



Raw material data representativeness and co-product allocation

LCA of wood modification processes: where are the weaknesses in inventories?

Discussion session of Working group 2 in COST FP1407

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Researcher, Norwegian Institute of Wood Technology

ETHZ, Zürich, 3rd of December 2015



Research question:

Based on experiences from previous LCA and EPDs on modified wood, how could PCR include specific requirements for raw material data representativeness and by-product allocation?

Agenda:

EPDs prior to EN 15804

Allocation and data requirements in EN 15804

Experiences with EPDs according to EN 15804

What should be further specified?

EPD Kebony pine

Chemically modified wood with
Furfuryl alcohol

Contribution to GWP

54 % production

32 % raw materials

14 % transport

Developed prior to EN 15804

(NEPD155N Kebony pine)

Environmental product declaration ISO 14025 

ke bonny **Kebony Furu** **NEPD nr.: 155N**

Godkjent i henhold til ISO 14025:2006, 8.1.4:
Godkjent: 06.07.2012 Verifikasjonsleder:
Gyldig til: 06.07.2017 *Susanne Fosdahl*

Verifikasjon av LCA-data: Intern Ekstern X
Uavhengig verifikasjon av data og miljøinformasjon er foretatt av Cathrine Grini, etter ISO 14025, 8.1.3. *Cathrine Grini*

Deklarasjonen er utarbeidet av:
Jarle Svanæs, OPAK 

Produsent
Kebony ASA
Havneveien 35, N-3739 Skien, Norge
Telefon: +47 06125 E-post: info@kebonny.com
Organisasjonsnummer: 979 446 276
ISO 14001 sertifisert: Nei
Kontaktperson: Per Brynildsen, +47 35 92 78 85, pb@kebonny.com

Om EPD:
EPD'er fra andre programoperatører enn Næringslivets Stiftelse for Miljødeklarasjoner er ikke nødvendigvis sammenlignbare.

PCR:
NPCR 015 Solid wood products, 2009

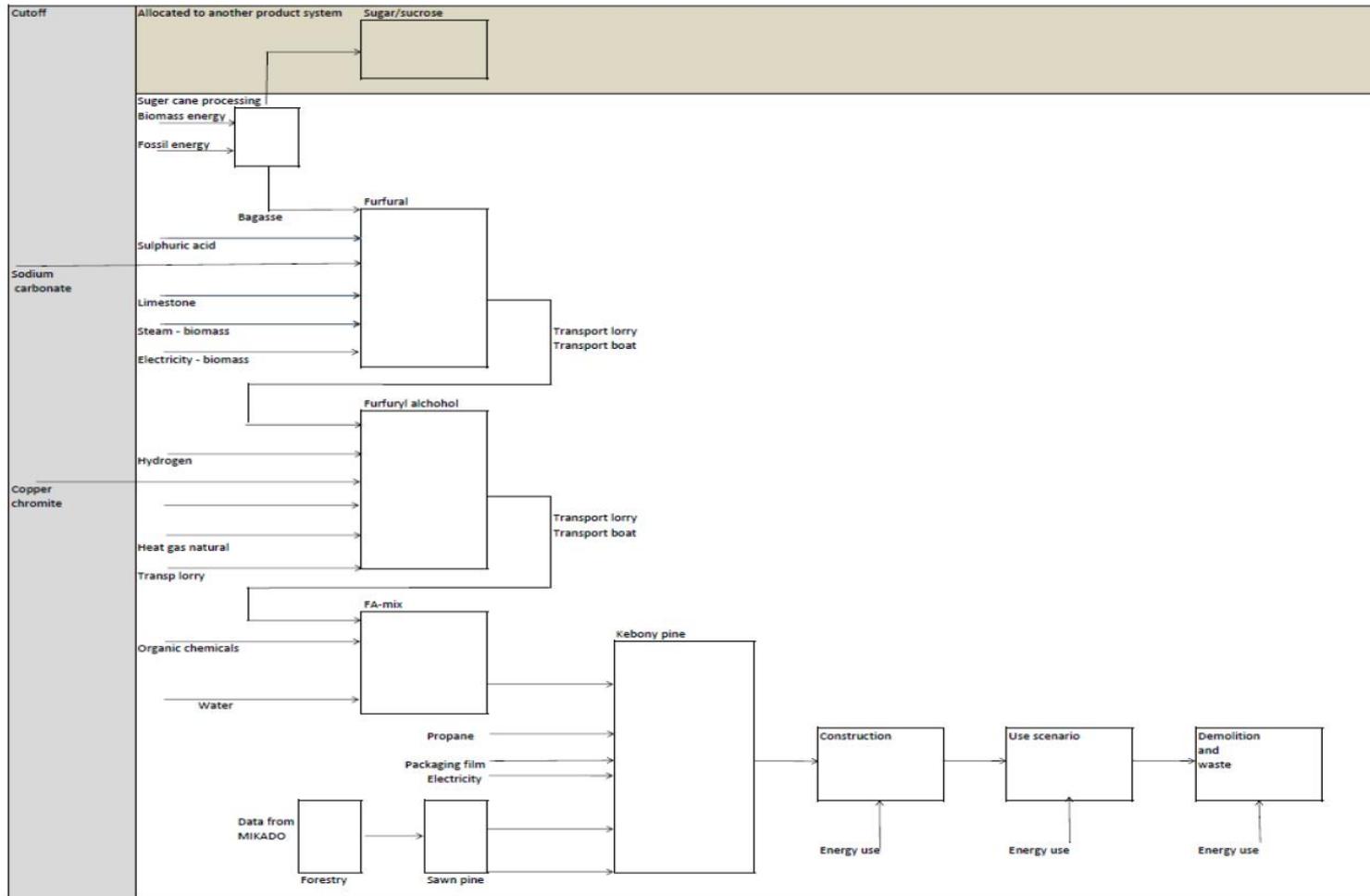
| Miljøindikatorer | Vugge til port | Vugge til grav |
|----------------------------|--|----------------|
| Global oppvarming | | 297 CO2 ekv. |
| Energiforbruk | | 12 790 MJ |
| Hvorav fossil energi | | 4 534 MJ |
| Andel fornybare materialer | | 99 % |
| Kjemikalier | Produktet inneholder ikke kjemikalier på kandidatlista eller den norske prioritetlista | |

