REPORT

Robust LCA:
PCR guide for construction products and works

- Specifications to and evaluation of EN 15804

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Report Summary

Project title

Robust assessment of products, construction and construction works with system analytic tools

Project sponsor

SBUF, SIVL, Cementa, Skogsindustrierna, NCC Construction Sverige.

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Title and subtitle of the report

Robust LCA: PCR guide for construction products and works - specifications to and evaluation of EN 15804

Summary

The main question handled in the project 'Robust LCA' is how to use LCA for a robust comparison of construction products or any construction works. The project is divided into two parts where the first part deals with a general introduction to methodology problems related to LCA and what we here call 'choice of system perspective'. The latter aspect deals with the question when to use to use attributional or consequential LCA. An LCA typology is developed in this part of the project, where different ISO 14044 methodologies are classified. The typology also deals with what question these different methodologies address.

The second part of the project, given in this report, deals with commonly methodology aspects that are important to find consensus about. These methodical aspects selected and handled here are based on a workshop result. Already existing standards is used as a baseline to describe the current best common practice. The main LCA methodology used as basis for this work is EN 15804, a so call 'core PCR', (product category rules) for all constructions products. However, since the common goal within an LCA case study is to use a harmonized method in the entirely study, such PCR are valid for all products and services used in the life cycle of any construction works. For instance, this implies that the impact from different energy wares is to be handled with the same methodology as used for the construction products.

This PCR guide includes specifications to EN 15804, as well as the potential development for aspects that are not handled in this standard today. The outlined suggestions and recommendations are the result of a series of workshops, with delegates from different parties within the Swedish building material, construction and real estate sector, including civil engineering work. The PCR guides have been subject to an open consultation that was closed on the 20th of October 2013, where all parties have had the possibility to put forward their opinions.

The final recommendation in this report is based on a common understanding within the project group and takes into account the submitted written contributions to the open consultation (version dated 2013-09-18). The recommendation therefore describes the current consensus in the Swedish group participating in this project. Moreover, the PCR Guide was also sent to some EPD program operators (EPD Norway, International EPD system, Institut Bauen und Umwelt (Germany)) and the working group behind EN 16485. This was done to create an opportunity to bring forward dissenting opinion to the specifications given here. Please note that this report shall not be regarded as a PCR, but as an inspiration for future development of such work.

Keyword

Biogenic carbon, carbon sink, life cycle assessment (LCA), EN15804, life cycle impact assessment (LCIA), life cycle inventory (LCI), product category rules (PCR), program operator, robust LCA

Bibliographic data

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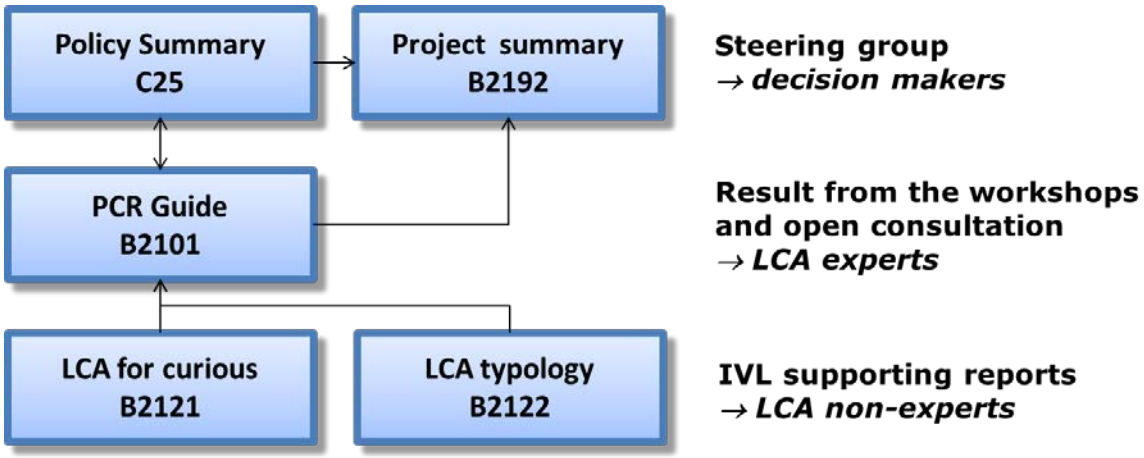
Foreword

The main question handled in the project 'Robust LCA' is how to use LCA for a robust comparison of construction products or construction works. The project 'Robust LCA' is divided in three parts of which two (A and B) are managed by IVL and the project group and the third (C) is managed by the project steering group. Part C was added to the project in November 2013 and includes a 'Policy Summary' elaborated by the steering group (report No C25) and an executive summary of the whole project (report No B2192). The primary target group of the project reports are given below:



The two parts of original project deal with:

A. a general introduction to methodology problems related to LCA, where outcome report is called 'LCA for curious' (report No B2121) and what we here call 'choice of system perspective' (report No B2122). The former gives a short introduction to ISO-LCA and different methodical aspects that have to be regulated to achieve a univocal LCA. The latter report (B2122) deals with the question when to use attributional or consequential LCA. An LCA typology is developed in this part of the project, where different ISO 14044 methodologies are classified. The typology also deals with what questions these different methodologies address. Both these reports are targeted to non-LCA-experts, as an introduction to the methodology problems handled within the project.

B. common LCA methodology aspects where consensus agreement is desirable. This report is called 'PCR Guide' and is intended for LCA experts only. The recommendations given in this final version of the report consider the statements given in the 'Policy Summary' from the steering group and the written submissions to the PCR guide open consultation.

Contents

1 Introduction to Robust LCA

This section gives an introduction to part B of the project 'Robust LCA'. The current report handles only methodical matters for LCA in the context of sustainable construction works and some general aspect related to public requirements. The main target group for this report is LCA specialists. Most of the recommendations given are related to the 'product level', i.e. the 'Core PCR' for construction products, namely EN 15804.

The aim of this specification is to make the methodology more precise, to support that the LCA performed using such a PCR is univocal, in other words, that the LCA calculation for a specific product or construction works will be same regardless of which LCA practitioner is performing it. Such LCA methodology is the starting point for a robust LCA.

1.1 Disclaimer

This report is not a PCR and not part of a standardisation work. Instead this report defines issues that the project members think should be improved in future updates of current standards related to sustainable construction works. The target reader of this PCR Guide is an LCA specialist.

The aim of this report is to provide a uniform description of where the consensus is on LCA and EPD, valid at least for the main interested parties in the Swedish construction and real estate sector. The long-term goal is that the recommendations given here will support the international standardisation work and encourage the use of a Robust LCA methodology. This kind of PCR approach supports a univocal outcome of an LCA and therefore a sound use of LCA as part of business relations and for legal requirements.

The recommendations given here reflect the result from the consensus process, valid for the involved parties in the project 'Robust LCA'. For critical issues, where no consensus could be established, the PCR Guide provides recommendations on research or development needs, rather than suggesting a 'best solution' that suits the majority. It should be noted that individual project members may have opinions that differ from the recommendations given in this report.

1.2 Project overview

The project 'Robust LCA' focusses on LCA and product comparisons, from the product level to the construction works level, relevant for the construction and real estate sector. The current standards in this area are the basis for this project. To achieve a fair product comparison, the LCA has to be built upon a robust LCA methodology.

The project goal is to reveal methodology settings given in current standards, which are not precise enough to enable the achievement of a univocal LCA. The ultimate objective is to contribute to established PCR standards that are valid for the entire sector.

The most important PCR for this purpose is a PCR for all construction products (i.e. EN 15804 and ISO 21930). When such PCR is established it will regulate the most significant methodology settings, which will then also be valid for all construction works, since the same LCA approach has to be used in the entire evaluated product system. It should be noted that this methodology regulation also includes the definition of the environmental impact from different energy wares.

The project 'Robust LCA' is divided in two parts:

A. A general introduction to methodology problems.

B. Common methodology aspects where consensus agreement is desirable, in order to achieve a robust LCA methodology.

This PCR guide includes specifications to EN 15804, as well as the potential development for such aspects that are not handled in this standard today. The report that you read now is the written delivery from part B of the project. This methodical work is based on a series of workshops.

1.3 The consensus process applied

The consensus process is central in this project approach. The time needed to argue for one's opinion and to listen to others takes time, but has to be accepted if we shall reach consensus. Based on earlier work, we were aware of the fact that it is not realistic to reach consensus on all matters. Nevertheless, these 'remaining' methodology aspects that we currently cannot agree upon, gives valuable information towards new development of LCA methods. The goal, however, is to expand the common understanding and enlarge the common opinion of methodology settings that are robust for product comparison, see Figure 1.

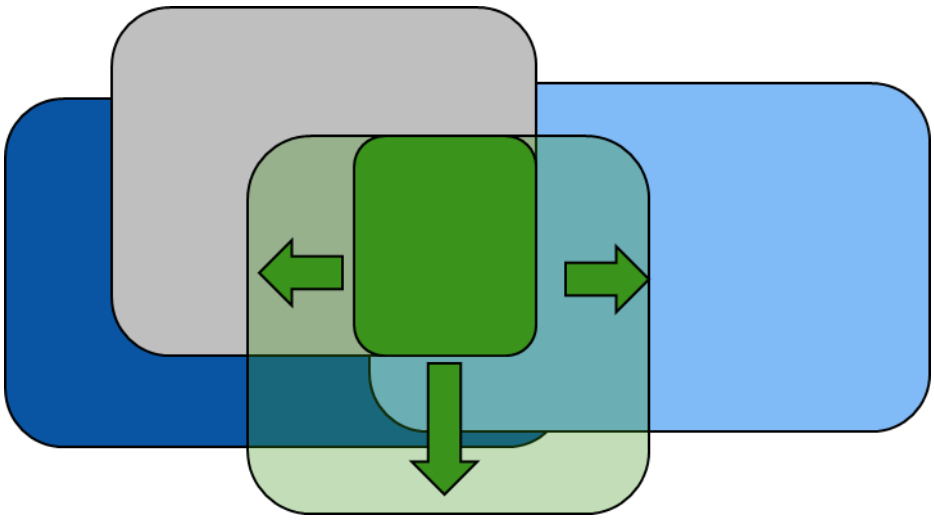


Figure 1 *Illustrative figure on a number of recognised methodology choices (blue, dark blue and grey boxes) that create a common understanding (indicated as the green area in the figure). The goal with the consensus process and this project is to enlarge this green area and define LCA aspects that are outside this green box but still represent a common understanding.'*

In order to not limit the consensus project to the parties that financially support the project; LCA experts were invited to open workshops, with delegates from many different parties within the Swedish building and real estate sector, including civil engineering work (see delegate list in the appendix). A stepwise consensus process was then applied in the project, as described below.

A number of workshops were set up in the beginning of 2013, where the first defined a number of methodology problems that were regarded as important by the attending LCA specialists. The next target was to rank these methodology aspects and to divide them in aspects related to either the product level or the construction work level. The aim was then to start work with the construction product related matters, and only if the budget allowed it, continue with the construction work level.

A number of workshops were arranged with the scope to reach consensus on the listed methodology matters defined by the same group. To support this consensus work IVL

produced background information and references to the different standards relevant for the specific matter. Besides this, IVL also provided interpretations on the meaning of the different standards. IVL also prepared and started the workshops by giving lectures related to the questions dealt with at each workshop. As a basis for the discussion recommendations were set up for each methodology matter covered. These recommendations were developed through a two-step voting procedure, where the result of the second voting was used for the recommendation. The recommendations were intended to indicate the level on consensus (outside the common green box given in Figure 1).

The initial recommendations, which were based on the outcome of the workshop, were then subject to an open consultation to all workshop participants. Moreover, the 'Open consultation version' of the PCR Guide (dated 18th of September 2013)[1] was submitted to different national networks and to some EPD program operators (EPD Norway, International EPD system, Institut Bauen und Umwelt (Germany)) and the working group behind EN 16485.

For the open consultation, it was clearly communicated that only written contributions were accepted (the missive is found in the appendix, section 4.6). Only when the respondent felt that there was an unacceptable recommendation in the proposed PCR guide they were asked to give comments. Thus, workshop participants who have not reported any dissenting opinion are assumed to approve of the recommendations given. The result from the open consultation is given in the appendix (section 4.7 - 4.11). In connection to this we state (see section 1.1);

> *"A natural consequence from this consensus approach is that individual project members may have opinions that differ from the recommendations given".*

Based on the input from the open consultation, the initial recommendations were revised to describe the common understanding of consensus for each question. For critical issues, where no consensus was established, these problematic matters are handled in the PCR Guide by giving recommendations on research or other development needs, rather than suggesting a 'best solution' that suits the majority.

[1] This version of the report is available on request to: martin.erlandsson@ivl.se.

1.4 Hierarchal PCR structure

1.4.1 Order between standards and program operator PCR

Environmental product declarations (EPD) are defined in ISO 14025. This standard also defines the organisation behind an LCA based declaration. Among others, ISO 14025 requires that so called 'Product Category Rules' shall be developed, maintained and published for different product groups by a 'program operator'. Consequently, a PCR is only valid if published by a program operator such as the International EPD System or EPD Norway. So, prior to the development of an EPD, a relevant PCR has to be launched. As a consequence of the existence of different program operators on the market, different PCRs for construction products also exist.

In addition, LCA-based EPDs reviewed by third part that follow ISO 14025 exist, as well as non-reviewed declarations implementing LCA-results. These kinds of self-claim declarations have to follow the requirements defined in ISO14021. The large variability among the different national declarations used constitutes a trade barrier and a limit for the European internal market, which is one of the reasons for the European Commission to mandate CEN/TC 350 to develop a set of standards to handle 'Sustainable construction works'.

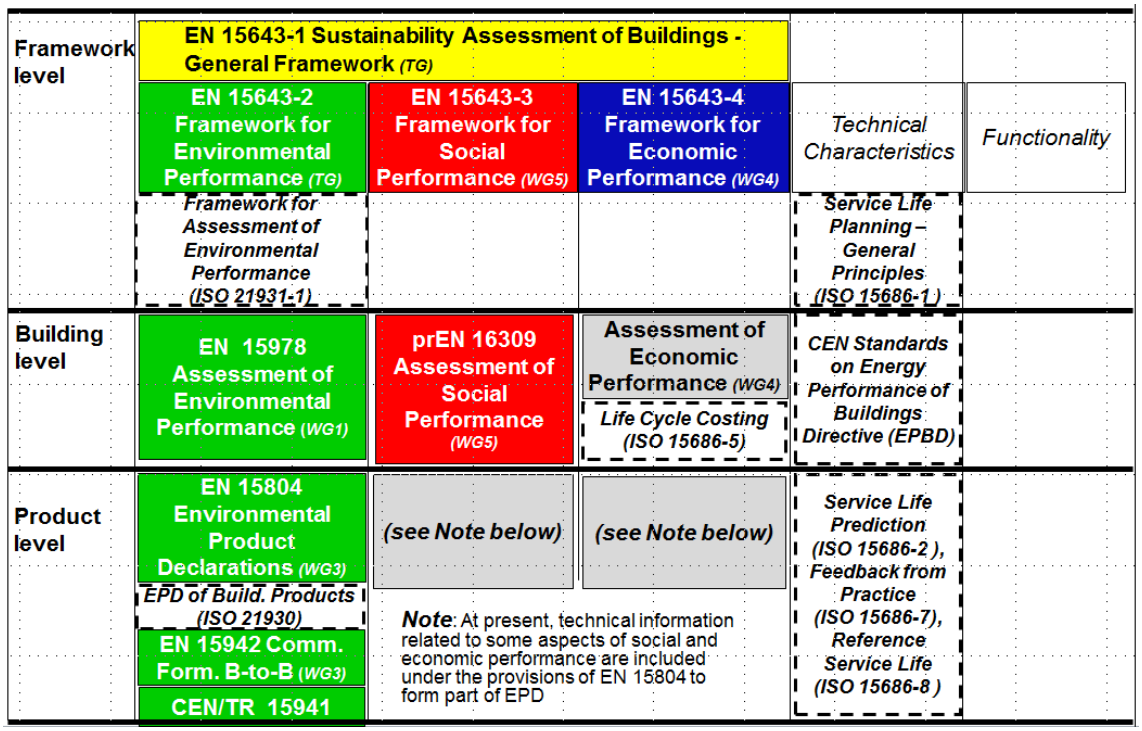


Figure 2 The family of standards developed by CEN/TC 350 according to the current mandate (figure from Ari Ilomäki, chairman of CEN/TC 350)

In order to harmonise the number of EPDs on the European market, EC outlined in the mandate to CEN, that a common PCR should be developed for all construction products.

The European Construction Product Regulation (CPR) addresses EPD as a source for environmental performance for construction products. The Core PCR EN 15804 fulfils these requirements but has to be adopted by a program operator to become operational, if the rules in ISO 14025 shall be met. To support the harmonisation between different program operators that make use of EN15804, an EPD platform is launched together with a mutual recognition[2]. EPDs on the product level related services may then be used as information sources for different construction works. On the building level, EN15978 is developed by CEN to support an EPD on this level, and development to define a core PCR for civil engineering works on the ISO level is on-going.

1.4.2 Using EPD and PCR in public procurement

As outlined in Figure 2, the information required for LCA assessments of any construction works can be found in individual EPDs covering different construction products. To support the modularity, the information on the product level is divided into different life cycle stages. The information module A1-3 may also be called an LCA result covering a ***cradle-to-gate*** perspective. This information module represents the mandatory information that the manufacturer has to give in an EPD, according to EN 15804 and is valid for all construction products. The other reporting alternatives coverers ***cradle-to-gate with options*** or ***cradle-to-grave***, see Figure 3. The latter alternative requires that the reference service life is included.

