you initial contact** with one or more suppliers of recycled plastics.
- **"Demystify" the feasibility of production:** reassure the operators and technicians in charge of moulding parts.
- **Prove the feasibility:** these first parts will be demonstrators.
- **Unite** everyone around the project, and communicate internally, including towards the General Management.

Helpful tip! To limit the risks and take advantage of an encouraging first experience, you can start by integrated recycled plastics into hidden parts, dark-coloured parts with a matt finish, or internal layers / sandwich constructions. This is a common practice for instance in EEE of the construction sector (tubes and profiles).

STEP 2: **Broaden the experiment** to more complex parts (higher technical and aesthetic constraints) and already produced in large series.

- **Build a multi-disciplinary project team** to include a project leader, a design office leader, a plastic processing specialist, a purchaser, the QHSE manager(s), a person from marketing, and a laboratory technician if any.
- **Draw up a funding application** for development work. In France, it could be supported by ADEME[2], the French Environmental Agency (ORPLAST scheme, Investments for the future and regional support) and by regional governments (innovation/environment funding).
- **Select one or more parts** whose production is well controlled by the plastics processing experts (for which only one parameter can be varied: the material).

2. www.ademe.fr

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- **Send the specification** to the supplier of the recycled plastic (generally corresponding to the specifications of the virgin material already used).
- **Perform the tests:** possible iterations with the recycled plastic supplier, with the plastic processing expert (minor adaptations to the mould), with the Design Department (minor modifications to the part), with the production teams, with the Social and Economic Committee when a pilot production run is initiated…
- **Qualify the manufactured parts** (i.e. measure the properties).
- **Involve management.**
- **Involve the social partners** or the Social and Economic Committee.
- **Take advantage of expertise** to be able to apply it to other products.

You can also start with a plastic part composed of a mixture of virgin and recycled material, which will be easier to use, and will be a first step to improve environmental benefits.

Did you know? Recycled resins can come from WEEE or other waste. Depending on needs and constraints, it can be easier to start from a known waste stream (WEEE, car bumpers, etc.) of items similar to the products to be manufactured, because the processes are similar and the grades of resin used depend on the choice of process. For example, the PS in small professional electronic devices is a different injection grade from the PS in a refrigerator, which is a thermoforming grade, and from the PS in a cup. Likewise, the PP in small electrical devices is an injection grade, whilst the PP in packaging is a thermoforming grade.

STEP 3: **Develop new parts** and the corresponding moulds whilst taking the characteristics of the recycled plastics into account.

- **Identify wider opportunities and possibilities** for the manufacture of most plastic parts, in particular based on more standard (and therefore less expensive) grades of recycled plastic.
- **Develop R&D partnerships** with institutional partners (for instance with ADEME in France), universities, collective take-back schemes, and plastics suppliers for special formulations.

Testimonial: According to Ingrid Tams, Environment Manager for the Groupe SEB and Project Manager for the integration of recycled plastics into their products, the ingredients for the success of such an initiative are:

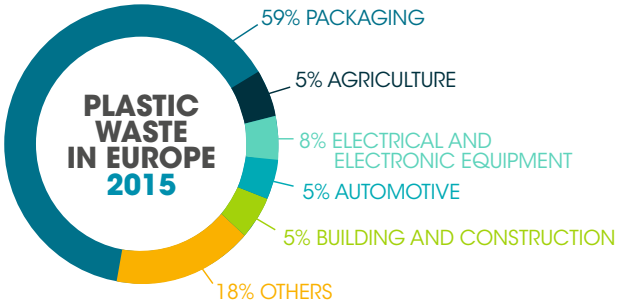
1. **Make sure the management is committed to it** (company objectives are a plus);
2. **Create a project team** with at least one operational project manager (to coordinate a very large number of stakeholders!), one person from Purchasing and one person from Marketing, who must be closely involved to bring the project into the standard product development process;
3. **Use the development and qualification processes in place:** there is no need to rebuild everything;
4. **Take the industrial effects into account:** any adaptations to the process that might be necessary must be identified, and operators must be prepared and reassured, because they sometimes have negative preconceptions about recycled materials;
5. **Demand a transparent, committed, and responsive relationship with your suppliers,** who should be able to adapt and demonstrate the REACH and RoHS compliance of their recycled plastics.

Abolish preconception: expert opinions

1. Bulk supply of recycled plastics in regular flows

"Post consumer" recycled plastics only come from recycled packaging. FALSE

In Europe, the packaging industry sector represents approximately 40% of total plastic consumption and generates around 60 % of the stream of plastic waste.



Source : Eunomia (2017)

In Europe, **27.1 million tons of plastic waste were collected in 2016, of which 8.5 were recycled[3].**
Packaging waste represents 80% of total recycled plastic (i.e. more than 6.8 million tons, but that leaves almost 2 million!).

Did you know? The Fédération de la Plasturgie et des Composites (French Plastics and Composites Federation) says that 590,000 tons of plastics were recycled in France in 2015. The aim is to increase this quantity by 50% in 2020, i.e. a total of 900,000 tons. In addition, the European Strategy for Plastics in a Circular Economy published by the European Commission in January 2018[4] proposes a recycling target of over 50% by 2030 for all plastic waste.