Omfang og marked
Funksjonell enhet 1 m³ Kebony furu, ferdig montert med 60 års forventet levetid.
Alle resultater i denne vurderingen forholder seg til 1 funksjonell enhet (FE)
Analyseomfang Vugge til grav. Studien er gjennomført i 2010 med data fra 2009.
Antatt levetid Kledning og konstruksjonsvirke 60 år, terrassebord og tretak 30 år.
Produksjonssted Skien, Norge.
Markedsområde Norge

Produktbeskrivelse
Kebony furu er produsert fra bærekraftig forvaltet trevirke som er behandlet med et biobasert fornybart insatsstoff. I prosessen blir tilsetningsstoffene herdet inne i trematerialet. Resultatet er et trevirke som blir hardere, mer stabilt og får bedret biologisk holdbarhet. Kebony furu er svanemerket.

NEPD 155N Kebony side 1 av 4

Complex upstream supply chain inventory for the modification chemical



(NEPD155N Kebony pine)

EPD Accoya

Chemically modified wood
with acetic anhydride

Contribution to GWP

40 % upstream

60 % core

Developed prior to EN 15804

(EPD S-P-00356 Accoya)

EPD

Environmental Product Declaration

Accoya® decking and cladding



Contents

- 02 The product
- 02 The company
- 03 The system, system boundaries and the functional unit
- 04 Use of resources
- 05 Cumulative Energy Demand
- 06 Emissions
- 06 Maintenance, hazardous waste and durability
- 07 Verification and certification
- 07 Contacts

This is an Environmental Product Declaration for Accoya® decking and Accoya® cladding of Accsys Technologies PLC, registered in the International EPD System (www.environdec.com).