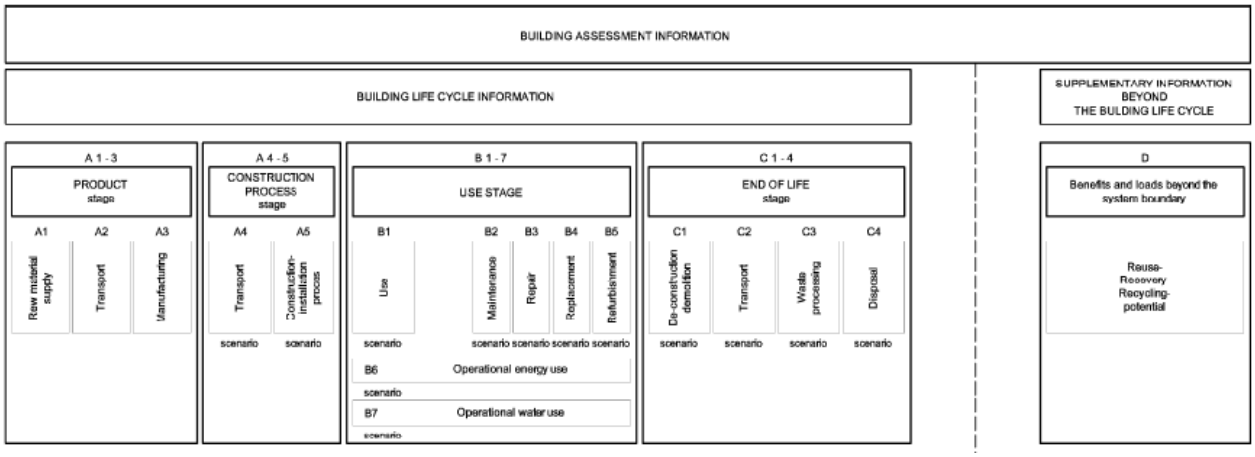


Figure 3. Module structure of EN 15804 and EN 15978.

An EPD based on a univocal[3] PCR and reported on a functional unit may be used as information source for product comparison. Module D describes environmental loads and benefits beyond the product or building life cycle and cannot be taken into account in such product comparisons, but is applicable for information in the recycling stage and provides guidance on what to do with the recycled material when the product is scrapped in future. Module D only gives information on different alternatives when the initial product material

[2] http://www.metsims.com/newsdetail.php?which=32 and http://www.eco-platform.org/
[3] Meaning that a methodology is given that cannot be mistake or misinterpret

is recycled as a raw material or for energy recovery and may be found on subjective or uncertain scenario settings.

One way to support the internal market and to avoid unfair competition is to use and refer to European standards. One opportunity to make use of EN 15804 and EN 15978 is to use them in the national implementation of European law, in other regulations, or in public procurement. Please note that EN 15978 is not a complete PCR, in the sense that it does not cover all requirements and all information needed to assure that an LCA conducted by different persons for a given building if the full life cycle is considered will produce the same result. In the context of using EPD on a product level and for construction works, the following recommendations are given as a result of the workshops in the project Robust LCA. In the text below the comments are divides as relevant for 'products', 'construction works' or a 'common aspect'.

Requirements:

1. If LCA data are asked for on ***construction products***, they shall be calculated in the way described in EN 15804.

2. If LCA data are asked for on ***construction works*** they shall be calculated in the way described in EN 15978. Note that EN 15978 is developed for buildings but the LCA methodology as such is applicable for all construction works. LCA data used on construction works may either be specific data or generic (database data) following the methodology described in EN15804. If other LCA data are used, the consequences of not following LCA methodology as defined in EN 15804 shall be evaluated as part of the LCA result.

3. ***Common aspect:*** Further methodology requirements than those specified in EN 15804 or EN 15978 can be stipulated as far as they can be regarded as specifications to these standards.

Verification:

1. A third party validation is suggested as the first choice on the ***construction product level***. However, for small companies (SME) this might induce an unacceptable cost and therefore reference to sector EPD is acceptable, or as a second choice compatible conservative database data or EPDs from other companies may be used. A documentation for the own process that describes whether the data is conservative or representative has to be given as supplementary information.

2. On the ***construction works level,*** the development of PCRs is in its initial phase and suffers from lack of practical experience when these EPD are used for public requirements etc. Therefore, we suggest that a self-claim declaration can be acceptable in order to introduce EPD in this context and to not make the use of LCA more costly than necessary.

3. ***Common aspect:*** If a self-claim declaration is adopted it is recommended to follow the requirements given by ISO 14021.

4. ***Common aspect:*** If third party verification is needed, requirements given by ISO 14025 should be followed. If a third part is asked for in public procurement, no particular program operator can be assigned, and thus all program operators that fulfil the ISO 14025 requirements shall be accepted. Consequently, if an additional PCR or any additional requirement to EN 15804 or EN 15978 is required, these should be available for all program operators for implementation, or alternatively handled as supplemental requirements.

5. ***Construction works level:*** Complementary validation on how the source data for the LCA calculations on construction work are gathered and what they cover is necessary to perform. In LCA terms this covers validation rules that describe routines and assumptions that are made to settle these so called *reference flows*, which constitute the source data for the LCA calculations. These source data are typically based on cost estimate systems, alternatively on CAD applications. The reference flow is normally handled by self-claim and a description of the underlying procedure (but better routines have to be developed in the future).

Scope:

1. *Product level EPD*:
   This can be conducted for:
   a) the ***same material*** that are based on the same PCR. Such EPDs might be evaluated within the same product group to define the best product alternative or supplier. In this case a declared unit is enough and typically covers at least a cradle-to-gate LCA. Therefore, the impact from the remaining life cycle stages such as the service life has to be equal for conducting such product comparison.
   b) an ***intended use***. A PCR may also be developed for a specified intended use such as roofing materials, which covers different materials and technical solutions. In this case, a functional unit is applied and comparison across different materials is possible.

   An additional PCR to EN 15804 may be developed that accounts for a full life cycle and where the LCA result is given in relation to a functional unit. An EPD based on such PCR may be used for a product comparison between different materials and products that fulfil the same function. The most common PCRs developed today are, however, limited to a construction product with a generic application and, therefore, do not allow comparison between competing materials. Comparison between different products/material is only valid if the same functional unit is applied. In all other cases comparison between construction products shall be avoided, since the full context of the product is not known.

2. *Construction work level EPD*:

Currently, there is no generic PCR for all construction works that is precise enough to enable two independent LCA practitioners to perform equal LCAs for a specific construction work covering the full life cycle. Thus, the usability of EPD for a fair comparison between different contractors will be limited. Therefore, we suggest that the generic PCRs may be supplemented with specific PCRs for different types of construction works. We recommend an initial use of LCA in public procurement where the same contractor gives several alternatives (all developed by the same contractor) in order to compare and highlight differences between alternative designs etc. In this case, the meaning is not to compare the results across different contractors. Even though the LCA methodology may differ between different contractors, the results will still be good enough to evaluate the environmental consequences for different alternatives, as long as the same contractor performs the LCA for the given alternatives. In this context, EN 15978 and similar generic PCRs[4] developed for different type of construction works will be sufficient.

In the future it might be possible to define reference values (or key values) and a precise LCA methodology and source data evaluation method for different construction types. Once such methodology and findings based on LCA from different construction works have been established, we recommend using the absolute level of environmental performance between different competing construction works. Then the LCA result could be used to set limit values (*in Swedish: skall-krav*) or evaluation requirements (*in Swedish: utvärderingskrav*) for public procurement etc.

During the discussion on this matter, it was suggested that the key role of a program operator should be to develop generic PCRs for buildings and civil engineering works, which could be used as a basis for further development of PCRs for individual types of construction works. It is then up to the developer /commissioner to define supplementary rules valid for that specific object – **object related PCR specifications**. Being developed by the commissioner, these object related PCR specifications automatically take the developer's goal and scope into account. This gives the commissioner the possibility to select the ambition level and if relevant select a single issue EPD (e.g. climate declaration) or simplify the LCA approach in any other means relevant for the specific goal and scope. All these sets of PCR requirements may be validated through a third party review, in line with a program operator. This approach will facilitate the work for the program operators and the harmonisation between them. A rebound effect could be that specific requirements put forward by different developers/commissioners are not actual specifications but evaluations or in conflict with the overarching PCRs whereby further harmonisation would be needed[5]. We regard this latter approach as crucial to establish LCA requirements on any construction works level

[4] Including the current PCRs and these that are under development such buildings, road infrastructure, rail infrastructure and bridges.

[5] Compare with complaints about to many different environmental requirements put forward in municipal land transfer competitions, see e.g. http://www.byggindustrin.com/stopplag-for-kommunala-sarkrav-ute-pa-re__10802

that are precise enough to allow two independent LCA practitioners to perform equal LCA:s for a specific construction work covering the full life cycle.

Open consultation (comments to paragraph 1.4)[6]**:**

The Swedish Transport Administration agrees that it is wise to divide the requirements on product and construction work level, respectively. With respect to verification requirements, this is a matter that is handled within an on-going project "Verifierad klimatberäkning..."[7], which involves a number of large contractors and the Swedish Transport Administration and was reported in 2013. Concerning comparative assessments on construction works level, the Swedish Transport Administration's goal is to compare different designs or technical solutions using EPDs or LCA and therefore they agree with the suggestion given in the PCR Guide concerning object related PCR specifications. Moreover, the Swedish Transport Administration wonders if the recommendations given in the PCR guide are valid for simplified LCA approaches.

The International EPD System. One of the comments given (see appendix 4.8 for a full list) is that they greatly appreciate the clarification that a PCR has to be developed under the framework of a programme in accordance with ISO 14025 to be classified as a PCR. This is not widely understood in the LCA community, and many documents called "PCRs" are in fact only "guidance documents for LCA practitioners." It should be highlighted that the family of standards only refer to the construction sector, and that many parallel single-sector and multi-sector initiatives are on-going. Alignment of independently developed guidance documents and standards from different sectors is a problem for programme operators, and should be an encouragement to adhere to easily-explainable, universally-applicable methodological choices.

Cementa Sweden, underlines the positive aspects of environmental classification systems as valuable tools to initiate the work process in this field.

Recommendation:
There seems to be a general agreement on the use of LCA in public procurement (or likewise) outlined here. The recommendations on the use of EPDs for building products given here are more extensive than what is given in EN15804. Moreover, the use of LCA in different certification systems for construction works is important, and harmonisation between these initiatives and the PCR development is essential and should be supported.

[6] The comments are handled as far as possible in the text given above in the revised version of paragraph 1.4
[7]http://www.sbuf.se/sa/node.asp?node=132&template=/templates/projectdirectory.asp&sa_content_url=/plugins/projectdirectory/show3.asp&id={CCFE5498-B980-44C4-8D9A-D75A14E5808D}&status=3

2 Construction products

2.1 Inventory methodology

2.1.1 System perspective

Requirements given in EN15804

5.1 Objective of the Core PCR
An EPD according to this standard provides quantified environmental information for a construction product or service on a harmonized and scientific basis. It also provides information on health related emissions to indoor air, soil and water during the use stage of the building. The purpose of an EPD in the construction sector is to provide the basis for assessing buildings and other construction works, and identifying those, which cause less stress to the environment.

Thus, the objective of the core PCR is to ensure:
- the provision of verifiable and consistent data for an EPD, based on LCA;
- the provision of verifiable and consistent product related technical data or scenarios for the assessment of the environmental performance of buildings;
- the provision of verifiable and consistent product related technical data or scenarios potentially related to the health of users for the assessment of the performance of buildings;
- that comparisons between construction products are carried out in the context of their application in the building;
- the communication of the environmental information of construction products from business to business;
- the basis, subject to additional requirements, for the communication of the environmental information of construction products to consumers.

...
4.3.1 General
...
The principle of modularity shall be maintained. Where processes influence the product's environmental performance during its life cycle, they shall be assigned to the module in the life cycle where they occur (see Figure 1).

The sum of the allocated inputs and outputs of a unit process shall be equal to the inputs and outputs of the unit process before allocation. This means no double counting or omission of inputs or outputs through allocation is permitted.
...
6.4.3.3 Allocation procedure of reuse, recycling and recovery
Where a secondary material or fuel crosses the system boundary e.g. at the end-of-waste state and if it substitutes another material or fuel in the following product system, the potential benefits or avoided loads can be calculated based on a specified scenario which is consistent with any other scenario for waste processing and is based on current average technology or practice.

If today's average is not available for the quantification of potential benefits or avoided loads, a conservative approach shall be used.

NOTE 3 In principle waste processing is part of the product system under study. In the case of materials leaving the system as secondary materials or fuels, such processes as collection and transport before the end-of-waste state are, as a rule, part of the waste processing of the system under study. However after having reached the "end-of-waste" state further processing may also be necessary in order to replace primary material or fuel input in another product system. Such processes are considered to be beyond the system boundary and are assigned to module D. Secondary material having left the system can be declared as substituting primary production in module D, when it has reached functional equivalence of the substituted primary material.

...

6.3.4.6 Benefits and loads beyond the product system boundary in module D

Information module D aims at transparency for the environmental benefits or loads resulting from reusable products, recyclable materials and/or useful energy carriers leaving a product system e.g. as secondary materials or fuels.

Any declared net benefits and loads from net flows (for calculation of the net amounts see 6.4.3.3) leaving the product system that have not been allocated as co-products and that have passed the end-of-waste state shall be included in module D.

Avoided impacts from allocated co-products shall not be included in Module D.

The information in module D may contain technical information as well as the quantified predetermined LCA derived parameters. The quantified predetermined parameters shall be those described in Clause 7.

...

Interpretation: The selected system perspective is not specifically expressed but the methodology requirement follows an attributional LCA for module A to C. Attributional LCA is considered to fulfil the PCR objectives listed above. Also, it is understood by most that the modularity principle, stressed in both ISO14025 and in EN 15804, requires the application of an attributional LCA methodology.

The specification given for module D is to use a consequential LCA approach, to handle open loop recycling (OLR) as a complement to the current so called '100/0' or 'cut off' method applied in module A to C.

Workshop discussions: Module D is now handled with a typical waste LCA methodology and in such LCA studies system expansion is the common methodological approach. Traditionally, in this system expansion approach, only the different waste alternatives and its processes are part of the analysed system until the upgraded material meet a functional equivalence with a substitute. This means that module D does not include a full life cycle when system expansion is used. One may say that the EPD shall only be based on attributional LCA and then system expansion would not be allowed according to EN15804. Nevertheless, one might also say that the aim with module D is to describe benefits with recycling and then system expansion is a suitable alternative. Since the result from module D shall be kept separate from the result from module A to C this provides additional information only.

The current recycling approach – sometimes referred to as the "100/0" or "cut off" approach – is sometimes criticised to support the use of recycled material but not to support future recycling of a particular product. An EPD should be based on robust, verifiable information which may be problematic when conducting scenario assessments. With the "cut off" approach all that is needed is to evaluate if the product is likely to be recycled or not. This is a much easier task – and therefore more robust – than to add what it might be used for and what it potentially might replace in the future.

Open consultation:

The International EPD system believes that a stringent use of the attributional LCA methodology has more benefits than the robustness aspects (described here), and compared to consequential LCA. An obvious risk of mixing the two systems' perspectives as is done in EN

15804 and the final draft of Product Environmental Footprint Guide, is that it will enhance the layman's view of: "LCA may provide any answer that you want", which reduces the credibility of LCA.

Recommendation: Currently EN15804 involves two system perspectives and in this respect does not use a stringent LCA methodology in the same EPD. This fact has to be taken into consideration in future updates.

A starting point is to decide if module D should handle an alternative burden allocation of open loop recycling or – more straight forward – just provide guidance on the best use of the scraped product in the future (recycling information). We do, however, not answer this question, nor do we give any recommendation on the best way to apply module D. Instead we propose three alternatives:

- As it is today; to have an attributional LCA approach for module A to C and use the "cut off" approach, combined with a system expansion in module D (i.e. consequential LCA).
- Only report different information modules in module D based on attributional LCA. These information modules may be used (outside the EPD) either for system expansion or handle different open loop recycling alternatives in any convenient way. In this approach the net impact will not be reported but this result can be calculated (see also 2.1.7). In this alternative the modular structure and a stringent methodology approach is maintained.
- Exclude module D, since no regular practice has been established yet and the consequences therefore not fully considered.

The recommendation agreed upon is that future development must help the EPD reader to be clear and state that the information in module D on a general level cannot be compared with the information from the LCA from module A to C if a different LCA system perspective is applied.

Developing need: A common practice on how system expansion could be handled in a robust way should be worked out and established. The basic goal with module D should be considered and with this as basis it can be improved in future standardisation work.

2.1.2 Temporal system boundaries

Requirements given in EN15804

6.3.7 Data quality requirements

...

- The time period over which inputs to and outputs from the system shall be accounted for is 100 years from the year for which the data set is deemed representative. A longer time period shall be used if relevant;

...

Interpretation: All inventory flows like emissions leaching and evaporation from wasted products when left at a landfill shall be accounted for during a period of 100 years regardless of the product service life etc. This cut off criterion is quite common and supported by other systems.