No recycled plastics come from WEEE. FALSE

The volume of recycled plastics from WEEE in Europe is estimated at 300,000 tons per year[5].

In France, the ADEME/DGE/2ACR study carried out by Deloitte estimates that, out of 440,000 tons of recycled plastics produced in France in 2012, 30,000 tons come from WEEE (mostly PP).

The resins from WEEE currently recycled are polyolefins (PP and PE), PS, ABS, and to a lesser extent, PA, PC, ABS/PC and PMMA.

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3. Plastics - the facts 2017, PlasticsEurope
4. EUR-Lex - 52018DC0028
5. Analysis of the plastics recycling value chain in France, March 2015: www.ademe.fr/analyse-chaine-valeur-recyclage-plastiques-france

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There are no, or very few, European and/or French suppliers. FALSE

Many French or European companies are able to supply recycled plastic. Some of these companies specialise in streams from WEEE, and others work also on the basis of other streams (ELV, packaging, etc.). We can put you in touch with these suppliers according to your needs (resins, quantity, location) and their industrial capacities.

There is no reliable supply from post-consumption waste (WEEE in particular). FALSE

EEE manufacturers brings to waste treatment and sorting operators information facilitating the management and recycling of their equipment at end of life and have tools allowing to take into account the possibilities of recycling for new equipment under development. For instance, APPLiA and DIGITALEUROPE have created the I4R (Information for Recycling) online platform (https://i4r-platform.eu/) to make available this information.

Additionally, the waste value chain is being structured, allowing many European and French players to be able to supply recycled plastics from WEEE, formulated for EEE applications or other manufactured products.

We can facilitate your contact with those companies.

It is impossible to develop a reliable supply chain. FALSE

The companies named are generally ISO 9001/14001 certified at least, and able to deliver in France, in Europe, and all over the world. They already have considerable experience of manufacturing culture, and work with car equipment manufacturers, the packaging sector, etc. However, the choice of recycled plastic supplier is crucial to the success of the project: transparency, commitment and involvement at every phase of the project should be selection criteria. Integration projects often involve partnership contracts.

The packages are unsuitable. FALSE

Recycled plastics obtained, in particular from WEEE are generally available in 25 kg bags, big bags, octabins, or bulk tanks. The packaging is no different from that of virgin materials.

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They commit themselves! Through a sectoral commitment signed in July 2018[6], FIEEC initiated with its members a joint approach aiming at integrating more recycled plastics into new products. This commitment covers the whole life cycle of products and reveals the conditions of success to determine the scale of the transition to more circularity of plastic materials.

HP, Legrand, Schneider Electric and Groupe SEB have also taken individual commitments to significantly increase or double the part of recycled plastics in their new products by 2020 to 2025, at national or international level.

6. *More information on FIEEC website: www.fieec.fr/integration-de-plastiques-recycles-le-secteur-des-industries-electriques-electroniques-et-de-communication-sengage-aux-cotes-du-gouvernement*

2. Supply of quality recycled plastics

The origins of the WEEE plastics are unknown and random. FALSE

WEEE Plastic waste treatment facilities are subject to an operating licence, and most of them are certified by WEEELABEX[7] (European WEEE treatment standard). They control the origin of the plastics. This means that WEEE is treated according to stream: SHA (Small Household Appliance), Screens, LHA (Large Household Appliance) cold and non-cold, SPE (Small Professional Equipment), LPE (Large Professional Equipment), and other specific professional equipment.

Experience shows a stability in the composition of the plastic fraction from each main stream.

The plastics are mixed, so the sorting and regeneration performance is inadequate. FALSE

The equipment is collected in mixture, then the material separation processes implemented by the actors use automatic and efficient technologies capable of identifying and separating plastics with a high level of reliability. These technologies may include infrared spectroscopy, visible or laser recognition technologies, x-ray fluorescence, XRT technology (x-ray transmission), densimetric sorting, triboelectricity, etc. Similarly, the know-how of compounders and regenerators can allow to achieve grades meeting industrial requirements.

The next stage, compounding, can allow to achieve a level of quality that can be comparable to that of virgin resin.

The sorting and regeneration processes are unsuitable for industrial requirements (ISO certification, process capability). FALSE

Most participants in the plastics recycling chain are now WEEELABEX[7], ISO 9001, or ISO 14001 certified, and have significant experience of relations with industrial customers. Very high-performance sorting technologies are already being used by some recyclers.

The quality is random because the recycling chain is still in its infancy, and some marginal players are involved. TRUE FALSE

The chain comprises many companies of different sizes and different levels of expertise. Despite this, it is already possible to work with experienced, recognised suppliers who have control over the quality of the recycled plastics they produce every day. We can put you in touch with them.

There are no data on properties and performance characteristics, and no technical data sheets. FALSE

Suppliers usually provide a catalogue of their recycled plastics and the associated technical data sheets. The contents of the technical data sheets may vary from one supplier to another, but any given supplier will provide the same information for recycled and virgin plastics.