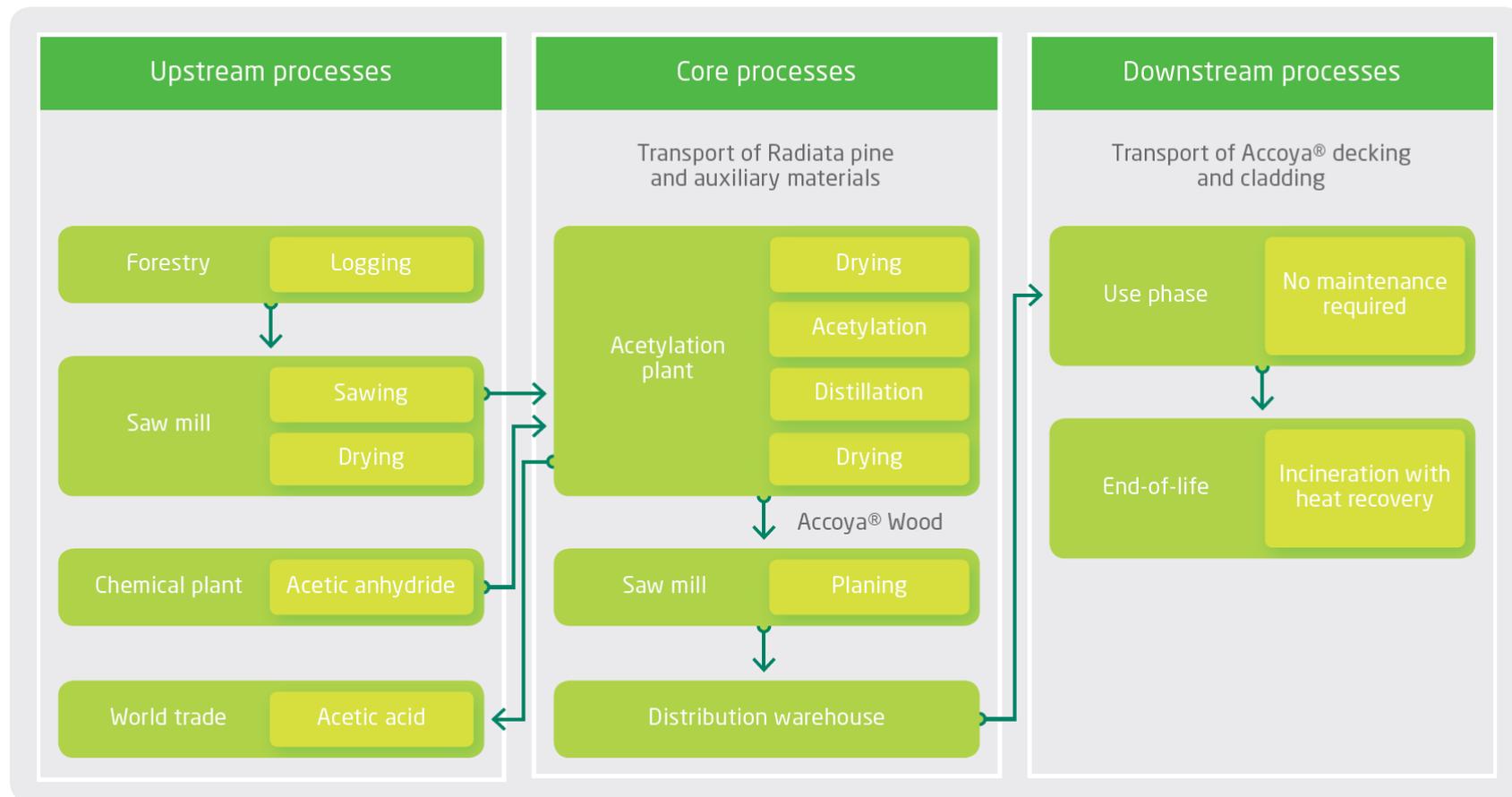
The declaration has been developed based on the results of a Life Cycle Assessment (LCA) in compliance with ISO 14044 and the Product Category Rules (PCR) for Builders' joinery and carpentry of wood, PCR 2011:23 version 1.0, 2011-12-19, CPC Class 31600, and has been verified according to ISO 14025. This includes verification by an independent and certified party.

Information and data given in this EPD can be used as upstream data by a customer who will perform a new EPD within the system boundaries given in a related PCR. EPDs within the same product category but from different programmes may not be comparable.



the world's leading high technology wood

System expansion/substitution of by-product



(EPD S-P-00356 Accoya)

