The environmental impacts associated with wood modification

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Carbon sequestration

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Conventional approach

- Calculate amount of atmospheric carbon stored in the timber (EN 16449)
- Determine the carbon footprint (kg CO_2 equivalents)

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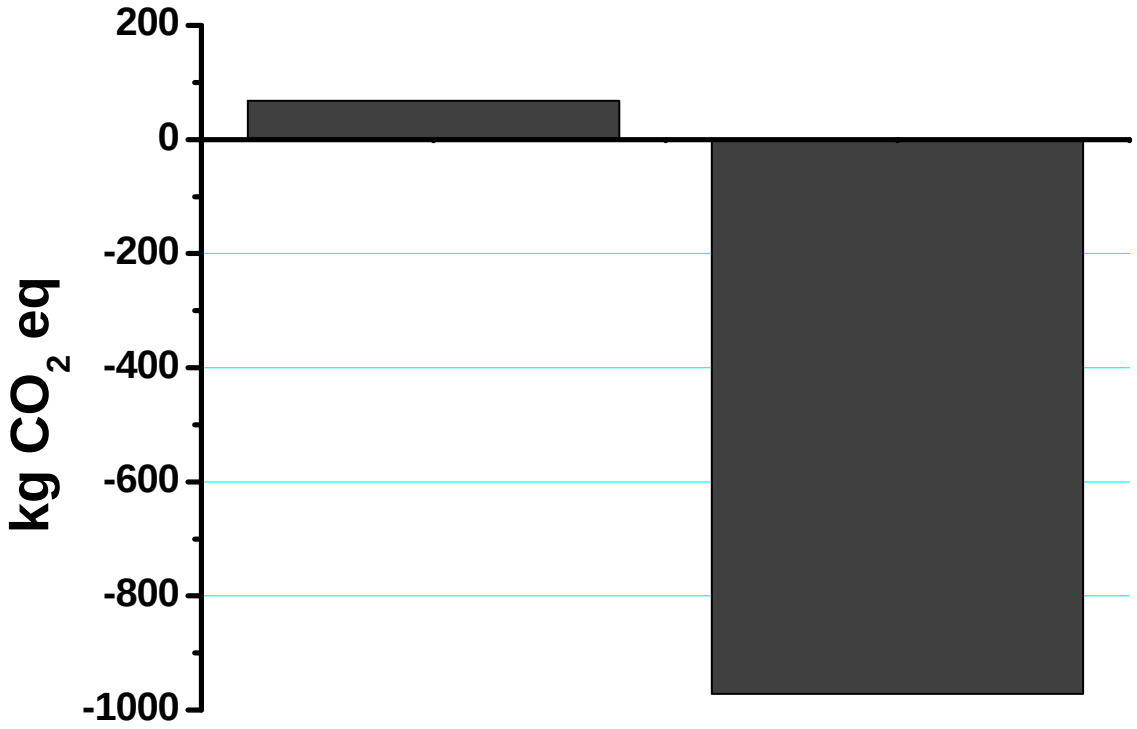
e.g. Scots pine (per m^3)



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Environmental product declaration ISO 14025

epd-norge.no
The Norwegian EPD Foundation

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

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

Deklarasjonen er utarbeidet av:
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Om EPD:
EPDer fra andre programoperatører enn Næringslivets Stiftelse for Miljødeklarasjoner er ikke nødvendigvis sammenlignbare.

KEBONY

Utslipp og miljøpåvirkninger

Miljøpåvirkninger

Indikator	Råmaterial	Produksjon	Transport	Byggeplass	Bruk	Avhending	Total
Global oppvarming (kg CO_2 ekv)	94,0	161,8	41,2	0,0028	0,0028	0,0007	297
Ozonnedbryting (kg CFC-11 ekv)	1,057E-05	2,09833E-05	6,01316E-06	3,46132E-10	3,46132E-10	8,65331E-11	3,75669E-05
Forsuring (kg SO_2 ekv)	0,94	0,34	0,36	4,77612E-06	4,77612E-06	1,19403E-06	1,64
Overgjødsling (kg PO_4-ekv)	0,21	0,05	0,05	1,69806E-06	1,69806E-06	4,24514E-07	0,31
Fotokjemisk ozon (kg C_2H_4-ekv)	1,11	0,02	0,01	2,76419E-07	2,76419E-07	6,91048E-08	1,13

hardere, mer stabilt og får bedret biologisk holdbarhet. Kebony furu er svanemerket.