Did you know? Technical data sheets contain at least the rheological, physical, and thermal properties of the recycled plastic and, optionally, the RoHS, REACH, and fire-resistance compliance characteristics measured according to the ISO (or ASTM) standards applied by all plastics manufacturers. The presentation of results may vary from one supplier to another and may not be a perfect match for your needs (e.g. IZOD or Charpy impact resistance). It is important to specify your requirement to the supplier.

7. www.weeelabex.org

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There is no guarantee concerning the quality or uniformity of batches. FALSE

The suppliers (compounders) generally have a test laboratory: tensile and bending test bench, impact pendulum (IZOD impacts), DSC/ATG, infrared spectrometer, colorimeter, calciner, plastometer (MFI), etc. The batches generally correspond to a full 20-22 tons truckload. They are filtered and homogenised during compounding, and then qualified. These practices achieve a quality level compatible with customer needs for closed-loop (WEEE to EEE) or open-loop reuse.

There is no performance guarantee over time. FALSE

Provided that the contamination level and conditions of use by the plastics manufacturer are controlled, the performance characteristics corresponding to those listed on the technical data sheet remain valid over time.

Recycled plastics may be contaminated with regulated substances. TRUE FALSE

The sorting, separation, and regeneration processes can only eliminate certain types of contamination, most notably the bromine from brominated flame retardants. In France, for example, plastic sorting operators are subject to controls in order to guarantee a sorting quality of brominated plastics above 99.8%. This can cause problems, in particular with newly regulated substances (e.g. some phthalates in RoHS). Many suppliers already guarantee the absence of contamination in accordance with regulations based on extensive testing to guarantee compliance.

Did you know? Many electrical and electronic devices contain flame retardants (brominated, chlorinated, phosphated, etc.) to comply with fire protection regulations. Several brominated flame retardants (BFRs) have negative effects on health and the environment or are strongly suspected of having such effects. Some of them can accumulate in living organisms. These are known as Persistent Organic Pollutants (POP). Most of these retardants are now prohibited in manufacturing or authorised in very limited quantities (European Directive RoHS, European Regulation REACH, European Regulation POP, etc.).

When collected, WEEE are by definition old products that can contain molecules that were permitted at the time of their manufacture and market launch. With regard to their recycling, the European WEEE directive imposes the sorting of brominated plastics in order to avoid exceeding the 2000 PPM (0.2%) "total" bromide threshold, irrespective of the chemical formula of the brominated additive. Analyses have confirmed that this level guarantees that the thresholds imposed on the manufacturer (RoHS) for a new product are observed.[8]

In France, ESR (Eco-systèmes) made a commitment in 2010 to a campaign to clarify the regulations, which were incomplete at that time. This resulted in the writing of the 'circulaire plastique' dated 30/11/2012[9]. Since 2015, this work has continued via the implementation of a development policy for an industrial tool able to achieve the sorting performance imposed by the regulations; this resulted in the setting up of several plastic sorting centres. These are subject to precise inspections. Moreover, strict rules for the elimination of fractions with a high bromine concentration (after sorting) have been established in 2017 and are regularly followed up with Public Authorities.

8. INERIS-DRC-17-164547-01461B: www.ineris.fr/sites/ineris.fr/files/contribution/Documents/Rapport INERIS-DRC-17-164547-01461C.pdf
9. https://aida.ineris.fr/consultation_document/23317

Recycled plastics give off odours during processing. TRUE BUT...

These effects cannot be ruled out. When applicable, tests can be carried out to identify the molecules responsible for the odours. These odours usually disappear when an extraction system is added to the production tools. It is important to have discussions with the Social and Economic Committee before the project and to prepare the operators for changes to processes and supply. If necessary, measures concerning workers' exposure at the workstation may be proposed to eliminate any risk to operator health.

These odour problems during processing (and not in the finished product) may be related to the presence of a tiny quantity of impurities in the recycled plastic.

They might also come from structural deterioration of the thermoplastics or the additives they contain during successive processes (the impact on the properties is often minor) or be related to exposure to UV and other stresses during the usage phase of the objects.

The performance characteristics of the recycled plastics (technical data sheet) nevertheless take this history into account. Post-consumer recycled plastic can therefore be used either as is (validation of performance characteristics for the requirement) or it can be doped during compounding in order to achieve the required properties.

Moulded parts using recycled plastic give off odours (problem experienced by customers). FALSE

If this were true, the problem would be detected during the first material qualification tests. This means that the likelihood of finding this problem during bulk production or at the customer's site is almost nil.

The more times plastics are recycled, the more they will deteriorate. TRUE BUT...

This is true, but at present the problem does not arise because of the low rate of recycling of plastics. In addition, the compounder can add additives to better answer to the functional specifications of plastic integrators.

Virgin and recycled plastics cannot be mixed. FALSE

Virgin plastic can be mixed into recycled plastic. This can be a first step to start an integration process and thus obtain economic gain and environmental benefits.

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When equipment manufacturing sites are located in Asia, the integration of recycled plastics is difficult. FALSE BUT...

As for virgin material, exports of recycled plastics from Europe could be possible as long as they do not contain polluting or regulated substances, which is guaranteed by the French approved sector. However, it would be relevant to evaluate the environmental impacts of this choice with regard to the benefits generated by the use of recycled plastics, thanks to a life cycle analysis for instance. We can provide support for environmental evaluations.