EN 15804 modularity

- included in cradle to gate
- included in cradle to gate with options
- excluded

| Building life cycle information | | | | | | | | | | | | | |
|---------------------------------|-----------|---------------|---------------------------|----------------------------------|----------------------------------|-------------------------------|--------------------------|-------------------------------|---------------------------------|------------------------------|-----------|------------------|----------|
| A 1 - 3 | | | A 4 - 5 | | B 1 - 7 | | | | | C 1 - 4 | | | |
| PRODUCT stage | | | CONSTRUCTION PROCES stage | | USE stage | | | | | END OF LIFE stage | | | |
| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | C1 | C2 | C3 | C4 |
| Raw material Supply | Transport | Manufacturing | Transport | Construction installation proces | Use | Maintenance (incl. transport) | Repair (incl. transport) | Replacement (incl. transport) | Refurbishment (incl. transport) | De-construction / Demolition | Transport | Waste processing | Disposal |
| | | | Scenario | Scenario | Scenario | Scenario | Scenario | Scenario | Scenario | Scenario | Scenario | Scenario | Scenario |
| | | | | | B6 Operational energy use | | | | | | | | |
| | | | | | Scenario | | | | | | | | |
| | | | | | B7 Operational water use | | | | | | | | |
| | | | | | Scenario | | | | | | | | |

| Supplementary information beyond the building life cycle |
|--|
| D |
| Benefits and loads beyond the system boundary |
| Reuse - Recovery - Recycling - Potential - |

| Type of EPD | Building life cycle information | | | | | | | | | | | | | | Supplementary information beyond the building life cycle | | | |
|--|---------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--|--------------------|--------------------|---------------------------|
| | A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | | C3 | C4 | D |
| Cradle to gate Declared unit | Mandatory | | | | | | | | | | | | | | | | | |
| Cradle to gate with option Functional unit | Mandatory | Inclusion optional | Inclusion optional | Inclusion optional | Inclusion optional |
| Cradle to grave Functional unit | Mandatory | Mandatory | Mandatory | Mandatory | Mandatory | Mandatory | Mandatory | Mandatory | Mandatory | Mandatory | Mandatory | Mandatory | Mandatory | Mandatory | Mandatory | Mandatory | Mandatory | Mandatory |
| | | | | | | | | | | | | | | | | | | RSL if all scenario given |
| | | | | | | | | | | | | | | | | | | Inclusion optional |
| | | | | | | | | | | | | | | | | | | Inclusion optional |

