Modelling options for module C and D: Experiences from 50 EPD for wood-based products in Norway

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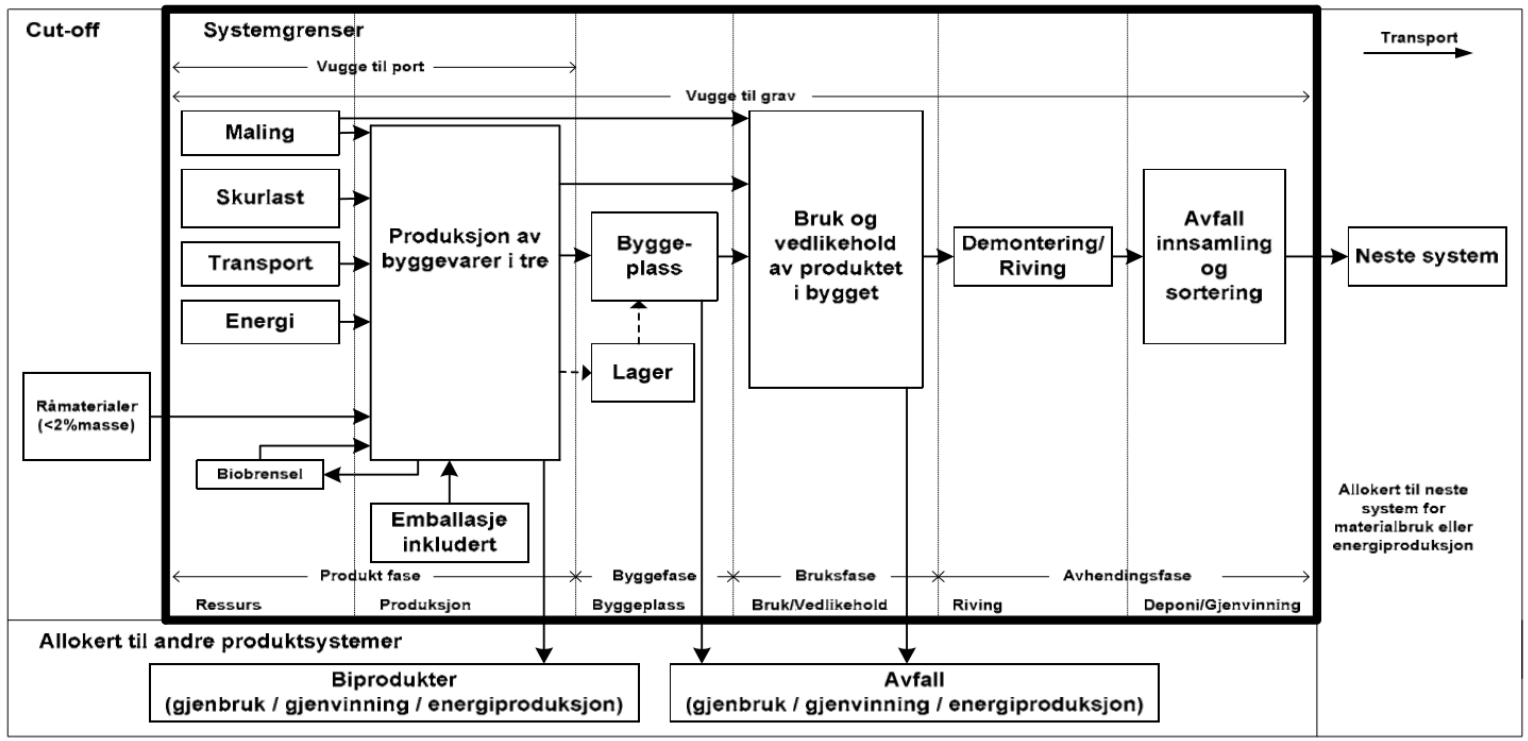
Background and methods

- 50 EPD developed in period of 2013 to 2017. All included module C + D
  - Solid wood products
  - Wood-based panels
  - Windows and doors
- The method was developed in three steps during this period
- Most of the details about the modelling have been given in confidential LCA-reports
- Method is review these EPD and standards + experiences from the work