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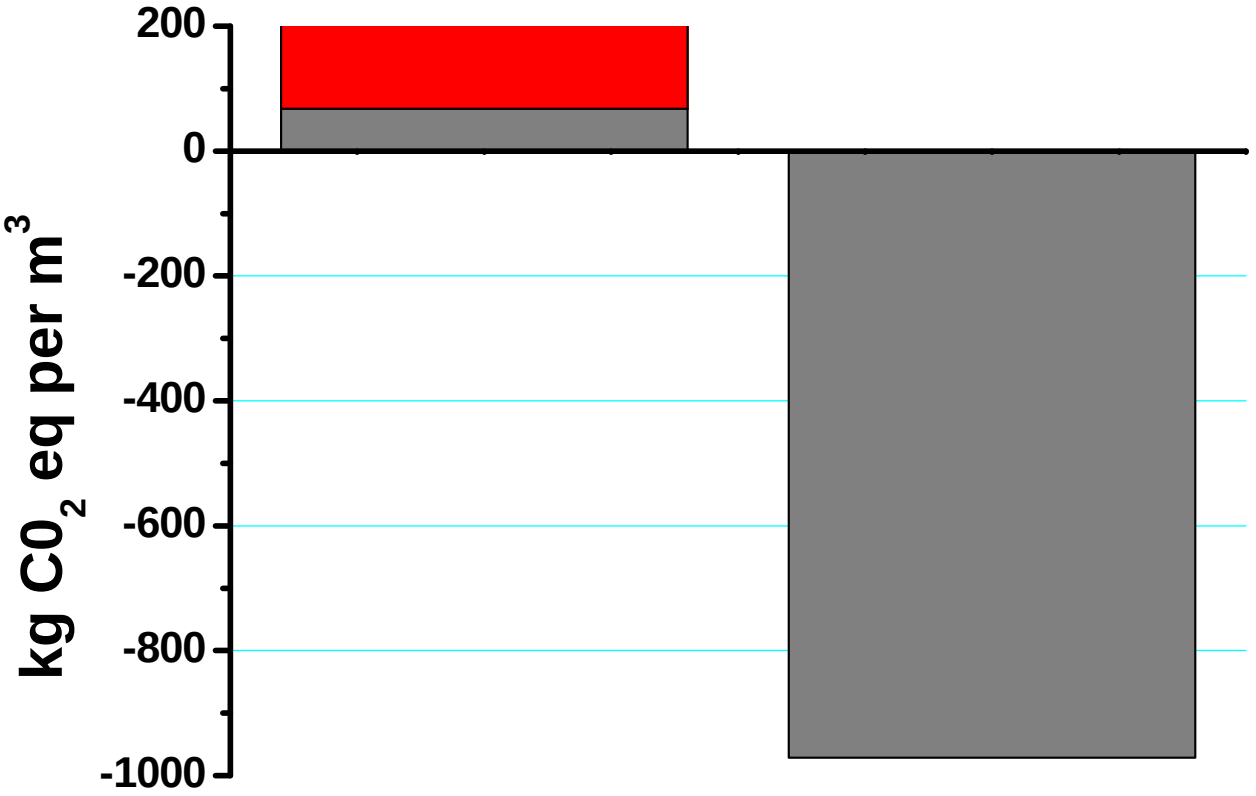

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But – need to include a temporal factor to report time carbon is in storage

- PAS 2050 (2008 vs 2011)
- pr EN 16485 vs EN 16485
- ILCD methodology (IES JRC)
- pr EN 16760

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PUBLICLY AVAILABLE SPECIFICATION

PAS 2050:2008

Specification for the assessment of the life cycle greenhouse gas emissions of goods and services

Annexes

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PAS 2050 (2008)

5.4 Carbon storage in products

Where atmospheric CO_2 is taken up by a product, and that product is not a living organism, the impact of this carbon storage over the 100-year assessment period shall be included in the assessment of the life cycle GHG emissions of the product, subject to the conditions described in **5.4.3** and **5.4.4**.

Where carbon of biogenic origin forms part of a product, the impact of this carbon storage over the 100-year assessment period shall be included in the assessment of the life cycle GHG emissions of the product, subject to the conditions described in **5.4.1** to **5.4.4**.

