How is waste and recovery reported in Environmental Product Declarations (EPD)?

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This Briefing Paper describes how waste and recovery are reported in Environmental Product Declarations (EPD). A separate paper discusses *How Waste and Recovery* are modelled in EPD.

Environmental Product Declarations (EPD) are now widely used to provide information about the environmental impacts of manufacturing, using and disposing of construction products. EPD assess a range of impacts from embodied carbon to eutrophication to resource use.

The European Standard, EN 15804 sets out Product Category Rules for the development of EPD for construction products, to ensure that all types of construction products are assessed consistently using the same methodology and approaches. EN 15804 was first published in 2012 and amended in 2019. Life cycle assessment experts have refined the concepts and methodology over the years. The UK Standards Committee that contributes to the development and revision of EN 15804 is BSI's B/558 Committee.

EN 15804 divides the product life cycle into four stages and then into Information Modules:

- **the product stage (Modules A1-A3)** covering all processes from extraction from nature until the product is ready to leave the factory gate (cradle to gate)
- **the construction stage (Modules A4-A5)** covering transport to site and installation on site
- **the use stage (Modules B1-B7)** covering any emissions from the product in use, and maintenance, repair and replacement over its service life in the building, and any energy or water consumed by the product in use
- **the end of life stage (Modules C1-C4)** covering demolition/deconstruction, transport to waste processing and waste processing and disposal

These stages and modules comprise the product life cycle, so explain what is within the "System Boundary". EN 15804 provides an additional module:

- **Benefits and loads beyond the product system boundary (Module D)** covering the benefit of any recovery processes from net output flows leaving the system.

All Modules beyond the factory gate are assessed on the basis of scenarios. Scenarios have be realistic and representative of one of the most probable alternatives and cannot include processes or

procedures that are not in current use or which have not been demonstrated to be practical using current processes and approaches.

How is Waste and Recovery reported in an EPD?

Environmental Indicators related to waste and recovery in EPD

EPD include a number of indicators which describe aspects of waste and recovery. These inventory indicators look at the waste resources being used to make a product (the inputs), the emissions to soil, air or water that result (the outputs), and the follow on recovery indicators.

Input indicators: At the input side, three indicators are provided:

- *Use of secondary material (measured in kg)*
- *Use of renewable secondary fuels (measured in MJ, net calorific value)*
- *Use of non renewable secondary fuels (measured in MJ, net calorific value)*

These indicators are normally manually calculated just for the foreground system (the system within the manufacturer's control) based on the inputs used (as most generic LCA databases and the International Life Cycle Database (ILCD) nomenclature which EN 15804 requires do not include this information).

See the separate section at the end of this Briefing Paper on Recycled Content for its relationship to 'Use of secondary material'.

Output Indicators: On the output side, three indicators are provided in an EPD, all measured in kg:

- *Hazardous waste disposed (measured in kg)*
- *Non hazardous waste disposed (measured in kg)*
- *Radioactive waste disposed (measured in kg)*

Based on the definition of waste disposal in the EU Waste Framework Directive, for non-radioactive waste, "waste disposed" means waste which is sent to landfill or to an incinerator which does not have R1 status[1], for simplicity called incineration. As with the input indicators, these indicators are normally manually calculated for Life Cycle Stages A1-A3 just for the foreground system (the system within the manufacturer's control) based on the waste being disposed of in landfill or incineration.

Recovery Indicators: There are in addition four recovery indicators:

- *Components for re-use (measured in kg)*
- *Materials for recycling (measured in kg)*
- *Materials for energy recovery (measured in kg)*
- *Exported energy (measured in MJ per energy carrier)*

Again for Modules A1-A3 (cradle to gate), these indicators are normally manually calculated just for the foreground system based on the material / fuel or energy leaving the system boundary (and are not normally found in LCI Databases based on ILCD).

If waste is used for energy recovery or incinerated with energy recovery, then only the exported energy is reported using the Exported energy in the module in which the energy leaves the system. If the

[1] https://www.gov.uk/guidance/waste-incinerator-plant-apply-for-ri-status

waste is converted to a secondary fuel before leaving the system, then the flow leaving the system is considered using Materials for energy recovery.

How are Waste and Recovery indicators considered over the life cycle?