Workshop discussions: Since emissions may occur after 100 years it is of interest to know what the potential influence of these remaining emissions could be. To assess this, a supplementary inventory could be performed, covering the remaining emissions during a longer, albeit surveyable time period and thus evaluate the impact from two time perspectives:

1) 0-100 years and 2) 100+
Recommendation: As a supplement to the 100 years "cut off" alternative we suggest that future updates of EN15804 also require an additional time frame for the inventory and an impact assessment that we here call 100+ or surveyable time.
Developing need: The time resolution will not influence the LCIA result If only impact assessment methods based on inherent properties were used. But since also time dependant midpoint category indicators like GWP are used, this time boundary will affect the LCIA as well. If impact assessment methods are used that take time into account a congruent time system boundary harmonised for LCI and LCIA is required. This would then require the development of a characterisation factor (CF) based on the 100+ time perspective. Note that this approach will also influence the carbon storage or delayed emission approach described below in paragraph 2.2.3.3-.

2.1.3 Selection of data and double accounting – e.g. electricity

Requirements given in EN15804
6.3.6 Selection of data As a general rule, specific data derived from specific production processes or average data derived from specific production processes shall be the first choice as a basis for calculating an EPD. In addition the following rules apply: – An EPD describing an average product shall be calculated using representative average data of the products declared by the EPD; – An EPD describing a specific product shall be calculated using specific data for at least the processes the producer of the specific product has influence over. Generic data may be used for the processes the producer cannot influence e.g. processes dealing with the production of input commodities, e.g. raw material extraction or electricity generation, often referred to as upstream data (see Table 1); – A specific EPD covering all life cycle stages (cradle to grave) may be calculated using generic data for some downstream processes e.g. waste incineration. For the sake of comparability the calculation of the use stage shall be based on the same additional technical information as is required in 7.3; ...
Interpretation: EN 15804 differs from two types of EPD valid for; 1) average products and 2) specific products. When the general rule cannot be followed the recommendation is to e.g. use generic electricity data as a general principle, to avoid any problems with double accounting. The first type of EPD is likely to handle sector EPD or a number of companies in a region etc. In this case the average electricity mix used in the LCI will reflect the common market as an average.
Workshop discussions: Compared to other physical commodities electricity has 1) different environmental impacts depending on the source and 2) includes electricity disclosure or contract bought as Guarantees of Origin (GO). Buying a GO certificate does not necessarily lead to any change on the market situation (including additionally) This is however not a problem as such in an attributional LCA. We have to distinguish between *production* and *use* of electricity, where the latter is defined by the act of cancelling a GO, or by the act of using the information contained in a GO for

disclosure. It is the use of electricity that is accounted for as specific data in LCA. This implies that if no electricity with a GO is bought, a 'specific' so called residual mix for the country or region has to be used. Where a net flow of GO is exported, this will influence the mix in the importing as well as the exporting country. GO is regulated in the new European RES Directive 2009/28/EC as well as in the Cogeneration Directive and the Internal Energy Market Directive. For instance, for products made of electro furnace steel and aluminium, the type of electricity used will dominate the environmental impact significantly, and has to be documented for transparency and regulated to achieve a fair comparison.

The problem occurs if a manufacturer has GO electricity and would like to use this specific data instead of average data. In an ideal attributional LCA one could support the use of specific GO data if such GO system fulfils the causality required by LCA. The manufacturers who do not have contract electricity with a certification of its origin will have to use data for the specific residual mix (for the country or region) in order to avoid a double accounting. We now have two alternatives and to minimise the double accounting problem (and unfair comparisons), and we cannot accept both approaches in the same system at the same time, if double accounting shall be avoided.

Open consultation:

MiSA strongly objects to a recommendation to include GOs as means to document the environmental impacts from electricity consumption, since it will render a result in the EPD useless to a decision maker, and potentially undermine the trust in the EPD system. Instead MiSA suggest that the information in the EPD should be based on the physical inputs to the product system under study. GOs facilitate the trade of environmental attributes (the "renewable attribute") totally independent of any physical transfer of energy.

SINTEF state that they do not want to see that GOs are included in an EPD. An EPD is supposed to show the physical reality of a process connected to a product (based on consumption mix) and to implement mechanisms like this into a standard can lead to green washing – and double counting of the environmental benefit.

The International EPD System support the use of GO to account for electricity production in markets where there is a robust system to do so. Robust in this case means ensuring that no double-accounting occurs, but could also implies that some connection to physical transmission capacity and properly functioning markets have to exist. As pointed out, the use of GO's has to be supplemented with the requirements that residual mix is used for unknown electricity production.

Recommendation: In theory there seems to be consensus to account for the electricity that is actually used/bought in an attributional LCA (as used e.g. in EN 15804). This will require a connection to physical transmission capacity and is accounted for in the system that handles GO. Current GO systems are papers that are issued when electricity is produced specifying the source and they can be sold independently of the physical product. This fact is received from both MiSA and SINTEF, but also the International EPD System argues that such physical connection to the real market situation has to exist. As far as this physical causality is not part of the GO system, there is no guarantee that GO will lead to a correct decision, why this approach with its current construction does not fulfil basic LCA requirements.

The following recommendation to EN 15804 (given below) shall therefore be regarded as the long term goal to be achieved. The recommendations are divided in two types of applications. Please note that it is only the first application that is valid for an EPD (according to our recommendation):

1) A) for a material producer the recommendation is to always use specific data for the core process.
   B) for construction works the recommendation is to use specific data for the materials and energy for the construction stage. In the usage stage it is accepted to use specific bought electricity data, but supplemented with generic country or regional average

Data on electricity used shall reflect its specific origin and environmental performance if it can be proved. Current GO certificates like RECS or likewise do not include such aspects that are required in the context of LCA. If no such data is available the average electricity mix in the region shall be applied (see comments above). This latter mix should be based on figures representing an average for between 3 to 5 years, depending on how much the grid mix varies from year to year[8].

2) **In generic EPD databases**: Specific data is always the first choice in an ideal LCA and especially in an EPD. But we also have to consider a streamlined approach when this is not possible and according to common understanding, generic data that are representative as an average or conservative is acceptable. We therefore recommend that specific data on electricity shall always be used (specific or residual data) if possible, and only when this is not possible generic data shall be used that reflect the average electricity grid on the market. The generic electricity bought in a region includes net import and export. In Sweden this market will be equal with the Nordic countries (excluding Island), since they share the same spot market and are physically connected to an integrated system. Moreover, we recommend using average figures covering 3 to 5 years, depending on how much the grid mix varies from year to year.

Developing need: No development need identified concerning LCA-methodology

2.1.4 Process allocation

EN 15804 follows ISO14044 on process allocation as outlined in paragraph 4.3.4 and give some specifications dealt with here. Then EN 15804 introduces an allocation procedure that does not follow the rules given by ISO14044 4.3.4 concerning by-product allocation dealt with here separate in paragraph 2.1.5 below.

Requirements given in EN 15804

6.3.4 System boundaries

6.3.4.1 General

...

– The “polluter pays principle”: Processes of waste processing shall be assigned to the product system that generates the waste until the end-of-waste state is reached.

For instance:

– the “cradle to gate with options” information of a cleaning agent used for maintenance of the product is declared in the product’s life cycle sub-module B2 “maintenance”;

...

6.3.4.5 End-of-life stage

...

– C3 waste processing e.g. collection of waste fractions from the deconstruction and waste

[8] Latest redual mix figures can be found on: http://www.reliable-disclosure.org/static/media/docs/RE-DISS_2012_Residual_Mix_Results_v1_0.pdf

processing of material flows intended for reuse, recycling and energy recovery. Waste processing shall be modelled and the elementary flows shall be included in the inventory. Materials for energy recovery are identified based on the efficiency of energy recovery with a rate higher than 60 % without prejudice to existing legislation. Materials from which energy is recovered with an efficiency rate below 60% are not considered materials for energy recovery.

NOTE 2 Only when materials have reached the end-of-waste-state can they be considered as materials for energy recovery, provided the energy recovery process has an energy efficiency rate higher than 60%.

...

6.4.3.2 Co-product allocation

...

– Material flows carrying specific inherent properties, e.g. energy content, elementary composition (e.g. biogenic carbon content), shall always be allocated reflecting the physical flows, irrespective of the allocation chosen for the process.

...

Interpretation: In respect to the specification given above it is clear that whatever allocation approach is used inherent properties have to be included – at least when the energy efficiency is more than 60%. So, if a waste material is used as fuel in an energy process with an energy efficiency higher than 60%, the emissions and inherent energy (resource use) shall be allocated to the downstream product (e.g. district heat). As an example of this interpretation; if fossil rubber and plastic from wasted products are used as fuel in the manufacturing process the delivered products from the process will be attributed to the fossil CO_2 emission and fossil primary energy etc. If the wasted material does not reach an end-of-waste status, both emission and inherent energy shall be allocated to the upstream product according to the 'Polluter Pays Principle' (PPP). This means that e.g. landfill gas (energy efficiency lower than 60%) can be used without any resource use or emission (since they are allocated to a historical product). The Polluter Pays Principle (PPP) as defined in the waste directive, point (1) Article 14 as follows: "In accordance with the polluter-pays principle, the costs of waste management shall be borne by the original waste producer or by the current or previous waste holders". In other words the PPP is not precise and thus the 60% rule supports its implementation concerning energy recovery. It is essential to understand that the directive distinguish between (point (17) Article 3),

- recycling and
- energy recovery.

Since the relative order between the 'inherent properties' and PPP is not given, it could be argued that inherent properties are excluded when following PPP. But if we do not assume PPP to overrule the 'inherent property' principle, the 60% energy efficiency would be pointless. We therefore conclude that the following order is valid for allocation according ISO 15804 (not following ISO14044): 1) PPP 2) Inherent properties 3) End-of-waste criteria.

Workshop discussions: An example following the stepwise procedure given above is co-generation of power and heat. Following the requirements that inherent properties cannot be allocated away (or 'natural physics laws' shall be followed) is that the energy use for the delivered electricity as well as heat will be ≥ 1 MJ_{in}/MJ_{out} for both heat as for electricity. This is perhaps not a problem, but other methods exist such as the so called 'alternative production' method (see PCR 2007:08, version 2.01, dated 2011-12-05, from the International EPD system). If this allocation procedure shall be implemented in combination of fist allocate the environmental impact that can be linked to inherent properties of the delivered products , only

part left that it will be handled by the 'alternative production' method is the energy losses).

A structural problem is that the end-of-waste criteria are based on the European waste legislation and are interpreted differently. This is an even worse problem on an international level since European law is not valid worldwide. One may also ask; what happens when this legislation is updated? Is the updated directive supposed to be followed? In a note in EN 15804 the following explanation is given concerning the end-of-waste criteria; "The criterion for "overall adverse environmental or human health impacts" shall refer to the limit values for pollutants set by regulations in place at the time of assessment and where necessary shall take into account adverse environmental effects. The presence of any hazardous substances exceeding these limits in the waste or showing one or more properties as listed in existing applicable legislation, e.g. in the European Waste Framework Directive, prevents the waste from reaching the end-of-waste state." The full meaning and implementation of this requirement will in practice depend on the interpretation by the person performing the EPD.

Open consultation:

The International EPS System underline that the ease-of-explaining of a methodology should not be underestimated. As long as decision-makers are aware of the benefits of a strict use of the polluter-pays principle to the use of recycled material, it is both elegant and may guide small-scale decisions in the correct way. Supplementary policy instruments should be implemented on a societal level to ensure that products are recycled in end-of-life or that available energy is used.

Recommendation: The allocation specifications makes the general process allocation very robust, thus we support them, except the vague definition of end-of-waste concerning toxic properties of the products end-of-waste criteria. In the meantime, different PCRs will have to specify an applicable definition to clarify understandable end-of-waste criteria introduced in EN 15804.

In future revisions of EN15804 we therefore suggest that the 60% efficiency rule is complemented with a requirement that the energy generated in the same process shall be used by market (and not just wasted). In the revised version, the order between the allocation principles should be more precise. Following ISO 14044 and our interpretation of EN 15804 gives the following order:

0) Divide the process into different sub-processes,

1) PPP

2) Inherent properties

3) Material flows: End-of-waste criteria. Energy flows: the 60% energy efficiency rule.

Developing need: An applicable end-of-waste definition in the context of LCA has to be developed that can be applied globally in a robust way. This matter has to be handled jointly with the by-product allocation procedure suggested in forthcoming update of EN 15804.

2.1.5 By-product allocation

Requirements given in EN15804

6.4.3 Allocation of input flows and output emissions
6.4.3.1 General

...
In this standard, the rules for allocation are based on the guidance given in EN ISO 14044:2006, 4.3.4. However, the basic procedures and assumptions used in EN ISO 14044 have been refined in order to reflect the goal and scope of this standard and EN 15643-2.
...

6.4.3.2 Co-product allocation

...
In the case of joint co-production, where the processes cannot be sub-divided, allocation shall respect the main purpose of the processes studied, allocating all relevant products and functions appropriately. The purpose of a plant and therefore of the related processes is generally declared in its permit and should be taken into account. Processes generating a very low contribution to the overall revenue may be neglected. Joint co-product allocation shall be allocated as follows:

– Allocation shall be based on physical properties (e.g. mass, volume) when the difference in revenue from the co-products is low;
– In all other cases allocation shall be based on economic values;
– Material flows carrying specific inherent properties, e.g. energy content, elementary composition (e.g. biogenic carbon content), shall always be allocated reflecting the physical flows, irrespective of the allocation chosen for the process.

NOTE 1 Contributions to the overall revenue of the order of 1% or less is regarded as very low. A difference in revenue of more than 25 % is regarded as high.

...

Interpretation: The motivation for not following ISO 14044 is quite vague and the reference to ISO doesn't make it clearer. Moreover, 'by-product' is not a defined term by ISO 14044, which only deals with co-product allocation. By-product is here regarded as a co-product that is not the primary product or service being produced, which also has a minor quantity and/or revenues when compared to the main products. A by-product definition is then given in a note where first evaluation is to analyse the overall revenues at the manufacturing plant. The second evaluation is the compare the revenue for different co-product from the same manufacturing plant.

Even though this allocation procedure is valid it says that it cannot overrule inherent aspects. Besides energy use and emission, also the fact that the by-products with pozzulane properties are used in concrete and the fact that they will carbonate in contact with air in the usage phase has to be handled. The capability to carbonate is based on an inherent chemical property and if these by-products take this into account in the allocation, such components will generate net negative emissions in an LCA. It is not clear how this shall be dealt with according to the procedures given in EN15804.

Common aggregation

Workshop discussions: The by-product allocation is a complicated question also for

construction products and there is no consensus about how to handle this in the LCA community. All kinds of waste that are created in large amounts have to find a market that also is large enough to receive the flow, and the building and construction sector is therefore always a target for all kinds of waste that appear in large amounts. The same problem is also valid for all by-products with an inherent energy that can be used as fuel and competes with other energy wares.

Somewhere, based on common sense, one can ask if the amount of the product is a sound basis for allocation. The major remark, however, with the allocation procedure suggested for by-product allocation is that it requires information on revenue that is decided by the manufacturer himself by different internal cost allocations methods and is seldom publically available. The market price is perhaps in this context a better basis for allocation (and more commonly used).

A practical problem for the concrete industry is then that e.g. different by products with pozzulane properties has almost the same price as the main product or the product they compete with (cement, quick lime, etc.). The price picture is quite natural since they have a better environmental profile and has desirable properties. In a market economy it is suspected that the price also will be just lower than the substitute, but not extremely low-priced.

Recommendation: A simplification of the allocation approach suggested in EN15804 is suggested here: All joint produced flows that are outputs from an ***environmental cleaning*** or ***waste treatment process*** with (in the latter case) an energy efficiency lower than 60% will be allocated to the upstream product system from which it originates, regardless of; inherent properties, price, revenue, if it fulfils end-of-waste criteria or is still regarded as waste. These kinds of by-products are never part of the main reasoning for the process. Such by-products are used downstream without any environmental inherent or upstream environmental burden. In this instance, the next system is acting as a waste processing, waste recovery or waste disposal process. However, the future environmental impact such as leaching etc from the product will be allocated to the downstream product system. With other words; no historical impacts from the waste producing system can be allocated to the next product system but future emissions from leaching etc will be accounted to the downstream user.

Developing need: Not identified

2.1.6 Open loop recycling (with attributional LCA)

Requirements given in EN15804

6.4.3.3 Allocation procedure of reuse, recycling and recovery
The end-of-life system boundary of the construction product system is set where outputs of the system under study, e.g. materials, products or construction elements, have reached the end-of-waste state. Therefore, waste processing of the material flows (e.g. undergoing recovery or recycling processes) during any module of the product system (e.g. during the production stage, use stage or end-of-life stage) are included up to the system boundary of the respective module as defined above.
...

Interpretation: EN 15804 uses the 100/0 or cut off approach for OLR. The same allocation principle for inflows shall be used for the inflows.

Common aggregation

Workshop discussions: Methodical settings for OLR is partly handled with the process allocation method applied and system boundaries between different product systems, see paragraph above (2.1.4, 2.1.5) and as complementary information to the 100/0 allocation applied in module D, see below (0).

As mentioned before: The current recycling approach, referred to as 100/0 or cut off approach, is sometimes criticized to support the use of recycled material but not to support future product recycling. The EPD shall be based on robust information and information that can be verified or likely to happen, this will always be a problem when we are talking about a scenario. In the cut off approach all that is needed is to evaluate if it is realistic that the product will be replaced or not. This is a much easier task – and therefore more robust – than to add what it will used for and then potentially replace in future.

Note that module D handle aspects that are not covered by the 100/0, see below in section 0

Consequences from downstream recycling – Module D.

Recommendation: the current 100/0 allocation approach is the most robust alternative, especially for long lived products and is therefore fully supported here.