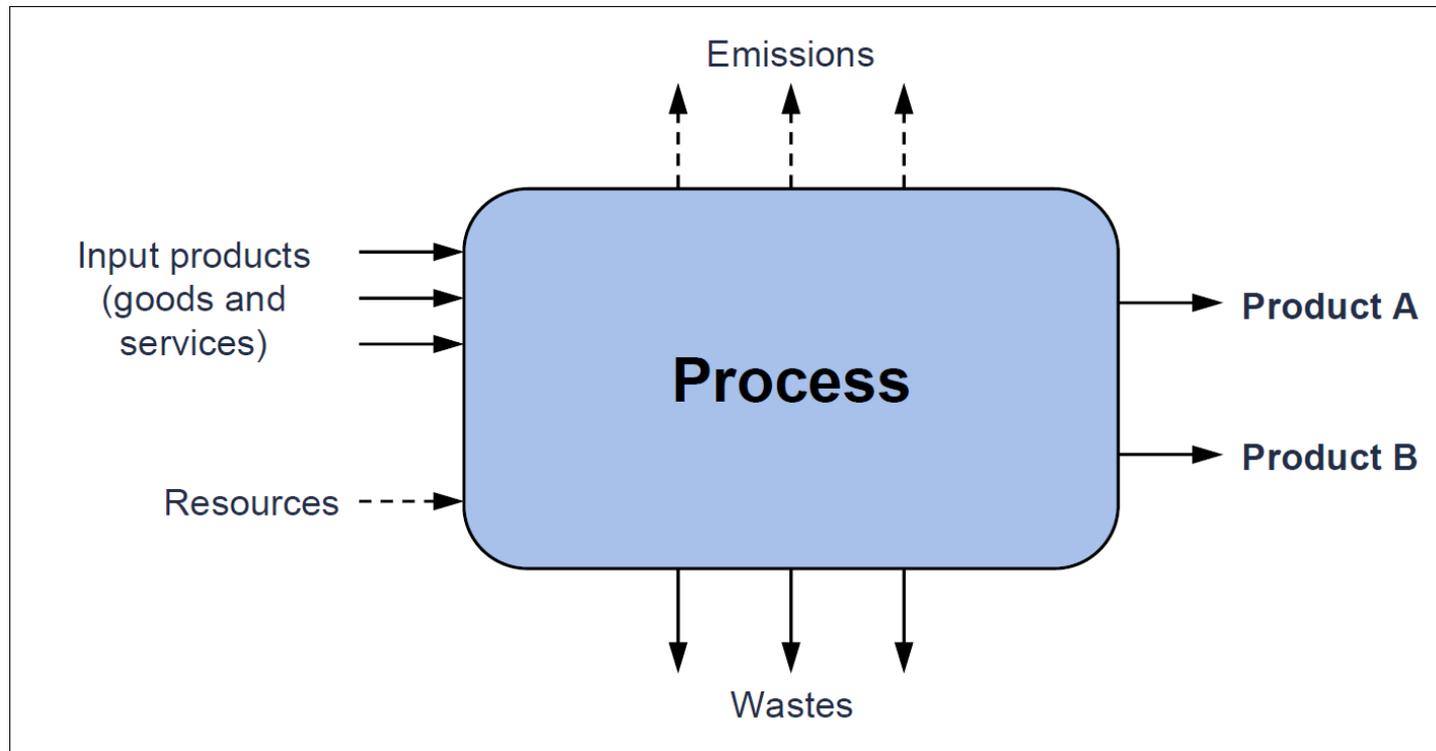


EN 15804 selecting data

Specific data for at least the processes the producer has influence over

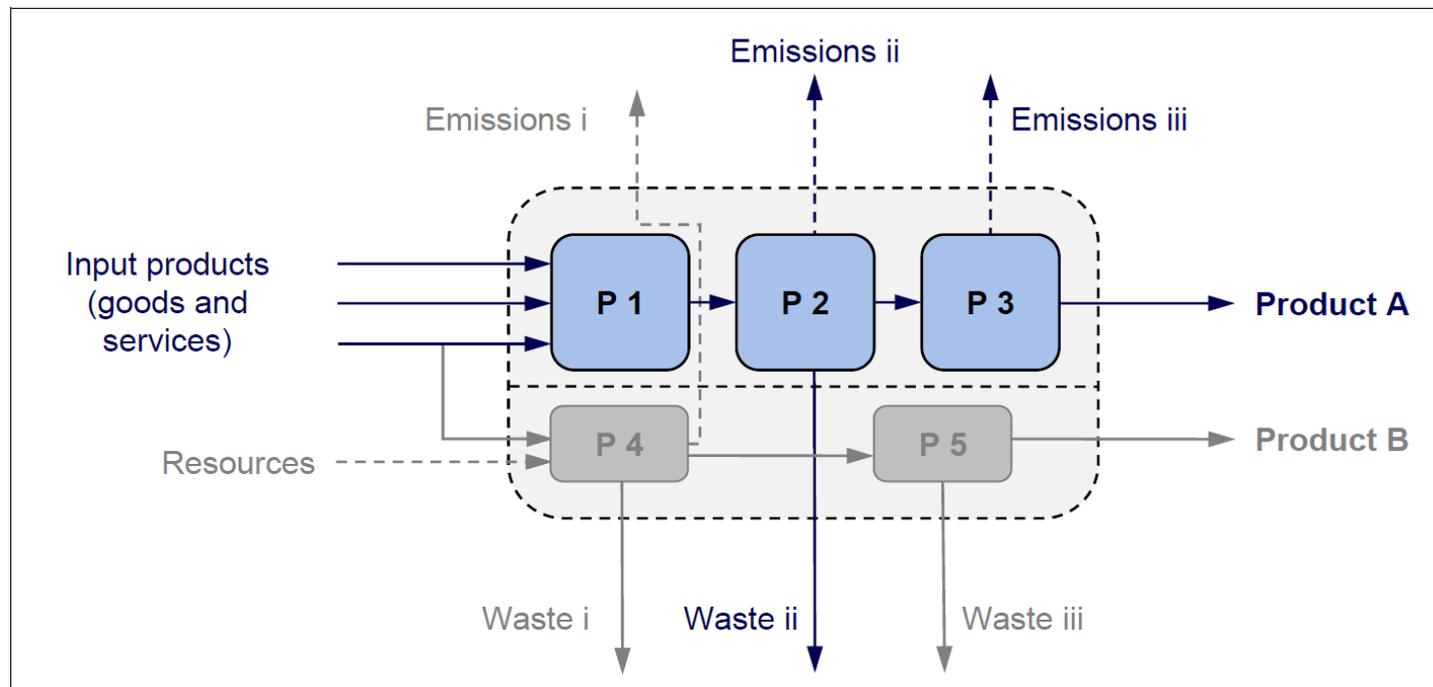
Generic data must document technological, geographical and time related representativity in the report