In addition, Asia, and China in particular, have plastic recycling sites, some of which perform very well. Many producers of new resins have compounding units in China in order to be near their customers. However, producers are advised to perform quality and regulatory checks on these materials in the same way that this is already implemented by producers for virgin material.

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3. Supply of recycled plastics compliant with specific user specifications

Recycled plastics cannot be processed with the production equipment used to transform virgin plastics. The usual production equipment is not suitable. FALSE

The production equipment (injection moulding presses, moulds, extruders, etc.) used for production with virgin material can also be used with recycled material provided that the recycled material has similar characteristics (particularly the rheological properties).

For slightly different characteristics, very slight changes to the settings or the moulds performed directly by the plastics manufacturer may be considered. For recycled materials with very different properties from the virgin material, the equipment (and particularly the mould) should take this into account from the part's design phase.

If a manufacturer decides to change its supplier of virgin material or replace a virgin resin with a recycled grade, a qualification procedure must be applied. This includes qualification tests and a quality audit of the compounder's process.

Did you know? According to a December 2016 study by the Federation de la Plasturgie et des Composites (French Plastics and Composites Federation), nearly 60% of companies surveyed "claim to have the in-house skills to develop products incorporating recycled plastics".

The injection or extrusion of recycled plastics is too difficult because of the risks of deterioration. FALSE

The plastics manufacturer can generally mitigate these risks by adjusting the processing parameters (temperatures, pressures, speeds, cooling times, etc.). This empirical approach is also applied to virgin plastics.

Moulded parts using recycled plastic are more fragile. TRUE FALSE

This is possible if the technical properties are inferior. Localised reinforcement of certain plastic parts (adding a rib, modifying a radius, local increase in thickness) may mitigate this risk of fragility. On the contrary, parts moulded with recycled material can be stronger, for example when replacing virgin PS with cheaper recycled ABS, which has better impact resistance than PS. Integrators of recycled plastics can take into account these specificities by adapting their R&D effort.

The performance characteristics of parts moulded with recycled plastic are less reliable over time. FALSE

If the recycled material has passed the qualification tests, there is no reason to believe that it would lose its reliability.

The technical (mechanical, thermal, and electrical) properties of recycled plastics do not satisfy the very specific requirements for EEE. FALSE

A very wide range of recycled plastics is available. Moreover, the specific properties required can be created on demand during compounding operations. EEE devices are made up of some technical and some less technical parts. The aim is not to permanently ban virgin plastics, but to replace them with recycled plastics whenever possible. With this in mind, the use of recycled plastics in the manufacture of large parts (external housings and casings, etc.) can account for 80% of the total mass of plastics in the final object.

Recycled plastics can only be used for hidden parts. FALSE

Some examples to the contrary, particularly for EEE devices (Groupe SEB, Electrolux, Philips, HP, Schneider Electric, etc.), automotive parts (spoilers, ashtrays, other interior trim parts), office equipment (luminaires, waste baskets, footrests, seats, etc.). In such cases, except for limits in terms of colour, the appearance of the plastic parts did not cause any problem.

Recycled plastics do not provide sufficient assurance concerning the absence of cosmetic defects. TRUE FALSE

It is true that the risk is higher. Qualification tests on the recycled material and the moulded parts are essential prior to validation for mass production. Afterwards, the implementation of a quality assurance system with the supplier should allow normal production to take place. Consideration of a higher rate of defective parts could also be incorporated upstream of the project, to evaluate the economic relevance and plan the necessary organisation.

Recycled plastics cannot provide the same characteristics in terms of finishing. TRUE FALSE

This constitutes a limitation for certain very specific applications. For example, velvet or textured finishing can only be obtained by grades formulated specifically for the purpose; or a gloss finishing is far more difficult to obtain than a matt finishing. In such cases, the use of recycled plastics does not seem appropriate, at the moment, from an economic standpoint.

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Recycled plastics from WEEE are not available in white. TRUE EXCEPT...

This is true, except for recycled plastics from Large Cooling Household Appliance and colour-sorted WEEE (note, however, that impurities are more visible with a white grade). Nevertheless, a painted finish is also possible in certain cases. Light grey shades can be obtained if colour sorting is performed, but this will probably make the cost of the recycled grade higher. Otherwise, the grades will mostly be dark shades (black, grey, blue, burgundy).

There is no equivalent or solution with recycled plastic to replace the highly technical plastics used in critical components for their technical properties (mechanical, electrical, thermal). TRUE BUT...

Certain electrical or electronic components are made of highly technical plastics that obviously have no recycled equivalent, except for PA and PMMA in certain cases. But in terms of mass/volume, these are minority applications, so do not prevent the use of recycled plastics for the common applications that represent the vast majority of volumes.

There is no equivalent or solution using recycled plastic to replace the plastics used in the medical, cosmetic, military and other sectors. TRUE

Recycled plastics are generally excluded from these applications, which have very specific requirements (hygiene / medical, technical / military, pharmaceutical, luxury brands & cosmetic applications and to a lesser extent food contact applications).