Developing need: Not identified

2.1.7 Consequences from downstream recycling – Module D

Requirements given in EN15804
6.4.3.3 Allocation procedure of reuse, recycling and recovery: The end-of-life system boundary of the construction product system is set where outputs of the system under study, e.g. materials, products or construction elements, have reached the end-of-waste state. Therefore, waste processing of the material flows (e.g. undergoing recovery or recycling processes) during any module of the product system (e.g. during the production stage, use stage or end-of-life stage) are included up to the system boundary of the respective module as defined above. Where relevant (see 6.3.4.5 and 6.3.4.6), informative module D declares potential loads and benefits of secondary material, secondary fuel or recovered energy leaving the product system. Module D recognises the "design for reuse, recycling and recovery" concept for buildings by indicating the potential benefits of avoided future use of primary materials and fuels while taking into account the loads associated with the recycling and recovery processes beyond the system boundary. NOTE 1 Module D also contains benefits from exported energy from waste disposal processes declared in module C4. Where a secondary material or fuel crosses the system boundary e.g. at the end-of-waste state and if it substitutes another material or fuel in the following product system, the potential benefits or avoided loads can be calculated based on a specified scenario which is consistent with any other scenario for waste processing and is based on current average technology or practice. If today's average is not available for the quantification of potential benefits or avoided loads, a conservative approach shall be used. In module D the net impacts are calculated as follows: – by adding all output flows of a secondary material or fuel and subtracting all input flows of this secondary material or fuel from each sub-module first (e.g. B1-B5, C1-C4, etc.), then from the modules (e.g. B, C), and finally from the total product system thus arriving at net output flows of secondary material or fuel from the product system; – by adding the impacts connected to the recycling or recovery processes from beyond the system boundary (after the end-of-waste state) up to the point of functional equivalence where the secondary material or energy substitutes primary production and subtracting the impacts resulting from the substituted production of the product or substituted generation of energy from primary sources; – by applying a justified value-correction factor to reflect the difference in functional equivalence where the output flow does not reach the functional equivalence of the substituting process. In module D substitution effects are calculated only for the resulting net output flow. The amount of secondary material output, which is for all practical purposes able to replace one to one the input of secondary material as closed loop is allocated to the product system under study and not to module D. NOTE 2 Avoided impacts from allocated co-products are not part of Module D information, see 6.3.4.6.
Interpretation: The interpretation of the description above to calculate the net impact (I) to

reported in module D is that it shall be calculated as follows:

ID = R – A, where

ID is the net environmental impact given per impact category for the inherent product mass that is an outflow from module C to the society

R is the impact for the recycling process and/or process to replace a primary material

A is the avoided impact for a resource that virtually is supposed or substituted by the recycling process.

Note that the mass of the product and the mass of the avoided product has to be of the same functional quality which means that is doesn't have to be the same amount unless it is a metal. In case the product substitutes an energy carrier, the same functional equivalence is assumed to be based on equal energy content. The conditions for the scenario shall be based on the current market situation (even though in reality recycling is likely to take place in future).

Requirements given in prEN 16485:2012[9]

...

Module	Landfill	Thermal waste treatment	Energy recovery		Recucling
...					
D	Avoided impact of electricity production and/or thermal energy recovery from landfill gas recovery	Avoided impact of electricity production and thermal energy recovery	Site operation and wood combustion and avoided impact of electricity production and thermal energy recover	Site operation and wood combustion and avoided impact of electricity production and thermal energy recover	Avoided impact of forestry, harvesting, wood chips preparation and drying
...					

...

6.3.5 Benefits and loads beyond the product system boundary in module D
As EN 15804 other than:
For wood and wood-products, in addition to a reuse, recovery and/or recycling scenario, the potential benefits of a cascading scenario can be declared as a combination of an energy recovery following a recycling scenario. In doing so, double-counting shall be avoided.

...

Interpretation: prEN 16485 lists different options that can be reported and divided in different categories or combinations. This PCR also stress the possibility to introduce cascade recycling (e.g. adding a series of recycling processes after each other).

Product Environmental Footprint (PEF)

An alternative is also to evaluate if the OLR formula in PEF that in fact also is applicable for module D. The introduction to Annex V is given below and consult the underlying report for more detailed information:
(http://ec.europa.eu/environment/eussd/smgp/pdf/annex2_recommendation.pdf)

Annex V: Dealing with Multi-functionality in Recycling Situations

[9] Round and sawn timber – Environmental Product Declarations – Product category rules for wood and wood-based products for use in construction.

Dealing with multi-functionality of products is particularly challenging when reuse, recycling or energy recovery of one (or more) of these products is involved as the systems tend to get rather complex.
The overall resulting Resource Use and Emissions Profile (RUaEP) per unit of analysis can be estimated using the formula provided below, which:

- is applicable for both open-loop and closed-loop recycling;
- if relevant/applicable, can accommodate re-use of the product being assessed. This is modeled in the same manner as recycling;
- if relevant/applicable, can accommodate downcycling, i.e. any differences in quality between the secondary material (i.e. recycled or reused material) and the primary material (i.e. virgin material);
- if relevant/applicable, can accommodate energy recovery;
- allocates the impacts and benefits due to recycling equally between the producer using recycled material and the producer producing a recycled product: 50/50 allocation split.

The quantitative figures for the relevant parameters involved need to be gathered in order to use the formula provided below to estimate overall RUaEP per unit of analysis. Whenever feasible, these should be determined based on data associated with the actual processes involved. However, this may not always be possible / feasible and data may have to be found elsewhere (please notice that the explanation provided hereafter for each term of the formula contains a recommendation on how/where to find missing data).

The RUaEP per unit of analysis is calculated with the following formula.

$$\left(1-\frac{R_1}{2}\right)\times E_V+\frac{R_1}{2}\times E_{recycled}+\frac{R_2}{2}\times\left(E_{recyclingEoL}-E^*_r\times\frac{Q_S}{Q_P}\right)+R_3\times\left(E_{ER}-LHV\times X_{ER,heat}\times E_{SE,heat}-LHV\times X_{ER,elec}\times E_{SE,elec}\right)+\left(1-\frac{R_2}{2}-R_3\right)E_D-\frac{R_1}{2}\times E^*_D$$

…

Interpretation: The PEF implies to merge a larger system perspective and integrate elements from both attributional and consequential modelling approaches. In brief, the equation above takes into account the 50/50 OLR allocation method and system expansion. Traditionally the same allocation approach shall be used for input flows as for output flows in OLR, which then creates symmetry (and avoids double accounting or the reverse). It is therefore a bit remarkable that quality degradation is handled different for input versus output flows (unsymmetrical). The main difference is actually in the context of using this information compared to EN 15804. In EN 15804 this kind of information is regarded as supplementary information and was introduces (at least partly) to handle a 'sustainable use of natural resources' (i.e. BWR7 in CPR) and aspects related to recycling. These methodical settings are in PEF part of an integrated final environmental performance profile that will be used to compare different products against each other. This profile includes not only verifiable information of the product and its upstream environmental impact, but also based on settings on future material fate and choice of substituted. No guidance is found in the PEF document on how to select the margin material. It is well known that this assumption will dominate the overall result to a great extent and should therefore be handled in detail in the context that system expansion is used here.

Common aggregation

Workshop discussions: The possibly to introduce cascade recycling for long-lived products like construction products seems unrealistic and will generate a number of 'avoided' impact per recycling loop. We do not regard this recommendation from the wood PCR to be in line with the requirements given in EN15804 and can therefore not be applied.

In the context of leaching of toxic substances it could be of interest to include a system expansion that actually accounts for not only the material substitution but also the substituted

function in the new extended life cycle. A methodology problem appears here, since e.g. down cycling will not lead to the same functionality as more or less always is relevant for metal recycling.

A recognized problem with Module D in its current handling in EN 15804 is that it is asymmetrical. If symmetrical, the environmental impact gained in module D should also be a burden if recycled resources are used.

Open consultation:

CBI, Cementa and Svensk Betong suggests that module D is deleted from the EPD. If it has to be used they stress that both environmental negative as positive aspects when the material is recycled into a new product has to be reported, in order to achieve a more objective result.

The International EPD System strongly supports that Module D, if included, shall be reported separately. Symmetry must be achieved of the upstream burden for using recycled material and the avoided burden of sending material to recycling. See also their comment on 2.1.1 for problem of mixing different systems' approaches.

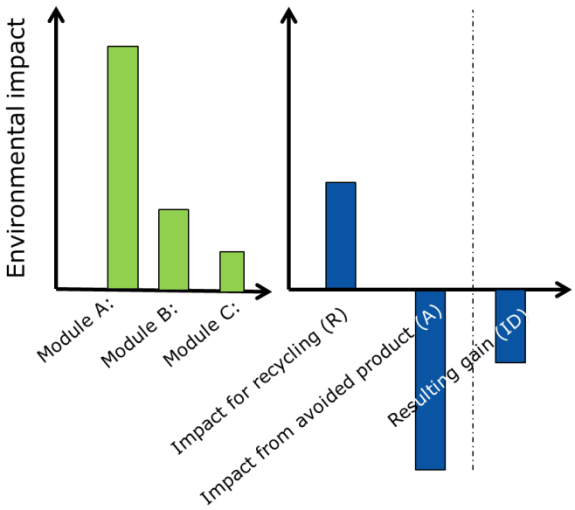
Recommendation: If module D be has to be included we suggest that the following requirements has to be accounted for:

- that Module D shall be reported separately from the target products environmental profile (the original products LCIA result), meaning that they shall not be reported in the same table or figure.
- a symmetric methodology has to be implemented for module D if OLR is to be accounted for, meaning that if an environmental material gain is achieved in end-of-life, it also has to be counted as a burden and used as input to the same life cycle.
- if current practice as a baseline scenario might not be defined, this baseline scenario shall be complemented with a realistic, worst case and best case.

EN 15804 explains on page 29: "If today's average is not available for the quantification of potential benefits or avoided loads, a conservative approach shall be used. " Note that 'realistic best' is introduced to illustrate the gap between the current practice and the most favourable alternative. This matter could also be handled within sub-oriented PCRs to EN15804 and submitted for open consultation to branches outside the own. Moreover, EN 15 804 in paragraph 6.4.3.3, explains: "In module D substitution effects are calculated for the resulting net output flow" meaning that it is the difference between the material input, typically in module A, and output in module C that shall be assessed.

Moreover, we strongly recommend that in future revisions of EN15804 it be stressed that the LCA result from module D shall be kept separate from the result from module A to C, since it is based on another system approach and the figures are not comparable (or modular). Motivation for selecting the marginal material/energy carrier shall always be reported in the EPD.

Concerning the reporting the LCA result from Module D it shall be made in a way that no data information is lost, which means that both the impact from the recycling process (R) and the avoided impact (A) shall be reported separately. If preferred, the total environmental gain (ID) can be given as well, see illustrative figure below:



As an ultimate goal it was agreed that Module D has to be transformed to a recycling declaration. This recycling declaration shall only account for the construction products inherent materials that come as an outflow from life cycle stage C, namely the scraped products and its parts. It is also noticed that the transparency has to be increased that in practice means that Module D will have to be split into several modules following the same structure for all other life cycle stages A to C. No consensus was reached. We did not agree on if this module should be mandatory, which LCA method or methods to use or if a qualitative description should be enough if this module is made mandatory.

Developing need: A number of subtasks could be identified and these two examples were identified in the project:

A common practice on how system expansion could be handled in a robust way in combination, with preferably the 50/50 allocation approach, should be worked out and evaluated as alternative approach fulfil the symmetry that the current implementation of EN 15804 doesn't. This development could be restricted for use in for module D in EN 15804, following our recommendations, or alternative as part of a new impact assessment method just dealing with OLR.

If possible a system expansion approach should be elaborated that goes beyond the material substitution to also account for substituted functions. This approach would then illustrate different recycling alternatives including down-cycling or other applications where the original functional quality is lost as well as the full meaning of life cycle thinking and taken reasonable for what inside the product and consequences this might have in future (especially if used in wrong applications or intended use)

2.2 Environmental performance declaration

ISO 14025 divides the environmental performance in a number of groups that shall be reported separately as follows;

a) life cycle inventory analysis (LCI) indicators,

b) life cycle impact assessment (LCIA) indicators,

c) other data based on LCA

'Other data' is here interpreted as other data based on LCA but for some reason (e.g. that the indicator is not robust enough) are reported separately. ISO14025 exemplifies such data with intermediate waste flows. We will here interpret 'LCI data' as a result that may be used for any LCIA model. Environmental performance that is not based on LCA may be reported under the heading "Additional environmental information".

2.2.1 Life cycle inventory (LCI) indicators

2.2.1.1 Resource use

Requirements given in EN15804

7.2.4 Parameters describing resource use

...

Table 4 — Parameters describing resource use

Parameter	Unit(expressed per functional unit or per declared unit)
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value
Use of renewable primary energy resources used as raw materials	MJ, net calorific value
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, net calorific value
Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials	MJ, net calorific value
Use of non renewable primary energy resources used as raw materials	MJ, net calorific value
Total use of non renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, net calorific value
Use of secondary material	kg
Use of renewable secondary fuels	MJ, net calorific value
Use of non renewable secondary fuels	MJ, net calorific value
Net use of fresh water	m^3

...

Interpretation: The list given in Table 4 is mandatory. Note that it is enough to report the total amount resource used per category indicator given in kg or MJ. Moreover, note that use of materials that are not an energy carrier doesn't need to be declared except for use of secondary materials. In traditional LCA calculations it is not common to account for the inherent

material content, only the use of natural resources or recycled material is normally declared. The LCI result defined in Table 4 is calculated from the knowledge of the inherent energy in the product and the total amount of energy carrier extracted.

Workshop discussions: It is hard to interpret the environmental LCI indicators listed in Table 4, especially since it is only required to report the total sum per category. To make more sense, the individual flow covering e.g. 90% per LCI category should be listed as well as the use of all kinds of materials. The large amount of agglomerated indicator figures in Table 4 on energy use may also be regarded as double accounting in relation to two of the impact categories; depletion of abiotic resources (elements) and depletion of abiotic resources (fossil), respectively. An alternative is therefore to accept the LCIA indicators as such without supplementing the agglomerated LCI result listed in Table 4. If so and to have a more complete assessment, it should be noted that there is a missing category indicator for use of renewable energy wares. Such LCIA method for use of renewable energy wares has to take the different scarcity of such sources into account.

Open consultation:
The International EPD system suggest that resource use should be reported as both LCI results according the General Programme Instructions of the International EPD® System (see GPI, section 4.4.2 USE OF RESOURCES). Then, for the LCIA result they suggest to use only one (non-mandatory) impact category for resource use namely abiotic resource depletion[10].

Recommendation: The general trend and goal for communicating the LCA result in an EPD is that the environmental performance is reported as a LCIA result: We regard this as a goal relevant also for the International EPD system (irrespectively of the comments given on this matter, see above). We therefore agree to the statement given in EN15804 suggesting that future updates of the EN 15804 standard should apply an improved common LCIA method for resource depletion. It also worth considering whether the LCIA result may be enough and the LCI result thus can be excluded. One LCIA method that could be further evaluated is the one proposed by Erlandsson and Sandberg (2012) where an impact assessment method that includes CF for both renewable as non-renewable energy resources was developed. Together with the current method for abiotic resource depletion of elements, such an impact assessment method could fill the current information gap. The CF asked for in this context shall cover all kinds of resources and the environmental mechanisms on a midpoint level.

Developing need: It is desirable to develop an integrated LCIA method and category indicator that will make it possible to compare the relative order between all kinds of resources used. Such a method should be prioritized in future updates of EN15804 or ISO 21930 (but probably with this latter standard not include any precise CF).

[10] http://www.environdec.com/sv/The-EPD-system/General-Programme-Instructions/Recommended-characterisation-factors/

2.2.2 Other data based on LCA

2.2.2.1 Generated waste

Requirements given in EN15804

7.2.5 Other environmental information describing waste categories and output flows

7.2.5 Other environmental information describing different waste categories and output flows

...

Table 5 — Other environmental information describing waste categories

Parameter	Unit(expressed per functional unit or per declared unit)
Hazardous waste disposed	kg
Non hazardous waste disposed	kg
Radioactive waste disposed	kg

NOTE The characteristics that render waste hazardous are described in existing applicable legislation, e.g. in the European Waste Framework Directive.

...

Interpretation: It is enough to report the total amount of waste generated per category indicator given in kg. All end-of-life processes that belong to the analysed product system are already part of the LCI.

Workshop discussions: The LCI indicators given in Table 5 have to be classified as intermediates and therefore, if correctly performed, should not be reported in the final environmental profile. An alternative is to coherently not include waste treatment in the LCI. The problem with this is that the full description of different waste flows should then be reported (and this is not in line with current EPD praxis).

Recommendation: The general trend for EPDs is that the environmental performance is reported as an LCIA result. The content of Table 5 is only supplementary information and it could be disputed why this information has to be accounted for in the final EPD. We therefore suggest that future updates of the EN 15804 standard drop the requirement to report waste flows. The environmental impact from the waste handling is covered by the LCA and its impact reported with the current CF.

Developing need: Generic LCI methodology that describes waste as source term in e.g. a landfill and the leaching behaviour applicable for LCA should be defined and implemented in the rules. This methodology may use the same analytic methods used for waste (i.e. batch leaching test – BLT) or the methods suggested in CEN TC 350 (i.e. column tests).

2.2.2.2 Technosphere flows

Requirements given in EN15804

7.2.5 Other environmental information describing waste categories and output flows

...