EN 15804 has specific requirements on by-product allocation



(European Commission -ILCD Handbook)

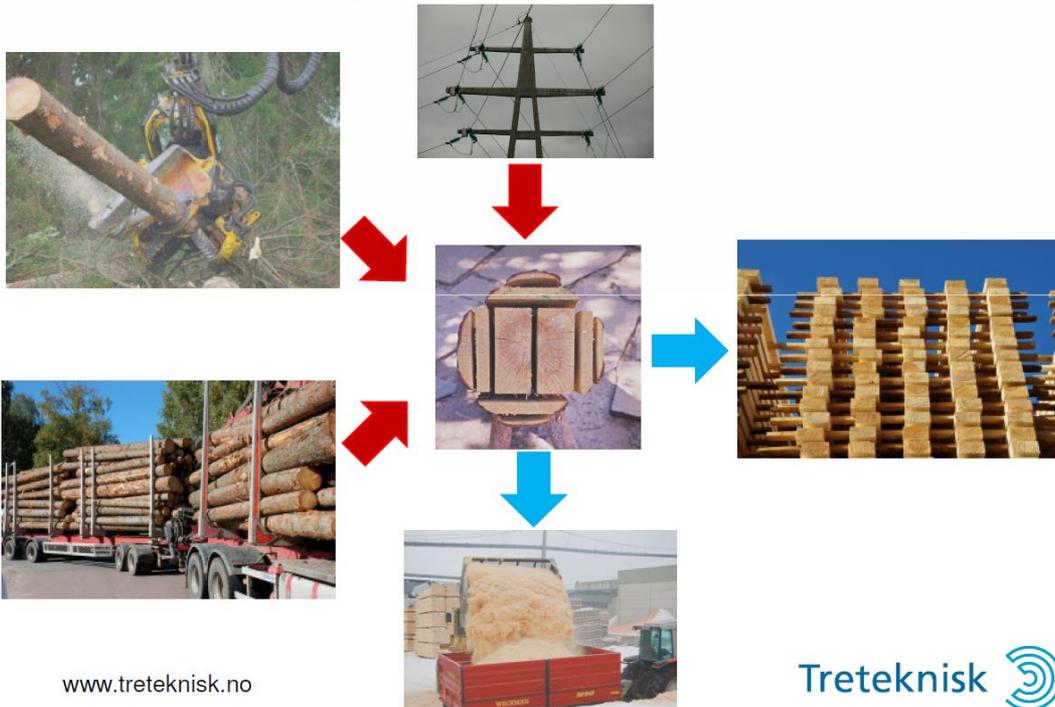
Preferred in EN 15804 - avoiding allocation by sub-division



(European Commission -ILCD Handbook)

Allocation still often necessary and EN 15804 requires economic allocation if there are large revenue differences

Vugge-til-port skurlast



www.treteknisk.no

Treteknisk

EPD Royalimpregnated timber

Cu-impregnated pine
with additional oil
treatment

According to EN 15804

(NEPD294N royal)

ENVIRONMENTAL PRODUCT DECLARATION

I henhold til: ISO 14025 ISO 21930 EN 15804

| | |
|-----------------------|--|
| Eier av deklarasjonen | Marnar Bruk AS |
| Utgiver | Næringslivets Stiftelse for Miljødeklarasjoner |
| Deklarasjonens nummer | NEPD00294N |
| Godkjent dato | 16.12.2014 |
| Gyldig til | 16.12.2019 |