Practice for EPD prior to EN 15804 in Norway

- Waste treatment process in energy recovery is allocated to the energy production



Three steps for scenarios

Table 1. List of EPD that represent the different stages of developing the scenario model for module C and D

	Product	Year	EPD number	Description
First model	Pine moulding	2013	NEPD00232	Statistical mix of end-of-life treatment and generic data for benefits
Second model	Pine panelling	2015	NEPD-309-179	Statistical mix for end-of-life treatments and market mix of benefits
Third model	Cross laminated timber	2017	NEPD-1269-410	Most common end-of-life treatment and average benefit

2013 EPD Painted moulding – product description

ENVIRONMENTAL PRODUCT DECLARATION

ISO 14025 ISO 21930 EN 15804

epd-norge.no
The Norwegian EPD Foundation

Eier av deklarasjonen	Barkevik Bruk AS
Program operatør	Næringslivets Stiftelse for Miljødeklarasjoner
Utgiver	Næringslivets Stiftelse for Miljødeklarasjoner
Deklarasjonens nummer	00232N
Godkjent dato	17.12.2013
Gyldig til	17.12.20□□

Malt listverk av furu
Produkt

Barkevik Bruk AS
Produsent

BARKEVIK
Listehøvleri

Produkt

Produktbeskrivelse:
Lister brukes til å lage en pen overgang mellom for eksempel vegg og gulv eller dør/vindu og vegg.

Produktspesifikasjon
Malt listverk av furu med en dimensjon på 15 mm x70 mm og en fuktighet på 17%.

Materialer	kg	%
Furu sidebord	0,58575	97
Maling	0,01	1
Strekkfilm - emballasje	<0,01	<1
Plastfolie - emballasje	<0,01	<1
Trebindebord - emballasje	0,01	1
Totalt	0,61	100

LCA: Beregningsregler

Deklarert enhet med opsjon:
1 løpemeter med malt furulist med en dimensjon på 15 mm x 70 mm, produsert, transportert, installert og avfallsbehandlet med en forventet levetid på 30 år.

First scenario model

CEN/TR 15941: 2010 states that the requirements for the end of life scenario are as follows: The use of generic data for scenarios describing the end-of-life stage (downstream processes) should reflect:

a) existing technology;
b) current regulations;
c) today's average practice and mix of different end-of-life treatments of the product group in the location where the process takes place.

- Statistics for Norway in 2011:
  - 91 % of wood to incineration with energy recovery
  - 7 % of wood to incineration without energy recovery
  - 2 % to landfill

- ELCD subsititution of energy recovery in module D

2015 EPD Softwood panelling - product

ENVIRONMENTAL PRODUCT DECLARATION
in accordance with ISO 14025, ISO 21930 and EN 15804

epd-norge.no
The Norwegian EPD Foundation

Owner of the declaration	Norwegian Wood Industry Federation
Publisher	The Norwegian EPD Foundation
Declaration number	NEPD-309-179-EN
Issue date	09.03.2015
Valid to	09.03.2020

Solid softwood panelling for interior use
Product

Norwegian Wood Industry Federation
Owner of the declaration

Treindustrien

Product

Product description:
Solid softwood panelling is produced by planed softwood of the members of the Norwegian Wood Industry Federation for use as a construction material. The raw material is Nordic sawn timber. Panelling is usually planed on the same site as the sawmill. Panelling is used to cover wall and ceiling in rooms with normal indoor climate.

Product specification
In the calculations panelling of pine is used with an dimension of 14 x 120 mm and consists of 0,014 m^3 of wood.

Materials	kg	%
Planed softwood	6,58	99,8
Plastic packaging	0,01	0,2
Total	6,59	100

EPD Softwood panelling - scenario

- Market mix, including export to Sweden

The transport of wood waste is based on average distance in 2007 in Norway and is at 85 km. It is further estimated that 46% are further transported to Sweden for treatment. It is estimated that 67% of this is on truck, 9% by rail and 24% is by boat, the transport distances to Sweden were assumed.