Table 6 — Other environmental information describing output flows

Parameter	Unit (expressed per functional unit or per declared unit)
Components for re-use	kg
Materials for recycling	kg
Materials for energy recovery	kg
Exported energy	MJ per energy carrier

NOTE 1 The parameters in Table 6 are also part of the additional information for scenarios at end-of-life, see 7.3.4, Table 12.

NOTE 2 The parameters in Table 6 are calculated on the gross amounts leaving the system boundary when they have reached the end-of-waste state as described in Annex B.

NOTE 3 The declaration of "components for re-use" and "materials for recycling": fulfils the conditions of 6.3.4.5, end-of-life stage.

NOTE 4 The parameter "Materials for energy recovery" does not include materials for waste incineration. Waste incineration is a method of waste processing and is allocated within the system boundaries. Waste incineration plants have a lower energy efficiency rate than power stations using secondary fuels. Materials for energy recovery are based on thermal energy efficiency rate of the a power station not less than 60 % or 65 % for installations after 31st of December 2008 in order to be in line with the distinction made by the EC.

NOTE 5 Exported energy relates to energy exported from waste incineration and landfill.

...

Interpretation: It is enough to report the total amount material generated per category indicator in kg, but for energy generated the figures shall be divided per energy carrier that we assume is equal to energy wares. As it is put forward here, one interpretation of this reporting requirement is that the scope is to report technosphere flows from all life cycle stages. This interpretation has to be considered overruled since these flows are handled with in the allocation procedure in the LCI and normally not needed to be reported. The adequate need for the information given in Table 6 is in the product end-of-life stage (module C) and only there. This kind of end-of-life information has to be based on a scenario, where the information in Table 6 describes the scenario outcome. Moreover, the information in Table 6 and its environmental gains is supposed to be evaluated further in module D, which describes the environmental load or benefits when the product inherent material is used by other product systems.

Concerning note 4; it should be noted that these figures are relevant for heat production and more information is found in the EC legislation on how to recalculate these if electricity is produced. However, the efficiency figures are set so low that a specific calculation is normally not needed and according to this rule, for instance all district heating plants in Sweden are classified as recovering energy (why they also has to take responsibility for the resource use and substances emitted at the waste incineration).

Workshop discussions: As indicated in Note 1, EN15804 requires that this information is reported in two places in the EPD. We agree that the information is relevant, but see no reason

to report it twice. Moreover, to make more sense the individual flow for all LCI-indicators should, for example, cover at least 90% of all individual flows per LCI category, i.e. in a similar manner as exported energy. It should be noted that the first interpretation of the inventory scope given above would in theory make it possible to add up all waste flows. An EPD of a wooden product could, for example, include all wood waste and by-products that appear from the forestry, through the installation of the wooden product in a construction, to the final recycling of the discarded product itself. The information on these waste flows may then be used as a starting point for system expansion in module D. In this case, the inherent wood in the product itself is actually smaller compared to the waste and by-products that will be generated in the whole life cycle. Such inventory scope interpretation would make it possible to include not only the product itself but already 'allocated away' inventory flows for system expansion in module D. This opportunity is not reflecting the aim of the attributional LCA methodology.

Recommendation: The correct place to handle this technical scenario information is as part of the end-of-life information module C. In this section it is also asked for a scenario description that describes the assumptions made. We cannot see any reason for reporting this information twice – if not the first interpretation scope is preferred – and suggest that the correct place to put this information is under paragraph 7.3.1 'Scenarios and additional technical information'. Note that if the interpretation of the meaning to include these indicators as suggested above are agreed upon, this interpretation would limit the 'misuse' to double account for the already allocated by-product in the e.g. wood product life cycle via an system expansion in module D.

Developing need: No such need defined

2.2.2.3 Biogenic carbon stored in the wood product

Requirements given in EN15804

This specific matter is not mentioned in EN 15804 beside a statement that impacts related to climate change shall be accounted for in the LCI and reported in the EPD. The exact scope is not defined.

Requirements given in prEN 16485:2012

6.3.2 Product stage:
As EN 15804 other than:
The product stage is an information module required to be included in the EPD. As illustrated in Figure 1 of EN 15804 it includes the information modules A1 to A3. The system boundary with nature is set to include those processes that provide the material and energy inputs into the system and the following manufacturing, and transport processes up to the factory gate as well as the processing of any waste arising from those processes. In the case of wood and wood-based products, this means:
The formation of wood in the forest is based on the absorption of CO_2 from the atmosphere. Therefore,

- the amount of biogenic carbon contained in the wood product is counted as a removal of CO_2. All other natural processes related to the forest are outside the system boundary of the LCA according to this European standard.
- All technical processes related to forestry operations, (e.g. stand establishment, tending, thinning(s), harvesting, establishment and maintenance of forest roads) are considered within the system boundary and are subject to co-product allocations as outlined in clause 6.4.3.2.

- Wood entering the product system from nature accounts for the feedstock energy and the biogenic carbon content as material inherent properties.

...

6.5 Impact assessment

As EN 15804 other than:

The GHG emission factor of biogenic CO_2 is 1 kg CO_2 e/kg. The import or export of carbon stored in wood as material inherent property is characterised with the respective factor and considered as part of the global warming potential.

...

Interpretation: Aspects related to land use is handled in paragraph 0 and carbon storage as impact assessment in paragraph 2.2.3.3. The wood PCR suggest that the inherent carbon is calculated as any other contribution to climate change and added up with all other contribution to the impact category global warming potential.

Common aggregation

Workshop discussions: Biogenic carbon as a product content is non-problematic as such. The timing of the greenhouse gases that might be disputed by some are accounted for within PAS 2050[11] and GHGP[12] as well as the upcoming PEF[13] from EC DG Environment and ISO/TS 14067. Other problematic aspect is if it is possible in a product perspective to account for forestry changes of the biogenic stock above ground (regardless if it increase or decrease). There seems to be consensus that the fact that the biogenic carbon in a product is stored creates a sink instead of e.g. a positive aspect. So if reported separately as an LCI result this mass balance of the inherent biogenic carbon is unproblematic, and the carbon assimilation will in the long run always be equal to the emissions, if the product is not stored in e.g. a landfill where not all carbon will break down in a foreseeable time horizon. The problem occurs first when these figures are converted to a contribution to climate change using GWP equivalents and then added up with the contribution with other emissions of greenhouse gases. And it should be noticed that the approach used in EN 16485; "The GHG emission factor of biogenic CO_2 is 1 kg CO_2 e/kg" is not scientifically correct.

Open consultation:

CBI, Cementa and Svensk Betong stress that biogenic carbon is in balance in sustainable forestry and generates a net emitter in non-sustainable forestry. Moreover, when reporting product content in CO_2 or CO_2 e it will mislead the reader to interpret it as an impact category result, why this shall be avoided. **The International EPD System** pointed out that also ISO/TS 14067 should be listed as a system that includes this matter.

Recommendation: Different opinions about how to handle this matter exist. If biogenic carbon stored in the product shall be reported as a LCI result it has to be in the EPD under 'Other environmental information', since it is not agreed upon in the common indicator list in EN 15804, nor as LCI or LCIA result.

See section 2.2.2.3 concerning recommendation about the potential sink effect (i.e. a LCIA result). Consensus may be reached that the stored carbon shall be reported as part of the product content following EN15804. This product content shall not be given in CO_2 or CO_2e in order not to mislead the LCA reader (C bio etc is more correct).

Developing need: Not identified, for a pure product content declaration.

[11] PAS, Publicly Available Specification (PAS 2050)
[12] GHGP, The Greenhouse Gas Protocol Product Standard
[13] PEF, Product Environmental Footprint

2.2.3 Life cycle impact assessment (LCIA) indicators

2.2.3.1 Selection of impact categories and LCIA methods

Requirements given in ISO 14025
6.7.1 Developing the contents of a PCR document **...** The programme operator shall produce the PCR document using the established consultation process, including the involvement of interested parties. The PCR document shall include the following: ... d) impact category selection and calculation rules, if applied; e) predetermined parameters for reporting of LCA data (inventory data categories and impact category indicators) (see Note below); f) requirements for provision of additional environmental information, including any methodological requirements (e.g. specifications for hazard and risk assessment); see 7.2.3 for information; g) materials and substances to be declared (e.g. information about product content, including specification of materials and substances that can adversely affect human health and/or the environment, in all stages of the life cycle); ... **7.2.3 Additional environmental information** A Type III environmental declaration shall include, where relevant, additional information related to environmental issues, other than the environmental information derived from LCA, LCI or information modules [see 6.7.1 f)]. This information shall be separated from the information described in 7.2.2. Identification of the significant environmental aspects should, as a minimum, take into consideration the following: a) information on environmental issues, such as 1) impact(s) and potential impact(s) on biodiversity, 2) toxicity related to human health and/or the environment, and 3) geographical aspects relating to any stages of the life cycle (e.g. a discussion on the relation between the potential environmental impact(s) and the location of the product system); ...
Interpretation: ISO 14025 outlines a minimum list of impact categories and characterisation factors (CF) that shall be used in all EPD within the same EPD system to support modularity. Moreover, if the environmental performance for the product includes any significant aspect that is not handled by the selected LCA (LCI or LCIA), this impact shall be reported with other measures in the EPD. ISO 14025 also lists a number of environmental aspects that are 'strongly recommended' to be considered in this context.
Workshop discussions: The text above can be interpreted as follows; 1) Biodiversity is an important impact category where there is currently no consensus nor any appropriate method to include in the LCA. If a relevant aspect for the product, e.g. for all bio-based products, other information dealing with this matter should be included in the EPD. Examples of inclusion of biodiversity in EPD exist and Vattenfall has a method that they call the 'biotope method'. A more common way to include this aspect in an EPD is to refer to recognised (type I – ISO 14024) forestry certification systems like PEFC and FCS.

2) Toxic aspects are relevant and even if included in LCA this aspect has dimensions that never will be possible to handle by LCA why other information should be given as supplementary information. Besides a content declaration some EPD also report selected emissions as LCI result in the EPDs.
3) Site dependent (as in LCA) and end-point based LCIA methods and site specific aspects in general, are perhaps handled more appropriately outside LCA or at least as a complement that might include more effect-oriented information than what is possible with LCA (only dealing with potential effects).

Requirements given in EN15804 (modified version 2013 given in red)

6.6 Impact assessment

The impact assessment is carried out for the following impact categories, ...;

- Global warming;
- ozone depletion;
- acidification of soil and water;
- eutrophication;
- photochemical ozone creation;
- depletion of abiotic resources (elements);
- depletion of abiotic resources (fossil).

...

The available characterisation factors for GWP, ODP, AP, EP POCP, and ADP from CML –IA version 3.9, dated November 2010 (Institute of Environmental Sciences Faculty of Science University of Leiden, Netherlands) and identified as "baseline" shall be used.
Note Columns containing baseline factors are identified in line 2 of the CML spreadsheet as *Problem oriented approach: baseline.*

Interpretation: EN15804 follows the trend for EPD to specify midpoint characterisation factors (CF). The list is a minimum list and it is allowed to add further CFs. The indicator describing the depletion of abiotic resources is subject to further scientific development. It is also mentioned in EN 15804 that "The use of this indicator is intended to be reviewed during the revision of this standard". When referring to CML 2002 it is not clear what CF actually should be used for 'abiotic depletion potentials' (ADP). This method includes non-renewable resources (fossil fuels and minerals). In Guinée et al. (2002) the ultimate stock reserves are used, which refers to the quantity of resources that is ultimately available, estimated by multiplying the average natural concentration of the resources in the earth's crust by the mass of the crust (Guinée, 1995). Additional characterisation factors have been listed by Oers et al. (2002), where the USGS economic reserve and reserve base figures are used instead. The latter CF is recommended by ILCD or more exactly described as "For resources depletion at midpoint, van Oers et al 2002 is the source of CFs (from the "Reserve base" figures), based on the methods of Guinée et al 2002."

Workshop discussions: It should be noted that the Core PCR EN 15804 is subject to a minor revision based on interpretation of actual CF to use. The suggested change is given above (in red). Instead of referring to the latest version of CML baseline CFs as done by ILCD EN 15804 refers to CML economical defined CFs. The original CF by Guinée et al 2002 must be regarded as more stable compared to later updates by Oers et al 2002 that are based on an economical definition of resource reserve.

Open consultation:

The Swedish Forest Industries and SP Trä suggest that if a complement to the 100 year default cut off for LCI and LCIA methods is asked for, a dynamic LCA approach is required.

This approach would then support a more effect oriented approach that requires further development.

Common aggregation

Recommendation:

1) For a product that consists of, or to a great extent use biotic resources, some indicator that deals with biodiversity shall be included in the EPD. As long as no consensus LCIA method exists the reporting on biodiversity shall be handled by reporting if any recognized forestry certification system is fulfilled or, as an alternative, the amount of the forestry resources that fulfil such requirements.

2) Toxic aspects related to the product emissions or leaching during its lifetime shall be reported as a minimal requirement. As long as no robust and generally accepted LCIA method for toxicity exists we prefer that this aspect is based on material specific data rather than fate approaches. This information may be based on measured data such as leaching figures from column leaching tests and do not necessarily have to be implemented in the LCA.

3) If it is possible in the future to reach a consensus method for human end ecological toxicity it should be included in the EPD. Such a characterisation model then has to be based on a midpoint indicator.

4) As mentioned above in paragraph 2.2.1.1 also use of renewable resources should be accounted for in the LCIA and reported in the EPD. If so, a common indicator which enables a comparison across different resource types should be used for all resources.

5) For transparency reasons, and as mentioned in paragraph 2.2.2.3, biogenic carbon stored in the product shall be reported as an LCI result and as a separate indicator (CO_2e_{BIO}) in the LCIA result. The recommendation on storage/sink carbon or delayed emissions is given in paragraph 2.2.3.3 and shall be followed.

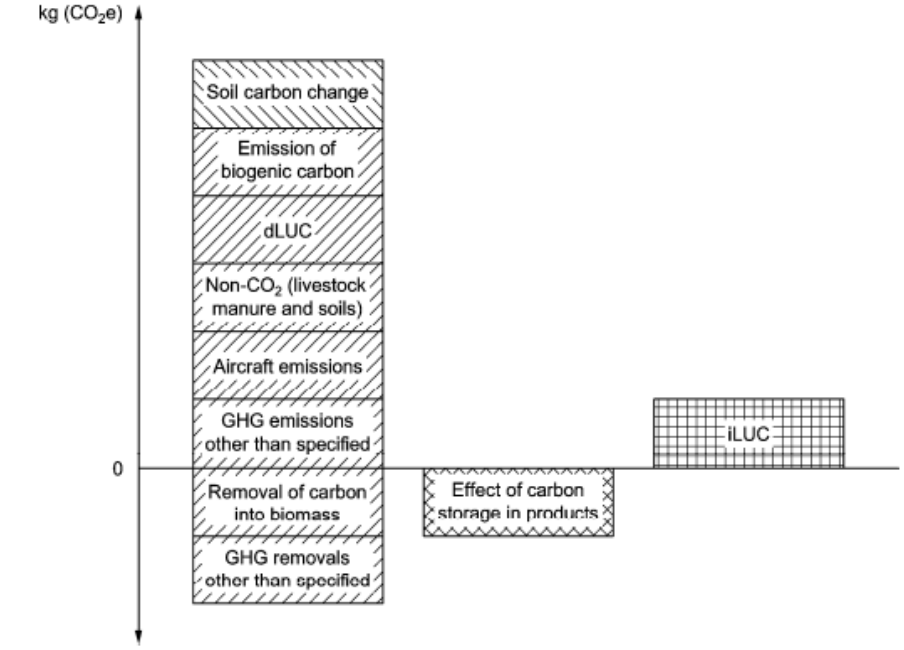
6) As mentioned in paragraph 2.2.3.2 consequences on land use and soil carbon stock change shall be reported, but separately to ensure transparency.

7) As mentioned in paragraph 2.1.2; a supplement to the 100 years cut off for GWP and other time dependent impact characterisations methods will require an additional CF. To differ from the normally 100 years integration time, these CF may be called 100+ or 'surveyable time' (covering 100-1000 years). An alternative to such CF is to develop an entirely dynamic approach, and following, that then requires typically yearly reported emissions. When analysing an energy system this yearly approach might not be sufficient enough, and a dynamic LCA approach may be more suitable.

8) Other impact categories that are not mentioned here but may be of interest is permanent occupation of land. A recognized generally accepted methodology for this is missing but the impact may be reported as a consequence within already existing impact categories, e.g. forestry land or agriculture land that stops net carbon fixation when turned into a construction site covered by asphalt etc. Further developing is needed to reach consensus in this area.

Developing need: For recommendation 1 and 2, non-LCA indicators exist namely forestry certification system and methods to determine leaching and emission as outlined by CEN TC 351, designed to be part of the CE label and so called declaration of performance (DOP). Nevertheless, developing of LCIA methods that makes it possible to integrate these aspects within the LCA is a research task. Also other characterisation models might be improved as for recommendation No 3 and 8 listed above, or if a dynamic LCA are aimed at (as relevant for bullet No 3, 5 and 7).

2.2.3.2 Land use and forest land carbon change

Requirements given in EN15804
This specific matter is not mentioned in EN 15804 more than impact related to climate change shall be accounted for in the LCI and reported in the EPD. The exact scope is not defined
Requirements given in ISO/TS 14067:2013[14]
6.4.10 Summary of requirements and guidance in 6.4.9 Table 1 is an informative summary of the requirements and guidance given in 6.4.9 and Figure 2 is an informative illustration of the specific components of the CFP. Refer to 6.4.9.2 to 6.4.9.8 for the full requirements and guidance. ...    **Key** Shall be included in the CFP Should be included in the CFP (if not already included in the dLUC) Shall be documented separately in the CFP study report if calculated, not included in the CFP Should be considered NOTE Soil carbon change, dLUC, Non-CO_2 (livestock, manure and soils) and iLUC can have a positive or negative contribution to the CFP. **Figure 2 — Illustration of the specific components of the CFP** ...
Interpretation: ISO/TS 14067 is published as a technical specification since no general agreement could be met to publish it as a full standard. Nevertheless, this is a result from a

[14] Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification and communication.

global consensus project. The environmental impact is divided into three groups where effects on carbon storage in the specific product and indirect land use change (iLUC) are reported separately.

