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

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

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 following describes their approach to waste and recovery.

How is Waste assessed in the EN 15804 methodology for EPD?

System Boundary: The first consideration is to understand what is the system being considered; where are the boundaries. Based on the Polluter Pays principle, and the product life cycle, the system boundary in EN 15804 includes all processes in relation to use of recovered material and fuel from the point at which the waste has been recovered (the "end of waste state") and all processes in relation to treatment and recovery of waste until it stops being waste (again, the "end of waste state"). **So the system boundary is the End of Waste state** and is defined using the EU Waste Framework Directive's end-of-waste criteria. Within Europe, you can tell when a recovered material or secondary fuel enters your system based on the point at which it stops being covered by Waste legislation and starts being covered by product legislation such as REACH for example.

Allocation Methodology: This is very complex but essential to understand how impacts are allocated. EN 15804 uses a "100:0" recycling allocation methodology for post-consumer waste, also known as the Cut Off or Recycled Content Approach – so all the impacts of using primary materials and recovered material from the point they enter the product system are allocated to the product and no impacts from production are allocated to any future recycling. This means that recovered post-consumer waste entering the product system does not bring with it any impacts from the previous system.

- If the product uses the same amount of a recovered pre-consumer waste as it produces, then this is closed loop recycling. If the amount of recovered pre-consumer waste which leaves the

system is more than that which is used (e.g. for a product made of primary metal) then EN 15804 says "co-product allocation" should be used to allocate impact to the output, based on the value of the recovered waste and that of the product. Conservatively, the recovered pre-consumer waste could be considered to leave the system with no impact (this would mean both recovered pre- and post-consumer waste enters the system with no impact).

- If the product uses more recovered pre-consumer waste than it produces (for example it is made of 100% pre-consumer scrap), then it should have the allocated impact from the process that made them. Conservatively, it can be considered to have the impacts of virgin production if data for allocation is not available.

How is the benefit of Recovery recognised in EN 15804 EPD

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; and
- **the end of life stage (Modules C1-C4)** covering demolition/deconstruction, transport to waste processing and waste processing and disposal.

These stages and modules make up 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.

Beyond the system boundary, Module D of an EPD provides information about the benefits of recovery in the next product life cycle. This is because the "100:0" recycling methodology used gives all the benefit of recycling to the product using the recycled material and does not show any benefits to products which are recycled. Module D should not be added to Modules A-C to give a total impact for the product as this will be double counting the benefits of recycling at both the input and output side, and will contravene the use of a consistent product system boundary applied at both the input and output side. As with other modules beyond the factory gate, Module D is also assessed using scenarios based on current approaches in common use.

How is Module D calculated?

Any waste generated in the system is first recovered, with the impact of the recovery process reported in the module in which the waste occurs. If the same waste is recovered to be used in A1-A3, then this is considered as "closed loop" and only the benefit of the net output flow (the mass of recovered material leaving the system minus the mass of the same recovered material entering the system) is considered in Module D. For the net output flow, the Module D includes the impact of any process to reach the point at which the output flow substitutes for primary material or energy, and deducts the impact of producing the substituted primary material or energy. For products made of primary materials which are recovered at end of life, Module D is normally negative showing a benefit. However for products made of recycled content, rather than a net output flow leaving the system, there is often a

net flow into the system. EN 15804 states net flows leaving the product system shall be included in Module D, so many EPD disregard net flows which enter the system. Some products with net input flows however treat them as negative output flows which means that rather than Module D showing a benefit, it will show a disbenefit from end of life recovery for these products using recycled content.

EPD and the Circular Economy

Construction is, in fact, one of the major users of recycled material, though there is always opportunity to use more recycled material. The CIRIA Mass Balance Report, published 20 years ago in 2002, identified that UK construction products used nearly 70 million tonnes of recycled, reused or secondary materials, around 18% of the total mass of final products sold. There is no more recent data and a new study would be beneficial.

Recovery of materials at end of life for construction is also already high, DEFRA Waste Statistics suggest that 92.3% for recovery for non-hazardous construction and demolition waste in the UK in 2018. However much of this is "downcycling", e.g. crushing concrete and bricks into aggregates and a move up the waste hierarchy would be beneficial.

As mentioned above, EPD use the 100:0 approach to recycling which recognises the benefit of recycling for those using recycled material. This approach has been used in construction because most construction products have very long lives – there is therefore a greater focus on trying to recognise and encourage recycling now rather than potential benefits at end of life in many years' time, when recovery infrastructure may be very different and there may be little difference in impact for primary and recycled processes.

Some suggest that including Module D in the calculation of impact by adding it to the impacts for the product life cycle (A-C) accounts for the Circular Economy. However this is a misunderstanding, as it double counts the benefit of recycling at both the input and output side. Also, using the EN 15804 calculation rules, there is no real difference in the impacts for A-C+D for a virgin product, which is 100% recycled at end of life, and a 100% recycled product of the same material which itself is also 100% recycled (truly circular). This does not seem to be correct in terms of encouraging both the use of recycled material and recovery at end of life as we must do to achieve a circular economy.

Further reading:

- EN 15804+A2
- UK Waste statistics
- Waste Framework Directive
- CIRIA Mass Balance Report - not accessible online.

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