Transport to waste processing (C2)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption		Value (l/t)
Truck	50	Lorry, 20-28t	85	0,05	l/tkm	
Truck	75	Lorry, >32t	200	0,026	l/tkm	
Railway		Freight train	400	0,239	MJ/tkm	
Boat	71	Barge	800	0,011	l/tkm	

Benefits beyond the life cycle is calculated on the exported energy and the substitution of conventional energy production and fuels. For the share recovered in Norway, this is substitution of Norwegian el-mix, district heating mix and different types of industrial fuels. For the share exported to Sweden generic data from ELCD 3.0 is used.

Benefits and loads beyond the system boundaries (D)

	Unit	Value
Substitution of biofuel	kg	1,6
Substitution of electric energy	MJ	7,8
Substitution of thermal energy	MJ	27,4

Softwood panelling can be sorted as clean or mixed wood waste. The scenario for further treatment is based on the Norwegian waste accounts in 2011. It is assumed that energy recovery, incineration and landfill are relevant for the wood.

End of Life (C1, C3, C4)

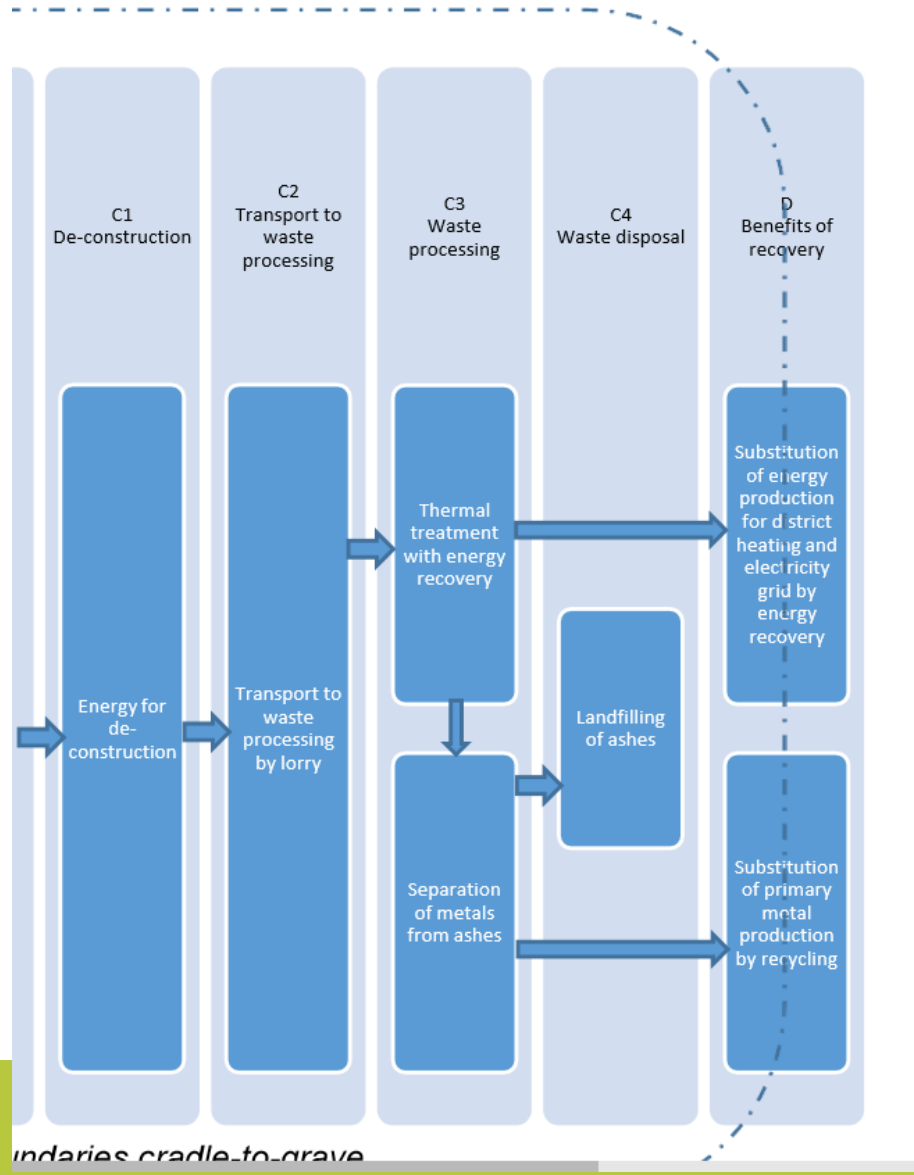
	Unit	Value
Hazardous waste disposed	kg	
Collected as mixed construction waste	kg	7
Reuse	kg	
Recycling	kg	
Energy recovery	kg	6,0
Incineration without energy recovery	kg	0,5
To landfill	kg	0,1