Note *Carbon storage may arise where biogenic carbon forms part or all of a product (e.g. wood fibre in a table), or where atmospheric carbon is taken up by a product over its life cycle (e.g. cement).*

5.4.1 Eligible products for the assessment of stored biogenic carbon

For products containing carbon of biogenic origin, the impact of carbon storage shall be included in the assessment of the life cycle GHG emissions of the product where:

a) the product is not for human or animal ingestion (i.e. not a food or feed);

b) more than 50% of the mass of carbon of biogenic origin in the product remains removed from the atmosphere for one year or more following production of the product; and

c) the material containing the biogenic carbon is obtained from either:

   i) an input that is the result of human actions that cause its formation for the purpose of using it as an input to a process (e.g. managed forestry); or

   ii) a recycled or re-use input that contains material that is demonstrated to comply with point (i) above.

Note 1 *The purpose of a) is to limit the need to carry out a carbon storage assessment to non-food items; the purpose of b) is to ensure that this provision is not required to be implemented for products of biogenic origin that have a short life span; the purpose of c) is to ensure that the storage of biogenic carbon in products is additional to that*

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2-25 years

$$\text{Weighting factor} = \frac{(0.76 \times t_o)}{100}$$

where

t_o = the number of years the full carbon storage benefit of a product exists following the formation of the product.

26-100 years

$$\text{Weighting factor} = \frac{\sum_{i=1}^{100} x_i}{100}$$

where

i = each year in which storage occurs,

x = the proportion of total storage remaining in any year i.

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PUBLICLY AVAILABLE SPECIFICATION

PAS 2050:2011

Specification for the assessment of the life cycle greenhouse gas emissions of goods and services

5.5 Carbon storage in products

5.5.1 Treatment of stored carbon

Where some or all removed carbon will not be emitted to the atmosphere within the 100-year assessment period, the portion of carbon not emitted to the atmosphere during that period shall be treated as stored carbon.

Note 1 *Carbon storage might arise where biogenic carbon forms part or all of a product (e.g. wood fibre in a table), or where atmospheric carbon is taken up by a product over its life cycle (e.g. cement).*

Note 2 *Storage of biogenic carbon in products varies depending on the type of product, the mean life span of the product, its rate of recycling and its disposal route (e.g. landfill, incineration).*

Note 3 *Non-CO_2 emissions, such as CH_4, can arise through the decomposition of the product in any form or location, such as in landfill.*

Note 4 *While forest management activities might result in additional carbon storage in managed forests through the retention of forest biomass, this potential source of storage is not included in the scope of this PAS.*

Note 5 *The use of a weighting factor to assess delayed emissions is no longer a requirement of this PAS. However, for entities wishing to undertake such assessment, provision is made in* ***6.4.9.3.2*** *and* ***Annex E****.*

5.5.2 Recording the basis of carbon storage assessment

Where the assessment of the life cycle GHG emissions of a product includes some carbon storage, the data sources from which the quantity of stored carbon was calculated, together with the carbon storage profile of the product over the 100-year assessment period, shall be recorded and retained (**4.4**).

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E.4 Recording the basis of the carbon storage assessment

Where the assessment of the life cycle GHG emissions of a product is accompanied by assessment of the impact of delayed release of the stored carbon, the data sources from which the impact of stored carbon was calculated, together with the carbon storage profile of the product over the 100-year assessment period, shall be recorded and retained (see **4.4**).

Note *Entities wishing to make the effect of carbon storage known to other parties may do this in parallel with the identification of the impact without carbon storage.*

prEN 16485 vs EN 16485

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Section 6.3.4.4.2

PAS 2050 methodology

Title: Draft BS EN 16485 -Round and sawn timber - Environmental Product Declarations - Product category rules for wood and wood-based products for use in construction

6.3.4.4.2 B1–B5 Use stage information modules related to the building fabric:

As EN 15804 other than

— **B1 Use of the installed product** in terms of any emissions to the environment (not covered by B2-B7)

The module "use of the installed product" covers environmental aspects and impacts arising from components of the building and construction works during their normal (i.e. anticipated) use, which are assigned to module B1.

EXAMPLE 1 Release of substances from the facade, roof, floor covering and other surfaces (interior or exterior) to indoor air, soil or water

NOTE 1 The EPD does not need to give this information if the horizontal standards on measurement of release of regulated dangerous substances from construction products using harmonised test methods according to the provisions of the respective technical committees for European product standards are not available, the EPD can lack this information.

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:

$$GWP_{dt} = C_{CO_2} \times \frac{-0.76 \times t_0}{100} \quad (1)$$

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:

$$GWP_{dt} = C_{CO_2} \times \frac{-\sum_{i=1}^{100} x_i}{100} \quad (2)$$

Where:

GWP_{dt} net avoided contribution to the GWP over 100 years from carbon storage; kg CO_2-e

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BS EN 16485:2014

BSI Standards Publication

Round and sawn timber — Environmental Product Declarations — Product category rules for wood and wood-based products for use in construction

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6.3.4.4 Use stage

6.3.4.4.1 General

As in EN 15804.