Gate to grave modules: All the input, output and recovery indicators are calculated for the gate to grave modules. For the input indicators, any reported indicators for Stages A1-A3 are used for inputs of material or energy into the gate to grave modules. For the output and recovery indicators, these are based on the amount of waste disposed to landfill or incineration in each module and the amount of recovered material, secondary fuel or recovered energy leaving the system in each module.
Some examples are provided below.

- **A1-A3 (product stage)**: the product declared unit is 1 kg and uses 1 kg recycled metal input. The *Use of secondary material indicator* is calculated at the system boundary when the scrap reaches the end of waste state. 1.1 kg scrap enters the system so the *Use of secondary material* is 1.1 kg.

- **A5 (construction)**: the product declared unit is 1 kg and the wastage rate is 5%. The waste is non-hazardous and 100% is sent to landfill. Therefore in A5, 0.05 kg will be reported as *Non-hazardous waste disposed*.

- **C3 (End of life recovery)**: the product declared unit is 1 kg, and no waste processing is required in C1 and it reaches the end of waste state when it reaches the recovery process in C3. If 50% is sent to an incinerator with R1 status (for simplicity called energy recovery) and 50% sent to recycling, then in C3, 0.5 kg will be reported as *materials for recycling* and 0.5 kg will be reported as *materials for energy recovery*.

- **C4 (End of life disposal)**: the product declared unit is 1 tonne, and at end of life is non-hazardous and 100% sent to an incinerator without R1 status (incineration). In C4, 1 kg will be reported as material for disposal. Although the incinerator does not have R1 status, it is still able to recover a small amount of energy as both electricity and heat. This is reported in C4 as, say, 800 MJ Exported Energy - Heat and 300 MJ Exported Energy – Electricity.

- **Module D (Benefits of recovery)**: Module D reports the indicators associated with any processing to reach the point of substitution, minus the indicators associated with the production of the substituted product. In particular, if there are net outputs of exported energy, secondary material or secondary fuel leaving the system boundary (rather than looping to input flows in A1-A3) then these are reported in Module D as *Use of secondary fuel* (as there is no indicator for Use of exported energy, CEN/TR 16970 recommends to use *Use of secondary fuel*) and Use of secondary material.

Specific Example:

An example (showing only relevant indicators) is provided below for 1 kg of plastic with a net calorific value of 40 MJ/kg and a recycled material content of 20%, which is recycled to substitute virgin plastic at end of life.

In A1-A3 (product stage), the product reports 32 MJ Use of *non-renewable primary energy resources* used as raw materials (PENRM) as 80% of 40 MJ/kg, 0 MJ *Use of renewable energy resources* used as raw materials (PERM) and 0.2 kg *Use of Secondary material* (SM) which will have 8 MJ energy content.

For recycling, 1 kg waste is generated at end of life and reported in C3 as 1 kg *Materials for recycling* (MFR), but as the product uses 0.2 kg recycled material, the calculated net output of recycled material into Module D is 0.8 kg (1.0-0.2=0.8), so 0.8 kg is reported in *Use of Secondary material* in Module D. This 0.8 kg recycled plastic substitutes 0.8 kg 100% primary plastic which will have 32 MJ PENRM impact, so -32 MJ is reported in Module D.

Indicator	Unit	A1-A3	C3	C4	Dtot
Use of non-renewable primary energy resources used as raw materials (PENRM)	MJ	32			-32
Use of secondary material (SM)	kg	0.2			0.8
Material for Recycling (MFR)	kg		1.0		

Recycled Content

EPD do not have to provide recycled content for products. If they do, it should have been calculated following the requirements of ISO 14021 and checked by the verifier. The *Use of secondary material indicator* will not be directly translatable to "recycled content". This is because the *Use of secondary material* is measured as recovered material enters the product system. Recycled content would need to take account of, e.g. losses of recovered material through wastage in its further processing and in the manufacturing process. For example the *Use of secondary material* reported in the UK Cares EPD for Carbon Steel Reinforcing Bar (secondary production route –scrap), Sector Average is 1,110 kg for a declared unit of 1 tonne of steel, meaning 1.11 tonnes of steel scrap was used to make 1 tonne of steel, along with primary alloying elements. Its recycled content is reported as 96% however, showing that around 150 kg scrap was lost through the scrap processing and manufacturing process.

Further reading:

- EN 15804+A2
- Waste Framework Directive
- ISO 14021

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