- Same statistical mix of treatments
- Mix of benefits (approx. %)
  - Municipal incineration Norway 25 %- district heating and electricity
  - Cement plant 5 % - coal substitution
  - Sawmill and particleboard 10 % - wood chips
  - Pulp and paper 14 % - oil substitution
  - Sweden 46 % - ILCD data for substitution

EPD-Norway - Harmonisation of scenarios project

- 6.3.8 in EN 15804 specify that one or several of the most likely scenario shall be used
- Not mix of end-of-waste treatment

(Tellnes et al., 2014)



2017 EPD Cross laminated timber - product

ver1 2015

epd-norge.no
The Norwegian EPD Foundation

ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025, ISO 21930 and EN 15804

Owner of the declaration:	Cross Timber Systems Ltd.
Program operator:	The Norwegian EPD Foundation
Publisher:	The Norwegian EPD Foundation
Declaration number:	NEPD-1269-410-EN
Registration number:	NEPD-1269-410-EN
ECO Platform reference number:	00000501
Issue date:	14.03.2017
Valid to:	14.03.2022

Cross laminated timber panels

Cross Timber Systems Ltd.

www.epd-norge.no

ECO PLATFORM EPD

Product

Product description:

Cross laminated timber (CLT) solid wood panels are made up of odd number of layers and are available in different panel thicknesses depending on structural requirements. The layers are bonded using formaldehyde free polyurethane adhesives.

Product specification:

The declaration covers CLT in 60-260 mm thickness made of spruce wood and polyurethane adhesive. The material composition is an average of 60 and 260 mm.

Materials	kg	%
Spruce timber, dry weight	375	88,52
Water content of wood	45	10,62
Adhesive	3,61	0,85
Total product	423,61	100
Wood packaging	13,82	
Plastic packaging	0,24	
Steel packaging	0,07	
Total with packaging	437,74	

2017 EPD Cross laminated timber – scenario

- Only the most probable scenario for end-of-life
- Incineration in C3
- Landfilling of ashes in C4
- National statistics for exported heat and electricity from waste incineration
  - 8 % of gross heating value in product sold as electricity
  - 55 % of gross heating value in product sold as district heating

The product has no operational energy use and water consumption.

Operational energy (B6) and water consumption (B7)

	Unit	Value
Water consumption	m^3	
Electricity consumption	kWh	
Other energy carriers	MJ	
Power output of equipment	kW	

The waste processing is assumed as wood waste treated with incineration with energy recovery. Ash from incineraiton is disposed in landfill.

End of Life (C1, C3, C4)

	Unit	Value
Hazardous waste disposed	kg	
Collected as mixed construction waste	kg	
Reuse	kg	
Recycling	kg	
Energy recovery	kg	423,61
To landfill	kg	

The transport of wood waste is based on average distance for Norway in 2007 and was 85 km (Raadal et al., 2009).

Transport to waste processing (C2)

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance km	Fuel/Energy consumption	Value (l/t)
Lorry	Unspecified	Unspecified	85	0,045 l/tkm	3,8

The benefits of exported energy from energy recovery is calculated with substiution of Norwegian electricity market mix on medium voltage and Norwegian district heating mix. The energy exported and the district heating mix is representative for the year 2015.