6.3.4.4.2 B1–B5 Use stage information modules related to the building fabric:

As in EN 15804 with the following addition:

B1 Use of the installed product in terms of any emissions to the environment (not covered by B2-B7).

The module "use of the installed product" covers environmental aspects and impacts arising from components of the building and construction works during their normal (i.e. anticipated) use, which are assigned to module B1.

EXAMPLE Release of substances from the facade, roof, floor covering and other surfaces (interior or exterior) to indoor air, soil or water.

NOTE 1 The EPD does not need to give this information if the horizontal standards on measurement of release of regulated dangerous substances from construction products using harmonized test methods according to the provisions of the respective technical committees for European product standards are not available; the EPD can lack this information.

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 order to reflect the biogenic nature of wood, its renewability and its potential carbon neutrality, the system boundary between nature and the product system under study is defined as follows:

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

— All technical processes related to forestry operations intended to produce timber, (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 6.4.3.2.

— Potential implications due to the unknown origin of wood or unsustainably produced timber are considered.

— Human induced impacts on forest carbon pools resulting deforestation are included.

Carbon Accounting (ILCD)(2010)

Sections 7.4.3.6.4 and 7.4.3.7.3

- International Reference Life Cycle Data System
- Recommends differentiating between fossil and biogenic carbon sources
- Carbon released due to land use change is counted as fossil carbon, as is litter and biomass from virgin forest (7.4.3.6.4)
- Use 100 year time frame
- Carbon sequestered by plants is listed as ‘resources from air’ [– CO_2e]

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Carbon Accounting (ILCD)

- Emissions use GWP100, but this is incorrect if carbon is sequestered for (e.g.) 80 years
- Dealt with by calculating a ‘correction flow for delayed emission’ (7.4.3.7.3)
- This is calculated as years x 0.01 kg CO_2e [- CO_2e]
- Emissions are counted as + CO_2e (GWP100)

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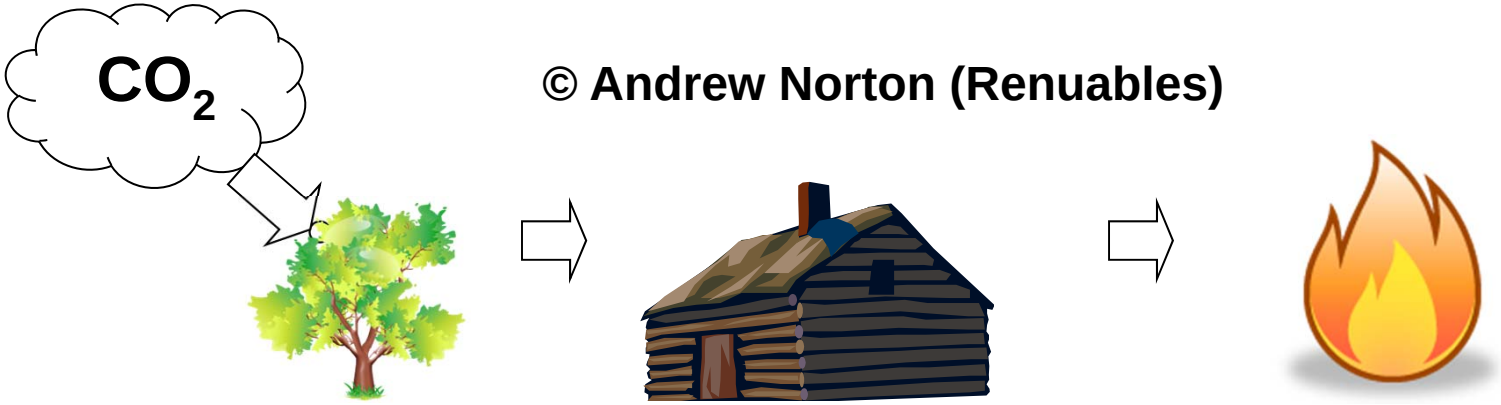
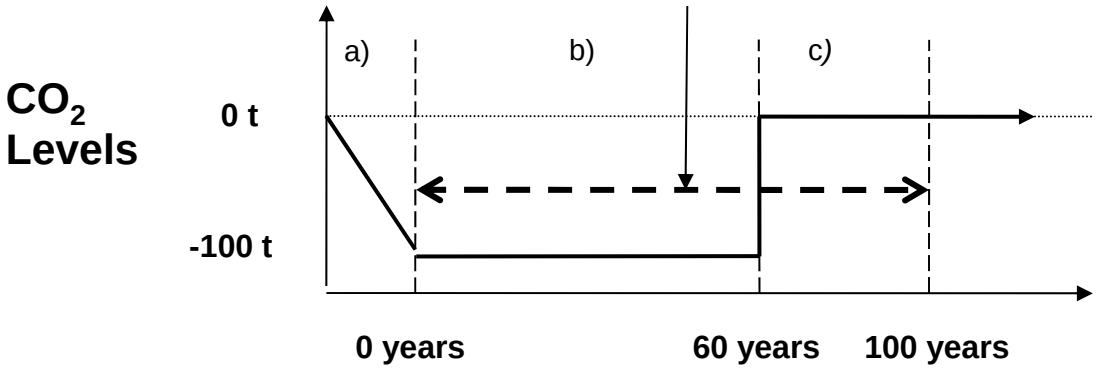
For one tonne sequestered carbon dioxide