Requirements given in prEN 16485:2012

6.3.2 Product stage:

...

Temporal changes in forest carbon pools resulting from forestry operations can be disregarded for sustainably managed forests and for forests where overall biogenic carbon stored in forest carbon pools is stable or is increasing.

Consideration of the biogenic carbon-neutrality of wood is valid for wood from countries that have decided to account for Art. 3.4 of the Kyoto Protocol or which are operating under established sustainable forest management or certification schemes.

...

In addition and when significant, the GHG emissions and removals occurring in forest carbon pools as a result of direct land use change resulting from harvesting operations should be assessed in accordance with internationally recognized methods such as the Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories. These GHG emissions shall be documented separately in the report. Double-counting shall be avoided.

...

6.5 Impact assessment

As EN 15804 other than:

The GHG emission factor of biogenic CO_2 is 1 kg CO_2 equiv./kg[15]. The import or export of carbon stored in wood as material inherent property is characterised with the respective factor and considered as part of the global warming potential.

...

Interpretation: A simplified approach suggested in prEN 16485 is that countries that account for Art. 3.4 may account the use of wood as such as carbon neutral, i.e. no emissions from land use change has to be accounted for. Article 3.3 and 3.4 of the Kyoto Protocol refers to emissions by sources and removals by sinks resulting from activities in the LULUCF sector: Article 3.3 refers to afforestation, reforestation and deforestation activities since 1990 (mandatory activities) and Article 3.4 refers to additional voluntary activities in land management that was decided later and implemented differently in each country. On a general level it is however regulated that the environmental impact from direct land use change should be reported separately but not in the environmental performance of the EPD. The dLUC contribution to climate change shall be reported separately for transparency and not added up with all other contributions to the impact category global warming.

Common aggregation

Workshop discussions: The common term here is to describe is impacts related to land use and greenhouse gas (GHG) emissions. We will here divide the different potential aspects related to GWP in the following items:

- ***direct land use change*** (dLUC) that includes change in the use of land at the location of production of the product being assessed (from PAS 2050)
- long term ***soil carbon change*** (SCC) includes emissions and removals that are not regarded as part of dLUC (from ISO TS 14067). It also includes carbon incorporated in

[15] Comment given here: 1 per kg biogenic CO_2 is equal with 1 kg CO_2 equiv.

plants or trees with a lifetime of 20 years or more (e.g. fruit trees) that are not products themselves but are part of a product system (from PAS 2050). This SCC is valid for the forestry land carbon pool unless it is not covered by direct land use change.

- ***indirect land use change*** (iLUC) that includes change in the use of land elsewhere than at the location of production of the product being assessed (from PAS 2050)

Land transformation or use change accounts for the purpose for which land is used by humans. Different factors for including forestry land and dLUC, SCC is given by IPCC: 'Good Practice Guidance for Land Use, Land-Use Change and Forestry' (GPG-LULUCF). Emissions and removals from dLUC are included in PAS, GHGP and PEF.

Forest land soil carbon change is part of the national reporting under the Kyoto protocol and is compared to the biogenic stock above ground a smaller figure and sometimes difficult to evaluate and calculate. The reporting under forest management is strongly linked to the reporting of Forest land remaining forest land under the UNFCCC-reporting. It is also likely the reason why PAS excludes this matter, if it is not part of the supplementary requirements (=any PCR) and GHGP do not include it either generally. It can, however, be included in the inventory results if companies can measure it.

Indirect land use change is not a requirement in the GHGP, but can be reported separately and excluded in PAS 2050. In PAS it is explained that "... the methods and data requirements for calculating these emissions are not fully developed. Therefore, the assessment of emissions arising from indirect land use change is not included in this PAS. The inclusion of indirect land use change will be considered in future revisions of this PAS." Offsetting has similarities with iLUC and may be handled and reported in the same manner. PAS defines offsetting as follows: "GHG emissions offset mechanisms, including but not limited to voluntary offset schemes or nationally or internationally recognized offset mechanisms, shall not be used at any point in the assessment of the GHG emissions of the product." It should, however, noticed that offsetting is not included in PAS.

Open consultation:

CBI, Cementa and Svensk Betong recommends that forestry certifications shall be used instead of reporting LUC and SCC. Moreover CBI put forward a number of obstacles that they regard as problems in this matter; see section 4.11 in the appendix for more details.

Recommendation:

Since the aspects handled here are not yet part of the EN 15804 standard LCIA indicators, we recommend to report this kind of result as part of voluntary information under 'Other environmental information'. If so, the following recommendation applies:

- dLUC and SCC emissions and removals shall be reported separately based on commonly accepted figures and only if such generally accepted methods are available.
- iLUC can be included in the EPD but reported separately and not added up with all other contributions to the impact category global warming.
- Offsets cannot be accounted for in an attributional EPD following EN 15804.

The dLUC and SCC figures may be reported to a common GWP indicator (following ISO/TS 14067), if the individual contribution from dLUC and SCC also is given as separate figures for transparency reasons. When dLUC, SCC or iLUC is included, it shall be assessed in accordance with internationally recognised methods, such as the IPCC Guidelines for National Greenhouse Gas Inventories and shall be documented separately in the LCA/CFP (Carbon Footprint of Products) study report. If a national approach is used, the data shall be based on a verified study, a peer reviewed study or similar scientific evidence and shall be documented in the LCA/CFP study report.

Developing need: In countries where SCC factors are available it should not be any problem to implement these figures in the EPD, but this is not the case for countries in Northern Europe.

In order to include iLUC in LCA development work is required, which is outlined by PAS, why other systems are likely to follow this development. Work on dLUC and iLUC is currently on-going, also in relation to regulation and biofuels in EC. It should be possible to include this kind of environmental impact in a near future when appropriate recommendations are established on iLUC. dLUC, SCC or iLUC could be included in the LCIA result in future updates of EN15804 if consensus is reached.

2.2.3.3 Carbon storage and delayed emission and uptake effects

Requirements given in EN15804
This specific mater is not mentioned in EN 15804 more than impact related to climate change shall be accounted for in the LCI and reported in the EPD.
Requirements given in prEN 16485:2012 (equations from PAS is included below)
6.3.4.4.2 B1–B5 Use stage information modules related to the building fabric: **...** For wood and wood-based products, the amount of biogenic carbon stored, calculated in accordance with EN 16449, shall be documented in CO_2-eq. as technical scenario information. NOTE 2 Storage time is the reference service life. In addition, the effect of timing of the GHG emissions due to biogenic carbon storage may be included as technical scenario information. The effect of timing is calculated for a reference assessment period of 100 years. Where the full carbon storage benefit of a product exists for between 2 and 25 years after formation of the product (and no carbon storage benefit exists after that time) the following equation shall be used: $GWP_{dt} = C_{CO_2} \times \frac{-0.76 \times t_0}{100}$ and PAS gives: $FW = \frac{100 - (0.76 \times t_o)}{100}$ Where: GWP_{dt} net avoided contribution to the GWP over 100 years from carbon storage; kg CO_2-e C_{CO2} biogenic carbon content of wood or wood-based product in CO_2-e.; kg CO_2-e t_0 time of carbon storage (dt < 25 years); year. In all cases that are not covered above, the weighting factor to be applied to the CO_2 storage benefit over the 100-year assessment period shall be calculated according to: $GWP_{dt} = C_{CO_2} \times \frac{-\sum_{i=1}^{100} x_i}{100}$ and PAS gives: $FW = \frac{\sum_{i=1}^{100} x_i \cdot (100 - i)}{100}$ Where: GWP_{dt} net avoided contribution to the GWP over 100 years from carbon storage; kg CO_2-e C_{CO2} biogenic carbon content of wood or wood-based product in CO_2-e.; kg CO_2-e i each year in which carbon storage occurs x the proportion of total storage remaining in any year

NOTE 3 Net avoided contribution to the GWP over 100 years from carbon storage (GWP_{dt}) is the amount of cumulated thermal radiation that is absorbed by the atmosphere outside/after the 100 year assessment period in the 100 year perspective underlying the definition of the GWP100 characterisation factor.
...

Interpretation: The wood PCR almost follows PAS in basic. In simple terms one can say that instead of calculating the reduced impact (as suggested by PAS), the wood PCR gives the 'discount' instead of PAS that gives the reduced price. Also PEF uses the same calculations as suggested by PAS. In the final version of EN 16485 the same approach as in PAS is specified, but now as voluntary information.

Common aggregation

Workshop discussions: Carbon storage and delayed emissions or, in the case of cement, delayed removal may be handled with the same methodological approach. The relative effect of such delayed emission or storage will be dependent on the time frame selected for the GWP. The common approach in LCA is to use GWP 100 i.e. integration over 100 years. Different approaches exist for handling of this subject. The consequence of the PAS equation is that all emission stored for more than 100 years will be equal to 1 kg CO_2e. The consequence for a delayed emission is that it is better to delay the emission in the near future compared to near the year 100. A longer time frame will reduce the importance of these aspects, see example on: http://www.ipcc.ch/ipccreports/sres/land_use/index.php?idp=74, where IPCC state:

"...The basic policy question that must be answered for any such system is how long carbon must be sequestered to be considered equivalent to "permanent" emission avoidance. (Article 3.3 of the Kyoto Protocol states that accounting should be based on verifiable changes in stocks in each commitment period-apparently precluding an equivalency factor approach). Several authors have analyzed the benefits of sequestration projects being accounted for on a ton-year basis rather than by requiring "permanent" sequestration. Ton-year accounting (Fearnside, 1995, 1997; Moura-Costa, 1996; Bird, 1997; Chomitz, 1998a; Dobes *et al.*, 1998; Tipper and de Jong, 1998; Moura-Costa and Wilson, 1999) would allow comparisons between avoided fossil fuel emissions and sequestration activities as well as among sequestration activities of different duration. Under a ton-year system, credit would be given for the number of tons of carbon held out of the atmosphere for a given number of years. A ton-year accounting system would provide a basis for temporary sequestration or delayed deforestation to be credited; the mitigation benefit from a given patch of land is greater the longer the carbon remains in place-which would be reflected in the credit earned.
As long as the policy time horizon is finite or a non-zero discount rate is applied to determine the present value of future emissions/ removals, even short-term sequestration will have some value. The explanation of this proposition is made clearer by considering the converse case: emission of 1 t CO_2 followed 20 years later by removal of 1 t CO_2. Although the net emission over the entire period is zero, there clearly has been an effect on the atmosphere. A ton-year equivalency factor can be used to determine the relative climate effect of different patterns of emissions and removals over time. For a given pattern, this factor will be a function of the time horizon and discount rate selected."

This equation is also valid for carbonisation of concrete. Carbonisation is a slow process that occurs in concrete where calcium hydroxide in the cement reacts with carbon dioxide from the air and forms calcium carbonate. Based on the concept given above, the effect of the carbonisation will be reduced since these emissions appear in the future.

Open consultation:
CBI state that they do not recognise any scientific evidence that a delayed GHG emission has any positive environmental effect, why such aspects should not be included.
The Swedish Forest Industries and SP Trä suggest that this aspect shall be handled with a dynamic LCA method and not limited to a 100 year cut off. They then conclude that such LCIA methodology has to be developed and needs to be more effect oriented than RF and GWP100.

Recommendation: No consensus exists concerning carbon storage or effects from delayed

emissions. This includes the commonly used IPCC based method as simplified by PAS (note that there are two equations covering two time span where PEF only uses the first). This approach is also valid for carbon capture storage (CCS) including bio-energy (BECCS).
Since no consensus is reached, and this environmental effect is not listed in EN 15804 as part of the mandatory LCIA result, it can only be reported as voluntary information in the EPD as 'Other environmental aspects'. If so, it is recommended not to report a single result based on a 100 year cut of but also longer cut off, e.g. 500 years. As an example following PAS 2050, 1 kg CO_2 of any biotic material that is stored for 70 years and then emitted generates a positive sink effect of 0.7 kg CO_2 when a 100 years cut off is used, while a 500 year cut off would generate a sink effect of only 0.14 kg CO_2.

Developing need: Methods to handle sink effect or delayed emissions require further development and have to find a scientific base to evaluate the relative importance of a future emission compared to if emitted today. Two alternatives are identified: 1) A dynamic LCA approach and a more effect oriented LCIA method, and 2) A simplified approach that can be used as a good indicator to reflect the result based on a more complex climate model. The first alterative 1) requires that the LCI data is reported per year and will definitely lead to a more complex LCA calculation. Alternative 2) can be normative based and if definable, is thus more likely to be widely used. The simplified method has to be based on climate model calculations, which illustrates the relative importance, of delayed compared to immediate emissions.

2.2.4 Additional environmental information – non-LCA environmental performance

Requirements given in ISO 14025
7.2.3 Additional environmental information A Type III environmental declaration shall include, where relevant, additional information related to environmental issues, other than the environmental information derived from LCA, LCI or information modules [see 6.7.1 f)]. This information shall be separated from the information described in 7.2.2. Identification of the significant environmental aspects should, as a minimum, take into consideration the following: a) information on environmental issues, such as 1) impact(s) and potential impact(s) on biodiversity, 2) toxicity related to human health and/or the environment, and 3) geographical aspects relating to any stages of the life cycle (e.g. a discussion on the relation between the potential environmental impact(s) and the location of the product system); ...
Interpretation: No 'Additional environmental' information is mandatory listed by EN15804
Workshop discussions: —
Recommendation: If important impact categories are not handled by LCIA (or handled but not covering all important dimensions of an environmental issue) then it is important that EPD:s and PCR:s include supplementary information. Examples of such environmental issue are listed in ISO 14025 and discussed paragraph 2.2.3.1 Selection of impact categories and LCIA methods. As long as these aspects are not handled within LCA other mandatory indicators or required information should be developed on a consensus basis. This is a direct need for certain product groups but should definitely be handled on a common technical committee level (CEN TC 350) in future revisions of EN15804.
Developing need: See above.

2.3 Data quality and its reporting requirements

2.3.1 Data gap – cut off rules

Requirements given in EN15804
6.3.5 Criteria for the exclusion of inputs and outputs The following procedure shall be followed for the exclusion of inputs and outputs: — All inputs and outputs to a (unit) process shall be included in the calculation, for which data are available. Data gaps may be filled by conservative assumptions with average or generic data. Any assumptions for such choices shall be documented; — In case of insufficient input data or data gaps for a unit process, the cut-off criteria shall be 1 % of renewable and non-renewable primary energy usage and 1 % of the total mass input of that unit process. The total of neglected input flows per module, e.g. per module A1-A3, A4-A5, B1-B5, B6-B7, C1-C4 and module D (see Figure 1) shall be a maximum of 5 % of energy usage and mass. Conservative assumptions in combination with plausibility considerations and expert judgement can be used to demonstrate compliance with these criteria; ...
Interpretation: The 'size' of a unit process is not defined in EN 15804 and it is not possible to assess the contribution of a non-measured energy flow why this validation is impossible to perform in a quantitative way. LCI data is easy to obtain in all standard databases for energy wares and is normally therefore not any problem. The material use is often known but its environmental impact is not always known. When the real material amount used is not known the same validation appears as mentioned above. These data gaps therefore have to be based on expert judgments. The data gaps per module are accepted to be as high as 5% and there is currently no need to inform the reader of the EPD of this fact.
Open consultation: The International EPD System support a requirement of covering as much as possible of the LCI (99% coverage).
Workshop discussions: On a unit level it should be known that the variation between years often exceeds 1% concerning both material and energy. In theory there might be a data gap of 5% origin from energy flows and another 5% from material use that will altogether be 10%. In practice; the best rule of thumb is to address an environmental impact to all flows and follow the recommendation given above in EN15804 which is the common LCA approach, namely to use conservative assumptions including estimates of the missing values; *A bad figure is better than zero that we for sure know is wrong*. The assumptions made should then be declared in the LCA report and evaluated by the reviewer.
Recommendation: Since the reported data might include data gaps up to 5% per information module we suggest that these missed flows shall be reported in a separate list the EPD simply as data gaps. Alternative: The cut off rule for data gaps shall be that 99% of the LCI should be covered. We suggest that the latter requirement shall be considered in future updates of EN 15804.
Developing need: No such need defined

3 Abbreviations

BECCS Bio-energy with Carbon Capture and Storage

CCS Carbon Capture and Storage

DLUC direct land use change

EPD Environmental product declaration

ESL Estimated service life

FSC Forestry Stewardship Council

GHG Greenhouse Gas

GHGP The Greenhouse Gas Protocol Product Standard

GWP Global Warming Potential

ILUC indirect land use change

LCA Life cycle assessment

LCI Life cycle inventory analysis

LCIA Life cycle impact assessment

LUC land use change

LULUCF Land Use, Land Use Change and Forestry

OLR open loop recycling

PAS Publicly Available Specification (PAS 2050)