Royalimpregnert trelast

Produkt

Marnar Bruk AS
Eier av deklarasjon

MARNAR BRUK

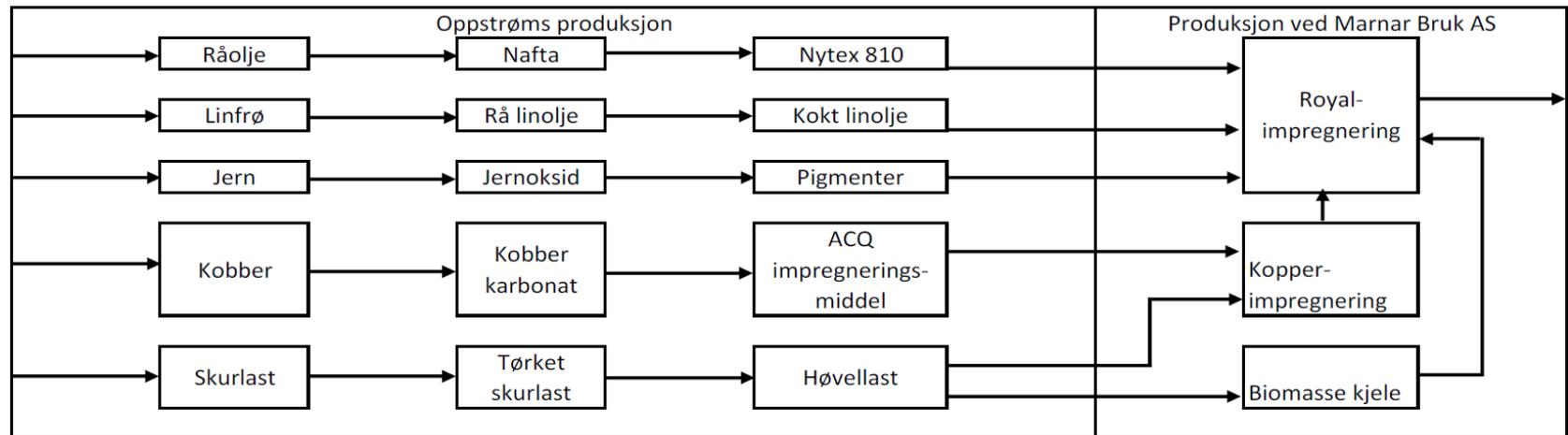


NEPD00294N Royalimpregnert trelast Marnar Bruk AS

1

Raw material data challenge

Upstream production of petroleum based oil, boiled linseed, iron oxide pigments and ACQ impregnation



(NEPD294N royal)



Solution ACQ-impregnation

Ecoinvent includes Cu-based wood preservative with boric acid, but wood preservative used has no boric acid

Modify an Ecoinvent process with other recipe, but keep energy us, transport etc. (technical representative)

Modify electricity to the country where the impregnation is manufactured (geographical representative)

Update electricity mix to latest statistical data available (time representative)



Raw material data

Modified wood consist of mainly wood and often some kind of chemical

Wood can be of specific spieces with limited data, but Ecoinvent v3.1 have several inventores with global representativeness

Chemicals can ofte be hard to obtain specific data. Sub-suppliers lack incentives. Should be specific

Possible requirements in an PCR for raw material data

Wood data shall be country and species representative?

Modification chemicals:

Chemical composition (technical) representative?

Specific for supplier, country or global?

EPD Accoya - revision

EPD was recently published at EPD-Norway, but withdrawn within a week.

This time EN 15804 had to be followed and it was verified, but the technical committee at EPD-Norway disagreed with compliance

www.epd-norge.no

 The Norwegian EPD Foundation



ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025, ISO 21930 and EN 15804

| | |
|---|--|
| Owner of the declaration: Program operator: Publisher: Declaration number: | Accsys Technologies PLC The Norwegian EPD Foundation The Norwegian EPD Foundation NEPD-376-262-EN |
| ECO Platform reference number: Issue date: Valid to: | 00000243 03.11.2015 03.11.2020 |

Accoya Wood - decking, cladding and planed timber for joinery applications

Accsys Technologies PLC



www.epd-norge.no



(NEPD-376-262-EN Accoya, currently withdrawn)

NEPD-376-262-EN Accoya Wood - decking, cladding and planed timber for joinery applications



Example case - by-product allocation

Accoya Wood - decking, cladding and planed timber for joinery applications

Accsys Technologies PLC



With regard to allocation of the by-product Acetic Acid, 2 methods have been applied:

a. The base case according to EN 15804, Section 6.4.3.2.

Economic allocation where the cradle to gate eco-burden up to the acetylation plant in Arnhem is divided between Accoya and acetic acid according to the economic values of the output (according to EN 15804 section 6.4.3.2, page 28), which is the base case

b. The classical case according to ISO 14044 (and EN 15804, Section 6.4.3.1).

Avoiding economic allocation by “substitution”, also called “system expansion” which is the preferred method, if possible, in ISO 14044, section 4.3.4.2, Step1 point 2. The by-product acetic acid will replace in this approach acetic acid made from fossil feedstock. In fact, this method is in line with the way wood waste is allocated.