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4. Regulatory aspects

Recycled plastics may be contaminated with regulated substances. TRUE FALSE

European regulation imposes a number of obligations concerning the materials resulting from the recycling of equipment. In the case of plastics, it is essentially a matter of sorting out those containing brominated flame retardants (although not all of them are prohibited), which have been used to protect consumers from fires during the product's life. In France, the quality of these plastics is subject to numerous controls to ensure that the 99.8% regulatory quality threshold is respected. If the quantity of total bromine (used as a tracer for regulated molecules) is indeed below the legal threshold of 0.2%, then it has been verified thanks to works of INERIS[10] that the concentrations of regulated bromine compounds comply with the different REACH and RoHS thresholds set for each substance. Nevertheless, many new substances are emerging and regulations are gradually being tightened. It is therefore the responsibility of plastics manufacturers and their customers to ensure the conformity of the material concerned, depending on the intended use for each plastic.

Did you know? There is no need to perform an exhaustive compliance check at each delivery, because the plastics from certain streams (e.g. SHA) is found to have a stable composition and certification of the quality of the processes used by suppliers allows such checking to be avoided. On the other hand, it is necessary to check this compliance for each type of recycled plastic, even from the same supplier. Compliance can therefore not be simply declared for a particular supply source in the generic sense. The conclusion is that compliance is declared for a material and a supplier.

There is no clear end-of-waste procedure. FALSE

Waste collections organised under the supervision of collective take-back schemes accredited by national authorities, strict sorting operations by recyclers, the technical resources and regeneration processes implemented by compounders, and the inspections and tests carried out by approved laboratories, currently constitute a pragmatic and credible process to enable recycled plastics to be put on the market. The final report published by JRC in October 2014[11] is the reference for the procedure and the criteria to be applied. The French Ministry in charge of Ecology published a "Notice to operators of waste treatment facilities and operators of production facilities using waste in substitution for raw materials" in the Official Journal dated 13 January 2016[12]. This notice perfectly clarifies the legal status of recycled plastics and confirms the possibility of using recycled plastics obtained from waste to manufacture new objects. In this case, the items produced remain subject to the requirements of REACH, POP, RoHS and CLP regulations (classification, labelling and packaging regulations).

There is much uncertainty concerning regulatory requirements, particularly REACH. Compliance is difficult to prove. FALSE

The simplest method is to apply the recommendations in the October 2014 JRC report[11]. The tests may be performed by approved laboratories with experience in this field. The labs may select the tests that are relevant to perform on the plastics: heavy metals (cadmium, lead, mercury, chromium VI, etc.), brominated flame retardants (PBB, PBDE, others), relevant substances from the SVHC list (Candidate List of substances of very high concern for Authorisation), etc. to issue certificates of compliance concerning RoHS, REACH Appendix XVII (EC) No 1907/2006, POP (EC) No 850/2004 regulations and other specific requests or instructions from the customer.

Most recycled plastics obtained from WEEE are not compatible with RoHS regulations. FALSE

Suppliers of recycled materials can provide materials that comply with RoHS regulation and provide RoHS compliance analysis certificates.

10. INERIS-DRC-17-164547-01461B: www.ineris.fr/sites/ineris.fr/files/contribution/Documents/Rapport INERIS-DRC-17-164547-01461C.pdf
11. JRC-IPTS, Monitoring impacts from Council Regulation (EU) N° 333/2011: End-of-waste criteria for Al/Fe scrap, October 2014, available via the following links: https://protect-eu.mimecast.com/s/_jlcC0VnLHkB7w0gUwMq5W?domain=susproc.jrc.ec.europa.eu, http://susproc.jrc.ec.europa.eu/activities/waste/documents/LF-NA-26884-EN-N.pdf
12. JORF n°0010 dated 13 January 2016 - regulation No.106 available here: http://urlz.fr/4WI8

Did you know? The articulation of regulations applicable to substances, products and waste can include several obstacles to the development of a circular economy. FIEEC has argued for several years for a holistic approach of these regulations, in favour of the reuse of recycle materials without prejudice of tehnical, sanitary and environmental properties of the equipment. A broad consultation has been enhanced by the European Commission in that respect in 2018[13].

There are no quality baseline to qualify recycled plastics. FALSE

There are standards (EN 15 343 for traceability EN 15 342 to 345 for the characterisation of recycled PS, PE and PP materials)[14], but they are inconsistently applied. European Strategy for Plastics in a Circular Economy from the European Commission (January 2018)[15] encourages the defining of quality standards for recycled plastics.

Until then, qualification can be declared on the basis of the following criteria:

- Regulatory requirements (REACH, RoHS, POP, CLP, etc.),
- Recommandations from JRC,
- Specific customer requirements (i.e. banned substances),
- Technical specifications (mechanical, thermal, rheological, and electrical properties, colour, etc.),
- Production of the technical data sheet,
- Information contained in the material safety data sheet, where available.

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There is no official label to qualify recycled plastics or guarantee their origin. FALSE

The customer may ask the supplier for a certificate providing these guarantees. There is also European quality and traceability certification for regenerators of post-consumer plastics, called EuCertPlast[16].

Food contact is impossible. TRUE FALSE

This remains a difficult goal to reach at any reasonable cost with recycled plastics obtained from WEEE, because food certification is required and a strict specification must be adhered to. This requires close collaboration with all stakeholders, as well as R&D work. Also note that grades obtained from food packaging such as PET are not particularly compatible with EEE applications. EC Regulation No 282/2008 specifies the possibilities for the use of recycled plastics in food contact applications.