PCR Product category rules

PEF Product Environmental Footprint

PEFC Programme for the Endorsement of Forest Certification

RSL Reference service life

4 Appendix

4.1 Participants on workshop No II, on the 11th of March 2013

Bodil Hökfors, Cementa
Francine Amon, SP
Håkan Stripple, IVL
Joakim Norén, SP Trä
Joakim Thornéus, Environdec
Karin Comstedt, Cementa
Kathrin Nordlöf, Tyréns
Kristian Jelse, IVL
Larissa Strömberg, NCC
Lars-Eric Sjölander, GreenIT
Lars-Gunnar Lindfors, IVL
Martin Erlandsson, IVL
Mikael Elisasson, Svenskt Trä
Otto During, SP CBI
Per-Erik Eriksson, SP Trä
Stefan Sandelin, Cementa
Susanna Toller, Trafikverket
Tomas Ekvall, IVL

4.2 Participants on workshop No III, the 28th of May 2013

Alexander Nyberg, Svenskt trä
Bodil Hökfors, Cementa
Diego Penaloza, SP Trä
Håkan Stripple, IVL
Kajsa Byfors, Svensk Betong
Karin Comstedt, Cementa
Kristian Jelse, Miljöstyrningsrådet
Larissa Strömberg, NCC
Lars Zetterberg, IVL
Lars-Gunnar Lindfors, IVL
Martin Erlandsson, IVL
Mikael Eliasson, Svenskt Trä
Nicklas Magnusson, Tyrens
Otto During, SP CBI
Per-Erik Eriksson, SP Trä
Peter Ylmen, SP
Stefan Sandelin, Cementa
Tomas Ekvall, IVL
Tove Malmqvist, KTH

4.3 Participants on workshop No IV, the 27th of June 2013

Alexander Nyberg, Svenskt trä
Bodil Hökfors, Cementa
Cathrine Löfgren, Innventia
Diego Penaloza, SP Trä
Håkan Stripple, IVL
Joakim Noren, SP Trä
Kajsa Byfors, Svensk Betong
Karin Comstedt, Cementa
Kristian Jelse, MSR
Lars Zetterberg, IVL
Lars-Gunnar Lindfors, IVL
Maria Berglund, SIK
Martin Erlandsson, IVL
Mikael Eliasson, Svenskt Trä
Nicklas Magnusson, Tyrens
Ola Castel, Skanska
Otto During, SP CBI
Tatjana Karpenja, Innventia
Tomas Ekvall, IVL
Tove Malmqvist, KTH

4.4 Participants on workshop No V, on the 29th of January 2014

Alexander Nyberg, Svenskt trä
Bodil Hökfors, Cementa
Catarina Warfinge, SGBC
Håkan Stripple, IVL
Kajsa Byfors, Svensk Betong
Karin Comstedt, Cementa
Kristian Jelse, MSR
Larissa Strömberg, NCC
Lars Zetterberg, IVL
Lars-Gunnar Lindfors, IVL
Linda Martinsson, Skanska
Marianne Hedberg, PEAB
Martin Erlandsson, IVL
Mats Zackrisson, SWEREA
Mikael Eliasson, Svenskt Trä
Nicklas Magnusson, Tyrens
Otto During, SP CBI
Per-Erik Eriksson, SP-Trä
Rickard Nygren, White
Susanna Toller, Trafikverket
Tomas Ekvall, IVL
Åke Iverfeldt, IVL

4.5 Participants on workshop No VI, on the 20th of March 2014

Alexander Nyberg, Svenskt trä
Bodil Hökfors, Cementa
Håkan Stripple, IVL
Kajsa Byfors, Svensk Betong
Lars Zetterberg, IVL
Lars-Gunnar Lindfors, IVL
Marianne Hedberg, PEAB
Martin Erlandsson, IVL
Mikael Eliasson, Svenskt Trä
Nicklas Magnusson, Tyrens
Otto During, SP CBI
Per-Erik Eriksson, SP-Trä
Diego Penaloza, SP-Trä
Rickard Nygren, White
Susanna Toller, Trafikverket
Tomas Ekvall, IVL

4.6 Missive to open consultation September 2013

This version of the report handles only methodical matters related to the 'product level' that means specifications and suggested evaluation or developing need to the so called Core PCR for construction products, referred to as EN 15804.

The work on this part of the project started with a workshop on the 11th of March 2013 that defined the methodical questions to handle further and to seek consensus about. This work ended up in two lists; one concerning questions on the product level and a second list concerning matters related to the construction work level. The latter part was however not dealt with further, after decision by the steering committee to focus the remaining part of the project to further elaborate general LCA questions to non-LCA experts. This works is, therefore, left to a subsequence project or other projects to handle.

This version of the report was first published as a discussion support for a workshop on the 28th of May 2013. An additional workshop was then arranged on 27th of June 2013. Participants on these workshops are listed in separate appendix.

The participants are supposed to list if they agree with the recommendation suggested here or not. If the disagree the respondent shall indicate if they think that a consensus within might be possible between competing interested parties or not. At the workshop some of the matters where consensuses are supposed to be found will be discussed.

If cited anything in this manuscript, please include "Initial open consultation version: ..." when quoted. Changes origin from the last workshop is highlighted in the document with the command "track changes", why these notes described result from this event.

Instructions for contributions to this open consultation

You are welcome to write any comment on the methodological suggestions given in this document. Any type of comment is welcome. Such comment shall be as short and precise as possible. If the contributions is to long we will expostulates that we then need to cut down the length of your contribution. Else, your contribution will be published in its original shape without any additions.

The contributions from this public consultation will be listed in a separate appendix enclosed to the PCR guide. The comments revived will comment by us individually or on a general level covering several contributions. Please indicate if your comments represent a personal opinion or your organization, company etc. All comments shall – as first mentioned in your text – refer to the section number and subtitle (e.g. 2.1.7 Consequences from downstream recycling – Module D).

The deadline for this public consultation is the 20th of October 2013.

Feel free to contact Martin Erlandsson martin.erlandsson@ivl.se + 468 598 563 30 if any questions.

4.7 Trafikverket

Hej Martin
Här kommer våra synpunkter på B2101, och med speciellt fokus på upphandlingsfrågan samt biogent kol och sänkor som du efterfrågade. Synpunkterna har bollats inom Trafikverkets funktionella grupp för material och kemiska produkter.

Med vänlig hälsning,
Susanna Toller

Övergripande
Vi tycker att resultaten från detta projekt har stor relevans för Trafikverket. De rekommendationer som ges i B2101 är intressanta och viktiga för oss, dels när det gäller att ta fram EPDer för genomförda väg- och järnvägsprojekt och dels i upphandling om vi går i den riktningen framöver att vi vill ställa LCA-relaterade krav.

Kommentarer ang kap 1.2, EPD i procurement
Här ser vi två tillämpningar av rekommendationerna. Dels när det gäller krav på hela projekts miljöpåverkan (dvs hela konstruktionen, som också kan ses som en slags produkt i ett ännu större sammanhang). Då är det dock inte rimligt att kräva en full EPD utan snarare enklare LCA-ansatser (t ex där endast några få miljöpåverkanskategorier är med och där delkomponenter beskrivs mer schablonartat) kan vara aktuella att använda i upphandlingar. Att genomföra en EPD för ett helt projekt vid upphandling är kanske något som kan ställas som kontraktsvillkor, men kräver troligtvis en alltför omfattande analys för att det ska kunna efterfrågas i teknisk specifikation eller användas i utvärderingskriterier. Vi undrar om rapportens rekommendationer är giltiga även för enklare ansatser?

Den andra tillämpningen är när det gäller de olika produkter som ingår som insatsvaror i enklare LCA-beräkningar. EPDer för specifika produkter ger viktiga underlag för LCA-ansatser med olika ambition, genom att de ger underlag i form av emissionsfaktorer.

När det gäller verifikationsrekommendationerna kommer vi tillsammans med branschföreträdare att utreda hur vi kan tillämpa dessa i projekt som beställs av Trafikverket. Detta görs i det pågående projektet ”Verifierad klimatbelastning”.

När det gäller ”scope” är detta stycke, och dess tillämpning i Trafikverket, lite oklar. Vi ser konstruktionen (väg eller järnväg) som en produkt, bestående av andra produkter, och vi behöver kunna jämföra design mellan olika typer av dessa konstruktioner oavsett entreprenör. Detta tror vi är möjligt i och med de PCRer vi utvecklat. Är det inte det? Detta är framför allt oklart i det första stycket under ”construction work level”. Vi håller med om, speciellt efter att ha tagit del av denna rapport, att specifika krav kan behöva formuleras som komplement till en PCR. Men vad menar ni i styckets sista mening med att säga att dessa kan lyftas fram av olika ”contractors”? Det är väl beställaren som anger dessa specifika krav och inte entreprenören?

Rekommendationer angående metodval
Att rapportera biogent kol, men att göra det separat i inventeringsresultaten för transparensens skull, låter vettigt.

Analogt med biogent kol skulle det vara intressant med en rekommendation på hur energi som är lagrad i form av bitumen bör hanteras, det hittar vi inget om?

När det gäller direkt markanvändning och kolinlagring i mark kan det vara motiverat att ha med enligt rekommendationerna som ges i rapporten. Dock är det oklart för oss vad som menas med ”commonly accepted figures” och vi ställer oss frågande till om sådana finns. Hur menar ni där? Vi funderar också på hur vi försvarar en avgränsning som bara hanterar direkt markanvändning och inte indirekt.

4.8 International EPD system

Comments on report: Open consultation version: PCR guide for construction products and works - specifications to and evaluation of EN 15804 (Erlandsson et al., September 2013)

By the Secretariat of the International EPD® System
2013-10-17

4.8.1 Disclaimer

Two of the co-authors of the report are connected to the International EPD® System:

- Kristian Jelse was employed by IVL Swedish Environmental Research Institute at the beginning of the "Robust LCA" project and moderated the first workshops in the project. He joined the Secretariat of the International EPD® System in May 2013 as project manager for the PCR library and PCR development, but has kept his involvement in the project.
- Lars-Gunnar Lindfors is a long-standing member of the Technical Committee of the International EPD® System. The Technical Committee has as one of its main responsibilities to review all draft PCRs before publication.

This feedback is provided as the common view of the Secretariat with a main focus on the compatibility of the recommendations with the General Programme Instructions and current working procedures. Any additions to the General Programme Instructions to comply with these recommendations are subject to a decision by the Technical Committee.

4.8.2 Detailed comments

Section	Comment
General	Please clarify the use of the phrasings Environmental Product Declarations referring to general environmental declarations according to ISO 14025 versus EPD® registered in the International EPD® System.
1.1 Order between standards and program operator PCR	We greatly appreciate the distinction made that a PCR must be developed in the framework of a programme in accordance with ISO 14025 to be classified as a PCR. This is not widely understood in the LCA community, and many documents called "PCRs" are in fact only "guidance documents for LCA practitioners."

Section	Comment
1.1	It should be highlighted that the family of standards only refer to the construction sector, and that many parallel single-sector and multi-sector initiatives are on-going. Alignment of independently-developed guidance documents and standards from different sectors is a problem for programme operators, and should be an encouragement to adhere to easily-explainable, universally-applicable methodological choices. One such example is strict adherence to the polluter-pays principle instead of creating many detailed exceptions to a general rule (see comment on 2.1.4)
1.1	The collaboration platform is called ECO Platform (http://www.eco-platform.org/). The nomenclature in this chapter could be updated to match what is said in the platform and EN 15804, e.g. "Core EPD" for A1-A3.
1.1	There are PCRs for buildings, road infrastructure, rail infrastructure and bridges currently under development in the International EPD® System, expected to be published in 2013 and 2014: www.environdec.com/PCR
2.1.1 System perspective	We believe the stringent use of attributional LCA methodology has more benefits than the robustness aspects (described here), and more than is often accredited to it by consequential LCA proponents. It is a risk that mixing the two systems' perspectives as is done in EN 15804 and the final draft Product Environmental Footprint Guide only enhances the layman's view of "LCA may provide any answer that you want", and thus reduces the credibility of LCA.
2.1.3 Selection of data and double accounting – e.g. electricity	We support the use of GO to account for electricity production in markets where there is a robust system to do so. Robust in this case means ensuring that no double-accounting occurs, but could also imply that some connection to physical transmission capacity and properly functioning markets have to exist. As is pointed out, the use of GO's has to be supplemented with the requirements that residual mix is used for unknown electricity production. Arguments made against GO is often based on (unintentional?) consequential LCA thinking. If it is accepted above that attributional LCA is used for the purpose of declarations, then attributing environmental loads of electricity production via a robust system of GO's should pose no theoretical methodological problems.

Section	Comment
2.1.4 Process allocation	The ease-of-explaining of a methodology should not be underestimated. As long as one (as decision-maker) is aware that the strict use of the polluter-pays principle benefits the use of recycled material, it is both elegant and may guide small-scale decisions in the correct way. Supplementary policy instruments should be implemented on a societal level to ensure that products are recycled in end-of-life or that available energy is used.
2.1.7 Consequences from downstream recycling – Module D	We strongly support that Module D, if included, shall be reported separately. Symmetry must be achieved of the upstream burden for using recycled material and the avoided burden of sending material to recycling. See also comment on 2.1.1 for problem of mixing different systems' approaches.
2.2.1.1 Resource use	For another alternative on the declaration of resource use, see the General Programme Instructions of the International EPD® System. There is no double-accounting there as the resource depletion impact categories in the default list of indicators.
2.2.2.3 Biogenic carbon stored in the wood product	ISO/TS 14067 should also be listed as a reference
2.3 Data quality and its reporting requirements **2.3.1 Data gap – cut off rules**	We support a requirement of covering as much as possible of the LCI (99% coverage).

4.9 Sintef

Subject: RE: Open consultation on PCR guidelines for some selected matters
From: Kari Sørnes [mailto:Kari.Sornes@sintef.no]
Sent: den 8 oktober 2013 10:09
Cc: Torhildur Kristjansdottir; Reidun Dahl Schlanbusch; Thale Sofie Plesser

Hi Martin,

Regarding **2.1.3 Selection of data and double accounting – e.g. electricity**

SINTEF do not want to see that GoOs are included in an EPD. An EPD is supposed to show the physical reality of a process connected to a product and to implement mechanisms like this into a standard can lead to green washing – and double counting of the environmental benefit.

Best regards
Kari Sørnes
Energy & Environment

4.10 MiSA

From: Christian Solli [mailto:christian@misa.no]
Sent: den 8 oktober 2013 09:41
Subject: Comments to the PCR guide for construction products and works

Hi Martin, please see below for MiSAs comments on the guide:

2.1.3 Selection of data and double accounting – e.g. electricity
The current recommendation is to include GOs as a means to document the environmental impacts from electricity consumption. MiSA strongly objects to this, as it will render the results in the EPD useless to a decision maker, and potentially undermine the trust in the EPD system. The information in the EPD should be based on the physical inputs to the product system under study. GoOs facilitate the trade of environmental attributes (the "renewable attribute") **totally independent of any physical transfer of energy**. Which means you could have your own, diesel generator powered, local grid, in Greece, and purchase GoO's from Iceland to cancel your emissions. This is greenwashing in its most perverted form.

You express worries of "double counting" of the renewable attribute. The way this system works today, one should more worry about the "no counting" of emissions connected to electricity generation, as the "residual mix" becomes dirtier, but the vast majority of electricity consumers are not performing any LCA or producing EPDs or even care about the impact of their electricity consumption. We believe that it is the companies who purchase GoOs to "cancel" emissions from their actual physical use of electricity, that actually "double count" the renewable attribute.

Although the EPD system is said to be attributional, **the legitimacy of using EPD data to choose between suppliers, lies in the belief that, if product A is chosen over product B, based on superior EPD performance, the world will be a better place**. If this benefit is achieved by the one company purchasing a GO from e.g. existing Norwegian hydropower, it is certain that this is not the case. In facts, there are several reasons to believe the trade in these instruments is actually harmful to the environment. It has zero additionality (which is often countered by the "attributional argument", see above). In addition, it may postpone investment in new energy efficient technology, as it is a much cheaper way of reducing emissions.

We recommend that the EPDs use electricity from the physical market, including (physical) import from other regions, in which the various facilities exist. If a specific supplier can document a physical delivery of a specific type of electricity (e.g. a production facility that is located in the same price region as the production facility), this data may be used instead of the regional mix.

The case of GoOs is exploding the Norwegian media right now, and Norwegian officials go pretty far in suggesting the system needs revision or simply to be shut down. Very few, if any, Norwegian electricity consumers accept that they use "dirty" electricity, when they in fact (physical fact, that is) are not. Remember Norway is by far the largest supplier of GoOs to the European market.

http://www.tu.no/energi/2013/08/22/norge-vil-be-eu-vurdere-om-handelen-med-opprinnelsesgarantier-fungerer

http://www.tu.no/energi/2013/08/27/-opprinnelsesgarantiene-er-bortkastede-penger
http://www.tu.no/meninger/2013/08/23/leder-opprinnelsesgarantier-er-null-verdt

Feel free to contact me if you need clarifications or further discussions.

Regards,

Christian Solli, Sivilingeniør
Seniorrådgiver, Partner

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4.11 CBI Betonginstitutet

From: Otto During [mailto:Otto.During@cbi.se]
Sent: den 1 oktober 2013 11:31
Subject: Open consulting version:

Hej Martin,
Här kommer några synpunkter från CBI.

2.2.2.3 Biogenic carbon

IVL:s rekommendation
Lagrad kol i produkten skall redovisas som CO_2 ekvivalenter. Men det krävs separat redovisning.

CBI:s rekommendation
Biogent kol skall räknas som ett kort kretslopp, det släpper ut lika mycket CO_2 som det tar upp därför bör det räknas som klimatneutralt under förutsättning av hållbart skogsbruk. Saknas återbeskogning skall det biogena kolet beräknas som om det har klimatpåverkan i likhet med fossilt kol.