A relevant issue here is that the acetic anhydride is made by the same processes as the acetic acid (the acetic anhydride is single source purchased by a chemical plant in Hull which produces both). The broader system picture is that the acetic anhydride is produced in Hull, is used in Arnhem, and then replaces acetic acid that had to be produced in Hull when the Accoya plant in Arnhem had not exist, see Fig. 1.

In LCA this is called ‘avoided burden approach’ or ‘crediting’

(NEPD-376-262-EN Accoya Wood, currently withdrawn)

Both according to EN 15804??

Economic allocation according EN 15804, section 6.4.3.2 (block A1 - A3)

| Parameter | Unit | Accoya from Radiata Pine | Accoya from Scots Pine | Accoya from Beech |
|-----------|---------------------------------------|--------------------------|------------------------|-------------------|
| GWP | kg CO ₂ -eqv | -4,33E+02 | -7,41E+02 | -1,01E+03 |
| ODP | kg CFC11-eqv | 1,43E-04 | 1,25E-04 | 1,74E-04 |
| POCP | kg C ₂ H ₄ -eqv | 3,68E+00 | 1,97E+00 | 2,39E+00 |
| AP | kg SO ₂ -eqv | 1,12E+00 | 9,83E-01 | 1,03E+00 |
| EP | kg PO ₄ ³⁻ -eqv | 1,77E-01 | 1,23E-01 | 1,60E-01 |
| ADPM | kg Sb-eqv | 2,73E-03 | 3,04E-03 | 4,19E-03 |
| ADPE | MJ | 1,53E+04 | 1,43E+04 | 1,97E+04 |

system-expansion/substitution according to ISO 14044 section 4.3.4.2, step 1.2, and EN 15804, Section 6.4.3.1 (block A1 - A3)

| Parameter | Unit | Accoya from Radiata Pine | Accoya from Scots Pine | Accoya from Beech |
|-----------|---------------------------------------|--------------------------|------------------------|-------------------|
| GWP | kg CO ₂ -eqv | -7,09E+02 | -1,13E+03 | -1,54E+03 |
| ODP | kg CFC11-eqv | 1,67E-04 | 1,40E-04 | 1,95E-04 |
| POCP | kg C ₂ H ₄ -eqv | 3,04E+00 | 5,29E-01 | 3,27E-01 |
| AP | kg SO ₂ -eqv | 1,21E+00 | 9,90E-01 | 9,45E-01 |
| EP | kg PO ₄ ³⁻ -eqv | -7,13E-02 | -1,89E-01 | -2,67E-01 |
| ADPM | kg Sb-eqv | 1,68E-03 | 1,80E-03 | 2,51E-03 |
| ADPE | MJ | 9,92E+03 | 7,03E+03 | 9,79E+03 |

GWP Global warming potential; ODP Depletion potential of the stratospheric ozone layer; POCP Formation potential of tropospheric photochemical oxidants; AP Acidification potential of land and water; EP Eutrophication potential; ADPM Abiotic depletion potential for non fossil resources; ADPE Abiotic depletion potential for fossil resources

(NEPD-376-262-EN Accoya Wood, currently withdrawn)

Other issues to be concerned about with inventory for EN 15804

Energy accounting:

Higher calorific value in Ecoinvent, while net calorific value in EN 15804

Allocation coorection for economic allocation

Use the right Ecoinvent v3.1 database. Recycled content

Water accounting. Check inputs and outputs in method are consistent with inventory

Conclusions

Specific requirements for allocation and raw material data is crucial in an PCR on modified wood

EN 15804 is large and complex, so there is room for misuse

EN 16485 PCR for wood and wood-based products for use in construction deals with this, but even more specific examples should be made in an PCR on modified wood



References

EPD S-P-00356. Environmental product declaration for Accoya. EPD programme operator: The International EPD System.

European Commission - Joint Research Centre - Institute for Environment and Sustainability: International Reference Life Cycle Data System (ILCD) Handbook - General guide for Life Cycle Assessment - Detailed guidance. First edition March 2010. EUR 24708 EN. Luxembourg. Publications Office of the European Union; 010

NEPD155N Environmental product declaration for Kebony pine. EPD programme operator: EPD-Norway.

NEPD294N Environmental product declaration for royalimpregnated timber from Marnar Bruk. EPD programme operator: EPD-Norway.

NEPD-376-262-EN, currently withdrawn. Environmental product declaration for Accoya wood. EPD programme operator: EPD-Norway.