There is no regulatory requirement concerning the integration of recycled material. TRUE BUT...

The French Roadmap for a circular economy ("Feuille de Route Économie Circulaire", FREC)[17] invites in its measure 1 to integrate in the products more materials proceeding from recycling activities while ensuring their quality, traceability and a real security for the citizens.

The European Commission's strategy for plastics in a circular economy[15] supports an improvement of the economy and the quality of the recycling of plastics thanks to actions aiming at improving the recycled content.

Did you know? During a future revision, the ERP (or "Eco-design") directive should extend its requirements to criteria concerning the efficient use of resources (or material efficiency) such as recyclability, durability, integration of recycled materials, etc. In this context, the European Commission has mandated European standardisation bodies CEN and CENELEC to produce standards concerning the definitions and calculation methods for material efficiency indicators. A standard defining a method for assessing the recycled material content in energy-related products is currently being developed.

13. www.ec.europa.eu/info/consultations/public-consultation-addressing-interface-between-chemical-product-and-waste-legislation_fr
14. EN-15 342 Recycled plastics - Characterization of polystyrene (PS) recyclates, February 2008, EN-15 343 Recycled plastics – Plastics recycling traceability and assessment of conformity
15. EUR-Lex - 52018DC0028
16. www.eucertplast.eu
17. www.ecologique-solidaire.gouv.fr/feuille-route-economie-circulaire-frec

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5. Economic aspects

The price of recycled plastics is not favourable when the price of crude oil is low. TRUE BUT...

That is true. However, the possible competitiveness on recycled plastics obtained from WEEE compared to virgin plastics is generally much higher than the margins on plastics obtained from packaging (polyolefin), which are the usual types (often the only ones available) in the price lists of recycled plastics.

The fixed costs to produce "basic" recycled polyethylene or polypropylene are globally the same as those required for the more "technical", higher-value plastics (in particular styrene-based ones, PC, ABS-PC, PMMA, and even PP copolymers obtained from WEEE). For recycled plastics obtained from WEEE and intended for higher added value applications, lower oil prices have less effect on competitiveness. This means that a difference between the price of recycled plastic and the price of virgin plastic can often be maintained. The more "technical" the plastic is (ABS, PC), the greater the price differences between the virgin and recycled materials.

The price difference compared to virgin plastic does not compensate for the additional costs of production and flaws. FALSE

Recycled plastic is generally less expensive than virgin plastic. In 2016, the difference between this recycled material and its virgin version was around 300€/t for PP[18] and could reach up to 800€/t for ABS[18]. Particularly for the integration of styrene-based plastics, this difference can absorb any additional costs that might be significant (equipment qualification procedure, pre-test, laboratory tests, etc.) or losses of manufacturing efficiency (lower yield, more manual handling, etc.). But there is a gain if all of the equipment production phases are taken into account. Moreover, it is important to work in partnership with recycled plastic suppliers to maintain an acceptable quality level and limit production losses.

The recycled material qualification process is long and costly. TRUE BUT...

Yes, but in most cases the same qualification process would also have to be carried out with the virgin material. This process can last two to three years (this includes pre-tests on low tonnages, and then bigger tests with an analysis of the chemical, mechanical and rheological properties of the resins concerned). In case of a minor change, a simplified procedure can be performed.

The R&D costs are high. TRUE BUT...

It is an investment (in particular, the R&D costs include the costs of the qualification procedure, pre-testing, laboratory tests, etc.), and its long-term profitability needs to be estimated.

The technical, scientific and logistical resources required to conduct these projects are not available. FALSE

Partnerships are possible (collective take-back schemes, recyclers, compounders, universities, etc.). We can support you and put you in touch with the relevant players.

Did you know? According to the survey conducted in December 2016 by the Fédération de la Plasturgie et des Composites (French Plastics and Composites Federation), only one quarter of the companies questioned believe that research structures are easily accessible.

18. PIE (Plastic Info Europe) data: https://pieweb.plasteurope.com

The investments required to adapt the production tools are large and not profitable. FALSE

An investment is not necessarily required or essential. Moreover, the design of new moulds can be defined by taking the use of recycled plastics into account.

In case of a defect in the parts or finished products, companies will not be able to bear the financial risks. FALSE

The qualification phase is essential in order to avoid these problems. After qualification, the probability of defects when using a recycled plastic is no greater than the probability with a virgin plastic.

There is no financial support or incentive. FALSE

Funding is offered in the context of various mechanisms, particularly those conducted by the French Environmental Protection Agency ADEME, such as the ORPLAST scheme (see the inset below). Other funding can also be obtained from ADEME (`investments for the future' and regional support) and from the regional governments (support for innovation/environment).

Since 2015, a possibility of bonus has been introduced for household EEE on the amount of the eco-contribution invoiced by the collective take-back scheme to its producers-members (reduction of 20% of the eco-contribution) in case of integration of post-consumer plastics up to 10% in washing machines, dishwashers, computers and television sets.