Benefits and loads beyond the system boundaries (D)

	Unit	Value
Substitution of electricity	MJ	612
Substitution of district heating	MJ	4208
Substitution of raw materials	kg	0

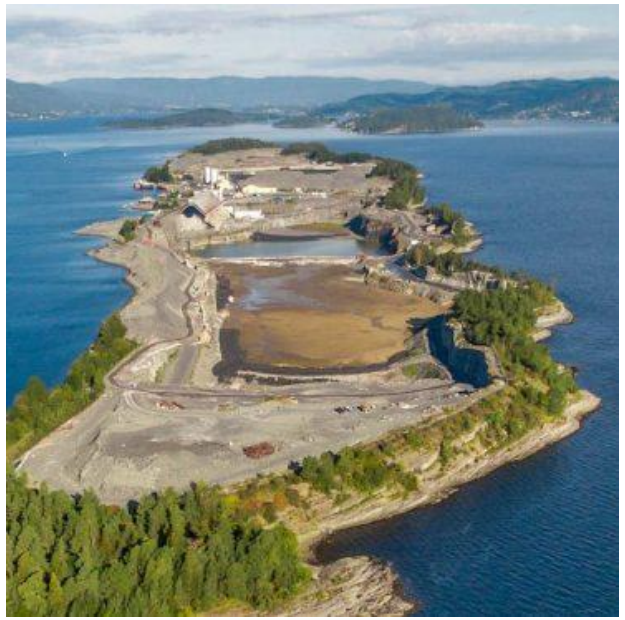
Three steps develop of LCI modelling in C3

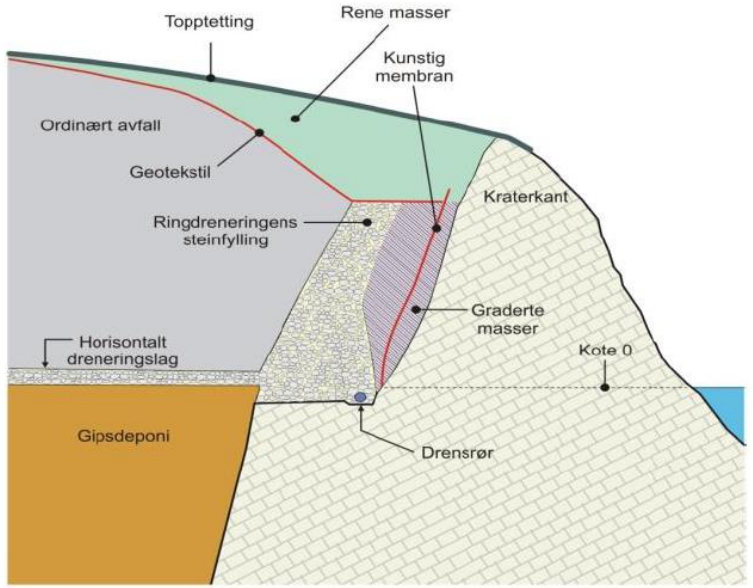
Table 2. List of EPD that represent the different stages of developing the LCI model for resin incineration in module C

	Product	Year	EPD number	Description
First model	Glulam beam	2014	NEPD00263	ELCD dataset for whole product
Second model	Standard glulam	2015	NEPD-336-222	Ecoinvent dataset for each material component
Third model	Glulam for custom projects	2018	NEPD-1577-605	Ecoinvent dataset adjusted to carbon content

Other issues - Long term emissions

- Long term emissions can in ecoinvent and SimaPro be excluded or included. For landfilling of ash from incineration, the content of ash is modelled as emission to soil if long term emissions are included





Future issues – carbon capture and storage (CCS)

- Two facilities for CCS are planed in Norway
  - Municipal and commercial waste incineration in Oslo
  - Cement kiln /hazardous organic waste incineration
- Both facilities will treat building wastes (C3), but also supply construction products manufacturing with heat.
- Will provide carbon negative for biogenic carbon, so allocation is important
- Case study suggest that this allocation follow end-of-waste criteria as normal in EN 15804 and that carbon storage is like a landfill in C4
- Carbon capture and utilization are different. Since the carbon is recycled, the biogenic carbon allocation should be treated as with recycling in EN 16485

(Tellnes & Hundhausen, 2016)

Conclusions

- Methodology has had an evolution from simple to very complicated
- References scenarios for end-of-life should be included in PCR, but depends on markets.
- Transparency is important for LCI in databases and verification and specific for the material composition. Unit processes are preferable
- Bio-CCS will bring carbon negative products, allocation is important and should be modelled like ash disposal

Thank you

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RESEARCH AREAS

References

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