Motiv

- CO_2 ekvivalenter är enheten för klimatprestanda i en miljövarudeklaration därför tolkas CO_2-ekvivalenter normalt som en del av klimatpestandan i en EPD även om den särredovisas. Därmed uppstår lätt dubbelräkning och negativa emissioner kan uppstå när en användare bedömer den totala klimatpåverkan. LCA utförda av träintressenter visa ofta den stapeln som en fördel för trä.
- Kraven enligt EN 15804 att deklarera biogen energi, tillsammans med övriga krav, är tillräckliga för att beräkna produktens miljöprestanda.
- Eftersom andelen trä från ej hållbart skogsbruk inte är försumbar inom EU bör kravet på hållbart skogsbruk finnas med för att ej underskatta klimatpåverkan.
- Anledningen till att lagrad kol i produkten inte är en del av miljöprestandan är som nämnts tidigare att upptag och utsläpp tar ut varandra inom relativt kort period.
- Principen om att emissioner av biogent CO_2 är klimatneutralt används av IPCC, alla EPD och industri och myndigheter i hela världen det kan därför synas besynnerligt att behöva motivera det.
- En EPD bör ej vara mer komplicerad än nödvändigt då kostnaden för att framställa den är en begränsande faktor. Därför skall nya metoder som inte ger en förbättrad förståelse av miljöprestandan undvikas.
- Att det idag skulle föreligga ett behov av metodik för att räkna vinsten av lagrat kol som en klimatvinst bestrider CBI. Om man vill lagra biogent kol i säkra bergförvar i framtiden hindrar inte dagens LCA metodik det eftersom LCA har full frihet att beskriva processer vilket gör att det upptag som sker på ett kalhygge efter att trädet fälls kan beräknas i en bokförings-LCA. Men notera då att upptaget sker i den nya

skogen som börjar växa samt att lagringsmetoder av biogent kol som hindrar det från att åter inträda i det korta kretsloppet inte finns idag annat än i teorin vilket gör att en sådan beräkning antagligen aldrig kommer att behöva göras, se även nedan 2.2.3.3.

2.2.3.3 Carbon storage and delayed emissions

IVL:s rekommendation
Följ IPCC:s rekommendation enligt PAS 2050 och det får även användas för CCS, Carbon Capture and Storage. Det rekommenderas att en längre tidshorisont på 1000 år används.

CBI:s rekommendation
Inga effekter av carbon store and delayed emissions skall beräknas eftersom det inte är vetenskapligt belagt att det finns några fördelar.

Motiv
- Genom att peka på CCS försöker IVL få med sig betongindustrin på idén men CCS kräver ingen metod för att beräkna tidsförskjuten CO_2-utsläpp till atmosfären eftersom koldioxiden förvaras i geologiska formationer där det inte förekommer CO_2 utsläpp till atmosfären. Därmed blir nyttan av CCS alltid tillgodosedd i en LCA med befintlig metodik.
- Det är endast genom att värdesätta nutiden högre än framtiden som ”delayed emissions” gör skillnad. Ett sådant synsätt finns inte inom LCA idag och det går inte att vetenskapligt visa att framtiden har ett lägre värde utan bygger på en politik som går tvärs mot hållbar utveckling, FN:s och humanismens mest grundläggande syn att alla människor är lika mycket värda(även de i framtiden).
- IPCC har ingen metod för carbon storage and delayed emission men från flera håll påstår man det för att få sina metoder att verka vetenskapliga.

2.1.7 Consequences from downstream recycling Module D

IVL:s rekommendation
Följa EN 15 804 men föreslår 50/50 allokering och att bästa och värsta scenarior skall väljas. Möjligen även en systemexpansion.

CBI:s rekommendation
- Att modul D stryks
- Om modul D ändå används skall både fördelar och nackdelar utanför systemgränsen behandlas på ett objektivt sett så att skapade resurser inte värderas högre än använda resurser.

Motiv
- LCA-metoden ISO 14 044 är utvecklad för att beräkna miljöpåverkan från ett tekniskt system innanför systemgränserna och inte i teknosfären utanför systemgränserna.

- Att bedöma vad som händer i teknosfären utanför systemgränserna är i grunden ovetenskapligt eftersom det inkluderar allting.
- Påverkan i teknosfären utanför systemgränserna sker genom konkurrens om resurser och mellan olika produkter vilket är mycket svårt att överblicka. Att endast titta på sluppna emissioner från återanvändning av ett utflöde är en mycket liten del av konkurrensaspekten och ger en asymmetrisk bedömning.
- En rättvisare bedömning nämns i EN 15804 men IVL väljer att fokusera på att modul D endast skall gälla End of life dvs. modul C EN 15 804/6.4.3.3 ”In module D substitution effects are calculated for the resulting **net** output flow” dvs. det är skillnaden mellan resurser in (ofta I modul A1-A3)och ut (modul C) som skall värderas
- Vad IVL avser med 50/50 allokering vet vi ej men i princip skall det inte ske allokering mellan modul D och resten av livscykeln eftersom de representerar olika typer av metodik och trovärdighet.

2.2.3.2 Land use and forest land carbon change

IVL:s rekommendation

Direkt land use change (dLUC) och Soil Carbon Change (SCC) skall rapporteras separat enligt allmänt accepterade metoder

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- SCC beror till stor del på klimatförändringarna och är inte lämpliga för att beskriva produktens klimatpåverkan.
- Skogsbrukets påverkan skall räknas från att skogen fälls till att ny skog bildats förutom det biogena kolet som anses vara klimatneutral om hållbart skogsbruk kan styrkas.(Det är viktigt att inkludera alla växthusgaser i skogsbruket.)

/Otto

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4.12 Skogsindustrierna, SP Trä

Synpunkter på metodanvisningar och projektrapporter från Robust LCA: PCR guide for construction products and works - specifications to and evaluation of EN 15804

I kommentar 7) på sidan 30 (stycke 2.2.3.1) står:
"7) As mentioned in paragraph 2.1.2 a supplement to the 100 years cut for GWP and other time dependent impact characterisations methods will require an additional CF that we here call 100+ or surveyable time (covering 100-1000 years), and following, then includes emissions and LCI report as well."
Vi föreslår att om vill man frångår 100-årsperspektivet, **så bör man utveckla en helt dynamisk LCA, dvs inventeringsdata och LCIA-modell baseras på årliga utsläpp och där en mer effektorienterad LCIA modell bör utvecklas för klimatpåverkan**. Slutsatsen som utgör punkt 7) bör således flyttas till "Development need", det vill säga om alternativ till GWP 100 skall hanteras är detta en utvecklingsfråga.

På sidan 35 (stycke 2.2.3.3) står:
Recommendation: Where the impact from carbon storage or delayed emission is to be assessed, it is recommended to use the IPCC method as simplified by PAS (note that it is two alternative equations covering two time span where PEF only use the first one). The approach will also be valid for carbon capture storage (CCS) including bio-energy (BECCS). When delayed or sink effects are accounted for GWP_{100} it is strongly recommended to complement the result by a longer time horizon such as GWP_{1000}, i.e. 1000 years instead of 100. Note that this result shall always be reported as a separate indicator.
Developing need: It is concluded that GWP shall be reported as GWP_{100} in all applications and then complemented with GWP 1000 (or 500 years to follow IPCC), such calculations guidelines has to be developed, following the Alterative thinking with GWP integrated over a longer period, or alternative as a supplement to GWP 100 i.e. GWP 100-1000 should be defined and evaluated and supplemented with the approach suggested by PAS.

Vi föreslår, i enlighet med förslaget ovan, att hela det resonemang som gäller att frångå 100-årsperspektivet flyttas från "Recommendations" till "Development needs" och uttrycks på samma sätt som i kommentaren ovan (fetstil).

Mikael Eliasson, Skogsindustrierna
Per-Erik Eriksson, SP Trä

4.13 Cementa and Svensk Betong

Bodil Hökfors, Karin Comstedt Webb, Stefan Sandelin/Cementa
Kajsa Byfors/Svensk Betong
2013-10-09

Utöver våra kommentarer till utskickad PCR-Guide så vill vi påminna om kommentarer på enskilda avsnitt i rapporten som lämnats inför workshop 3 (se bilaga). Vi kan inte se att de har beaktats i PCR-Guiden daterad september 2013 vilket vi ställer oss frågande till. Det gäller främst texterna om kollagring i byggnader.

2.2.2.3 Biogenic carbon

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Vår rekommendation

Biogent kol skall räknas som ett kort kretslopp, det släpper ut lika mycket CO_2 som det tar upp därför bör det räknas som klimatneutralt under förutsättning av hållbart skogsbruk. Saknas återbeskogning skall det biogena kolet beräknas som om det har klimatpåverkan i likhet med fossilt kol.

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Motiv

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sluppna emissioner från återanvändning av ett utflöde är en mycket liten del av konkurrensaspekten och ger en asymmetrisk bedömning.
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- Vad IVL avser med 50/50 allokering vet vi ej men i princip skall det inte ske allokering mellan modul D och resten av livscykeln eftersom de representerar olika typer av metodik och trovärdighet.

2.2.3.2 Land use and forest land carbon change

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Bilaga: Utvärderingssvar av föreslagna rekommendationer

2013-05-24

Uppgiftslämnare: CBI, Cementa och Svensk Betong.

Rekommendation (stycke nr)	**Instämmer med föreslagen rekommendation (ja/nej)**	**Om nej, tror du att det är rimligt att nå konsensus kring denna fråga? (ja/nej) OBS! vid JA avser vi att med utgångspunkt från våra synpunkter bör vi hitta konsensus**	
1.2 Using EPD and PCR in public procurement	Nej, inte just nu.	Ja	På kort sikt (5 år?) är SGBCs olika system den väg som bör lyftas fram och användas bl.a. i offentlig upphandling. Detta eftersom de redan är etablerade, genom att de beaktar helheten är de ett stort stöd för fastighetsägare och byggherrar samt att alla systemen utvecklas till att bli mer och mer LCA baserade, och också kopplade till EN 15804. Eftersom EPD fortsatt behöver utvecklas och spridas innan det kan användas, specifikt för jämförelse mellan olika produktlösningar, så är det vår åsikt att utveckla användningen av EN 15804 både i SGBCs system och i EPD men att inte förorda EPD

Rekommen-dation (stycke nr)	**Instämmer med föreslagen rekommendation (ja/nej)**	**Om nej, tror du att det är rimligt att nå konsensus kring denna fråga? (ja/nej) OBS! vid JA avser vi att med utgångspunkt från våra synpunkter bör vi hitta konsensus**	
			förrän systemet är utvecklat och accepterat. Dvs EPD får inte ta bort krafterna från befintliga fungerande system, t.ex. SGBC med deras tre system som tar i beaktande helheten.
2.1.1 System perspective (EN 15804/6.4.3.3) (EN 15804/6.3.4.6))	Nej till alternativ 1,2 Ja, till alternativ 3 – ta bort modul D för byggprodukter/byggnadsverk.	Ja	Om D ska användas måste den vara dubbelriktad (dvs. både plus & minus). Sammansatta byggnadsverk.
2.1.2 Temporal system boundaries	Ja, men 100 år + vad som återstår av produktens livslängd.	Ja	När startar tidssystemet? Vilken livstid gäller? Den reella eller ett förutbestämt värde? Önskar att livslängden tas i beaktande.
2.1.3 Selection of data and double accounting – e.g. electricity (EN 15804/6.3.6)	Ja. Redovisa även elmängd.	Ja	Det finns exempel där valet av eldata påverkar resultaten kraftigt. Därför förordar vi att man alltid gör en känslighetsanalys, t.ex. alltid inkludera nordisk elmix. Nordisk mix är annars inte representativ då den inte återspeglar handeln mellan länderna på ett korrekt sätt. I övrigt är rekommendationerna att precisera el bra. Gärna även ett krav på att elmängd redovisas samt att påverkan från både specifika värden och medelvärden för el redovisas.
2.1.4 Process allocation	Nej	Ja	Återvinning och förädlingsprocesser bör bäras av den produkt som bär nytta av processen enligt PPP, vilket stämmer med befintliga riktlinjer och praxis. T ex inkluderar cementindustrin miljöpåverkan från malning av masugnsslagg om det ingår i cementet. Är verkligen 60% regeln nödvändig?
2.1.4 Process allocation			Ny fråga, benämningen process-allokering finns inte i EN 15804. Mer information önskas.
2.1.5 By-product allocation (EN 15804/6.4.3.2)	Nej	Ja	Vi tolkar standarden så att ekonomisk allokering sker då värdet av biprodukten är över 1 %. I princip enkelt att följa även om siffran 1 % kan diskuteras. I övriga fall vill vi att biprodukten räknas som avfall och inte bär någon miljöbelastning från tidigare utsläpp
2.1.6 Open loop recycling (with	Ja	Ja	Bra att återvinning enligt förslaget inte ger några sluppna emissioner men återvinningsgraden kan ändå ge fördelar genom

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attributional LCA)			att resursförbrukningen påverkas av återvinningsgraden.
2.1.7 Consequences from downstream recycling – Module D Varför begränsa D till nedström? Rubriken lyder fördelar och nackdelar som ligger utanför systemgränser na	Nej	För tillfället så är detta accepterat I EN 15804 men det finns ett stort behov att nyan sera beräkningar na i modul D	Systemexpansion skall inte tillämpas för byggprodukter. Det bör heller inte tillämpas på byggnader i en robust LCA. Regler för miljövarudeklarationer som EN 15804 är ofta inte lämpade för universitetens behov av miljösystemanalyser eftersom kommunikationsmaterialet inte är helt öppet och avsett att starta en diskussion vilket vi bör understrykas i projektet robust LCA, dvs. tydliggör att EN 15804 är accepterade kommersiella styrverktyg medan akademiska systemanalysers syfte är att utveckla kunnandet och förståelsen för att löpande förbättra EN 15804.
2.2.1.1 Resource use	Ja	Ja	Som ni påpekar finns problem med värderingen av resurser som nu sker i antimonekvivalenter. Tittar vi på resurser som naturgrus och fosfor så är de mycket viktiga för hållbar utveckling utifrån olika perspektiv som kan vara svåra att fånga in i ett enda karakteriseringsindex. Ett förslag är att i en komplimenterande text till EN 15804 i detalj beskriva resursernas hållbarhetsaspekter och vilka resurser som måste kvantifieras separat för olika produktgrupper.
2.2.2.3 Biogenic carbon stored in the wood product	Nej	Ja	Att flytta kol från skogen till ett hus ger ingen minskning av CO_2. Om inte summan av skogens kolförråd och infrastrukturens kolförråd ökar så sker inget nettoupptag. Det går inte att studera med en enskild produkt. Redan idag är inte alla delar av skogsbruket medtaget, t.ex. har Göteborgs Universitet på uppdrag av Naturvårdsverket visat att emissionerna från dikade torvmarker i Sverige är större än de samlade Svenska industriutsläppen, se http://www.science.gu.se/aktuellt/nyheter/Nyheter+ Detalj/utslapp-av-vaxthusgaser-maste-synliggoras.cid1107109. Dessutom påverkas skogens kolförråd av klimatförändringar genom varmare och fuktigare klimat, se t.ex. Canadas skogsbruk som gått från att vara ett upptag till att vara en källa under senare år, samt ökade halter an näringsämnen vilket gör att det inte

Rekommen-dation (stycke nr)	**Instämmer med föreslagen rekommendation (ja/nej)**	**Om nej, tror du att det är rimligt att nå konsensus kring denna fråga? (ja/nej) OBS! vid JA avser vi att med utgångspunkt från våra synpunkter bör vi hitta konsensus**	
			går att allokera någon förändring i kolförråden till en enskild produkt.
2.2.3.1 Selection of impact categories and LCIA methods	Nej	Ja Nej till IVLs förslag	En liten avvikelse finns i punkt 5 se 2.2.3.3 och punkt 7 se 2.1.2
2.2.3.3 Carbon storage and delayed emission and uptake effects	Nej.	Ja	Finns bara i PAS vilket är utan bäring. 16485 6.3.2 säger att skogens upptag av CO2 skall räknas som ett CO2 upptag inkluderat i en träprodukts livscykel. Med detta förfarande antas upptaget ske vid avverkningen tidsmässigt, vilket ju inte är sant. Det bryter mot dagens betraktelsesätt och vi motsätter oss det av flera skäl. 1. Det ger felaktiga incitament att avverka skog eftersom det i verkligheten inte sker något upptag den dagen som skogen fälls. 2. Skogens upptag av CO2 är historiskt. 3. Skogens upptag av CO2 sker utanför Teknosfären (systemgränsen för produktsystemet) 4. Skogens upptag av CO2 som kommer från mänsklig påverkan bör tas med i produktsystemet. Dikning av torvmarker är en sådan mänsklig påverkan, se kommentar 2.2.2.3 5. Kolet kretslopp för biogent kol är kort vilket gör att ingen nettoeffekt sker. 6. Det skapar massa beräkningar utan att beskriva någon miljöpåverkan på ett bättre sätt. Vill man göra en materialbalans måste ett större perspektiv ingå där upptag och utsläpp under en hel kolcykel är beskriven med rätt tidsangivelser. 7. Att lägga ett stort upptag på en träprodukt och ett stort utsläpp på ett sekundärt biobränsle bränsle är inte en rättvis allokering. 16485 6.3.2 Eftersom vi ej erkänner klimateffekter av kollagring finns ingen mening att rapportera den, allra minst som CO2- ekvivalenter. Vi erkänner inte några effekter av senarelagda utsläpp