Did you know? In 2016, ADEME launched a recycled plastics integration financial support scheme, ORPLAST, which was very successful and has been renewed in 2018. The purpose of this scheme is to provide financial support for the integration of recycled plastics by plastics manufacturers or processors, in the form of:

- Funding for diagnosis and feasibility studies;
- Investment funding;
- Funding for the procurement of recycled plastic materials.

Of 140 applications submitted in 2016, 68 were chosen for funding in 2016 (including Groupe SEB, Johnson Control, Nexans, Acome, etc,). This represents 15 million euros of aid for a total projects cost of 93 million euros. It will allow the integration of almost 100,000 tons of recycled plastics per year in several sectors and involving more than 14 different resins, saving 300,000 tons of CO_2eq. In 2018, 26 new projects have been accompanied under the second phase of the scheme.

6. Marketing and CSR aspects

The image of the finished product is at risk of damage. TRUE FALSE

It is easy to imagine that certain consumers or product users might find it hard to accept the presence of recycled plastics in products. Others might consider this to be a selling point. It depends on the product, the market, and the target. This is discussed in detail in the Dutch guide to the integration of recycled plastics[19].

There is no market incentive concerning the integration of recycled materials. FALSE

Labels such as EPEAT for the IT sector, the European Eco-label for household EEE products, and LEED (the North American `Leadership in Energy and Environmental Design' standard for environmental quality in buildings) strongly encourage the use of recycled plastics. Furthermore, calls for tenders in the medical and building sectors increasingly tend to include environmental criteria such as recycled material content.

19. Guidelines Designing with recycled plastics, Partner for innovation, september 2015

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Eco-design is not a selling point in France.

TRUE FALSE

Tomorrow, the absence of eco-design could quickly become an obstacle! Although eco-design, and more specifically the integration of recycled plastics, can be difficult to highlight, it could become an advantage in the years to come as a way of standing out from the competition, satisfying the needs of people who are increasingly concerned by environmental issues, and anticipating future regulatory requirements. For this reason, ADEME has published an analysis of economic and financial gains of eco-design for companies, showing that eco-design can impact on sales from +7% (low hypothesis) up to +18% (high hypothesis) for the analysed panel[20].

Did you know? Every year, the Plastic Industry Awards honours the best recycled product in the United Kingdom. For example, in 2016, the prize went to Counterplas for its Loft Stilt (a tool used in the field of insulation), made of 100% recycled PP.

Not many companies communicate on the integration of recycled plastics.

TRUE FALSE

Some companies are beginning to…

They make commitments! HP has been publicising the integration of recycled plastics in its printers, cartridges, and screens since 2004. Lexmark too, for its printers and cartridges, since 2009.

Goupe SEB communicated widely in 2016 on a Rowenta steam unit whose base is made of 100% recycled PP obtained from WEEE (partnership with Triade Electronique et Eco-systèmes). Since then, the company has extended this initiative to other products, and has been conducting tests with other resins (ABS).

Canon, Konica, Philips, Electrolux and Nespresso also communicate on the integration of recycled PP and ABS in their consumer electronic products.

The integration of recycled plastics does not represent a significant environmental benefit.

FALSE

In 2014, more than 500,000 tonnes[21] of plastics were recycled in France, of which 250 - 300,000 tonnes were reintegrated into new products. This prevented the emission of 1.5 million tons of CO_2eq[21] (equivalent to the average annual travel of 900,000 cars), and saved 6500 GWh[21] (i.e. the energy output of 650 wind generators or 90% of a nuclear reactor for one year) and 2.6 million m^3 of water[21] (i.e. the annual consumption of 17,500 four-person families). Moreover, according to the SRP (national union of plastics regenerators) data published in 2017, the use of recycled PP generates 9 times less CO_2eq emissions and its production consumes 9 times less non-renewable energy than the use of virgin PP.

Did you know? Eco-systèmes and Récylum, in collaboration with ADEME, have compiled and published the first EEE end-of-life database[22] for use by EEE producers with their Life Cycle Analysis software. In order to facilitate their use, these data are directly available in most of the Life Cycle Analysis softwares.

For a closed-loop recycled plastic integration project (plastics obtained from WEEE to be used in EEE applications), these data are a basis for calculating the benefits to be obtained from integrating recycled raw materials into a new life cycle.

20. www.ademe.fr/sites/default/files/assets/documents/benefice-eco-conception-2017-rapport.pdf
21. National recycling report 2005-2014, ADEME 2016
22. http://weee-lci.recylum.com/ICV et http://weee-lci.eco-systemes.com/Node

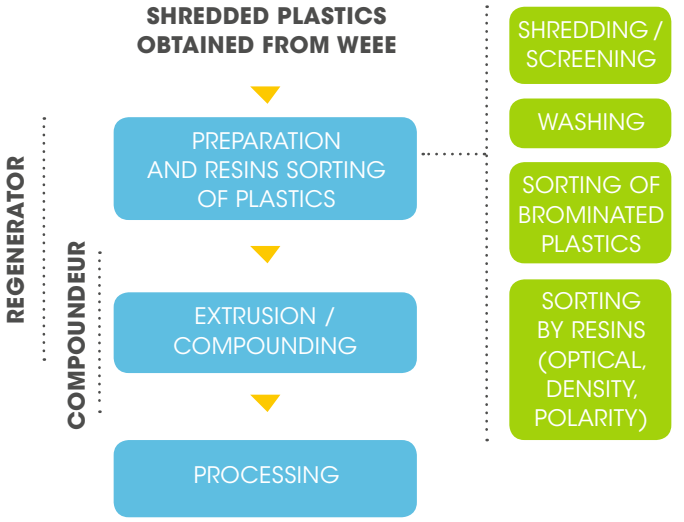
FIND OUT MORE ABOUT PLASTIC REGENERATION PROCESSES

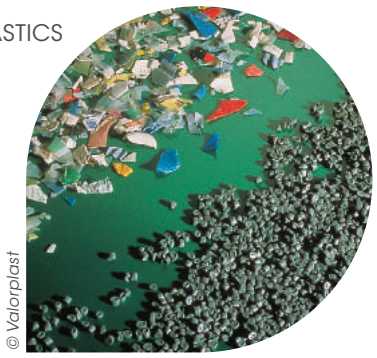
PLASTICS FROM WEEE ARE REGENERATED IN THREE STAGES:

1. **PREPARATION AND SORTING OF PLASTICS ACCORDING TO RESIN:** Shredded plastics are re-shredded and then washed to remove any undesirables (paper, wood, metal, inert matter, etc.). A first sorting is then performed to separate brominated from nonbrominated plastics according to the norm EN 50625-1 and the technical specification TS 50625-3-1. Depending on their composition, brominated plastics are used in energy recovery or disposed of. Then, the recyclable plastics are sorted according to resin by optical detection, by density, or by polarity.

2. **EXTRUSION/COMPOUNDING:** The shredded materials or flakes of sorted resins (PE, PP, ABS, PS, PC/ABS, etc.) are then sent to the compounder. Additives are added during extrusion to satisfy the customer specification. At this stage, the plastics are in pellet form.

3. **PROCESSING:** The plastics manufacturer receives the pellets from the compounder and processes them into products by extrusion, injection, blow moulding, sheet extrusion, thermoforming, etc.





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FROM THE FLAKE TO THE PELLET

Regeneration: Any process that allows substances, materials or products that have already been used to display performance characteristics equivalent to original substances, materials or products, in view of their intended use. (Definition suggested by the 2ACR working group).

Compounding: Thorough mixture of one or more polymers with other substances, such as fillers, plastifiers, or colourants, which is used as a raw material in machines that manufacture plastic items. (Definition by the French committee on terminology, Official Journal of the French Republic dated 16/11/2011). Some regenerators are also compounders.

Thermoplastics: When heated, thermoplastics soften and become flexible. They can be moulded into the desired shape. This process is reversible. That is why thermoplastics have the potential to be recycled.

Thermosets: When heated, thermoplastics soften and become flexible. They can be moulded into the desired shape. This process is reversible. That is why thermoplastics have the potential to be recycled.

Recycled plastics can come from **Post-manufacturing** streams (production scraps such as drill core, flawed parts, excess material) or **Post-consumer** streams (obtained from waste household or industrial products).

The recycling of plastics can take place in a **closed loop** within a sector (plastics obtained from WEEE for integration into an EEE) or in an **open loop** (different sectors).

GLOSSARY

ABS: Acrylonitrile Butadiene Styrene

BFR: Brominated Flame Retardants

CLP: Classification, Labelling, Packaging (EC Regulation No. 1272/2008)

CSR: Corporate Social Responsibility

EEE: Electrical and Electronic Equipment

ELV: End-of-Life Vehicles

JRC: Joint Research Centre (European Commission Research Centre)

LHA: Large Household Appliances

LPE: Large Professional Equipment

PA: Polyamide

PC: Polycarbonate

PMMA: Poly (methyl, methalcrylate)

PP: Polypropylene

PS: Polystyrene

PVC: Polyvinyl chloride

REACH: Registration, Evaluation, Authorisation and Restriction of Chemicals (EU Regulation)

RoHS: Restriction of the use of certain hazardous substances (European Directive)

RPM: Recycled Plastic Materials

SHA: Small Household Appliances

SPE: Small Professional Equipment

SRP: Syndicat national des Régénérateurs de matières Plastiques (national union of plastics regenerators)

WEEE: Waste Electrical and Electronic Equipment

We can answer to your questions or accompany you in your projects!
Please contact us at:
expertiseplastiquesrecycles@es-r.fr

ESR

ESR is the non-for-profit organisation accredited by the French Authorities regrouping the collection and recycling activities of Eco-systèmes for household WEEE and Récylum for professional WEEE, lamps and small fire extinguishers

FIEEC
FEDERATION DES INDUSTRIES ELECTRIQUES, ELECTRONIQUES ET DE COMMUNICATION

FIEEC is a federation for the industry regrouping 22 professional unions in the electricity, electronic and digital sectors (consumer goods, intermediary goods and equipment goods).

Fédération des Industries Mécaniques

The Federation of Mechanical Industries (FIM) is in charge of the economic and technical interests of 24 professions, grouped into three main areas of activity: equipment, transformation and precision.
FIM recommends the use of this guide.

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