Calculation period



Impact over 100 years = - 0.6 t CO2 eq GWP calculated

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 16760

June 2014

ICS 13.020.60

English Version

Bio-based products - Life Cycle Assessment

Annex B
(informative)
Example of fossil and biogenic carbon flows accounting

B.1 General

Carbon flows can have two origins: fossil or biogenic. Carbon flows can both come from material resources (fossil and biomass) used as a feedstock of the bio-based product and from energy resources (fossil and biomass) used in the production of the product.

Fossil and biogenic carbon emissions both need to be accounted for. In the creation of LCIs for bio-based or partially bio-based products, sequestration of atmospheric carbon by the plant should be considered. As required under 6.5: "Carbon emissions and removals arising from fossil and biogenic carbon sources and sinks shall be included in the LCI and shall be listed separately in the inventory".

NOTE 1 The amount of CO_2 taken up in biomass and the equivalent amount of CO_2 emissions from the biomass at the point of complete oxidation results in zero net CO_2 emissions when biomass carbon is not converted into methane, non-methane volatile organic compounds (NMVOC) or other precursor gases.

NOTE 2 This clause describes LCI generation for biogenic and fossil carbon accounting. Emissions from land use change and of non-carbon emissions (e.g. N_2O emissions from farming) should be considered and included in the inventory. However, the specific guidance for calculations of land use change and farming emissions is addressed in 5.4.2.

B.2 Fossil carbon inventory flows relevant for LCI

In this example, fossil carbon flows emitted to the environment, are accounted for as positive flows. The nature of the emissions is identified (e.g. CO_2, CH_4, and other fossil carbon emitted to air, water, soils).

B.3 Biogenic carbon inventory flows relevant for LCI

B.3.1 Biogenic carbon from the biomass used as a feedstock in the production of the bio-based product

The following biogenic carbon flows are considered:

— Fixation of atmospheric CO_2 in biomass during biomass growth. This flow is accounted for as a negative flow in the growth phase.

— Carbon emissions to the air (CO_2, CH_4 and others). Those flows are accounted for as positive flows.

— Carbon emissions to water.

— Carbon emissions to soils.

The biogenic carbon in the bio-based product is equal to the biogenic carbon sequestration by biomass in the growth phase minus emissions of biogenic carbon released to air, soil and water in the production and end-of-life.

The biogenic carbon embedded in the bio-based products should also be equal to biogenic carbon released in case of end-of-life treatment of the product with complete oxidation.

A simplified approach may be used to determine the net quantity of atmospheric carbon dioxide fixed in a product using stoichiometry or the biogenic carbon content.

B.5 Temporal accounting

B.5.1 ILCD guidance for calculating temporal accounting (CFP = Carbon Footprint)

$CFP_{temp,Storage} = - \sum m_i * t_S * GWP_{IPCC,i} / 100$

$CFP_{temp,Storage}$: Carbon footprint of temporarily stored GHG species i

m_i: Mass of greenhouse gas i removed:

For CO_2: $m_{CO2} = m_c * M_{CO2}/M_C$

with m_c being the mass of carbon stored in a product and released as carbon dioxide within a 100 yr timeframe
M_{CO2} , M_C being the molecular weights of CO_2 and carbon, respectively.

For CH_4: $m_{CH4} = m_c * M_{CH4}/M_C$

with m_c being the mass of carbon that is temporarily stored in e.g. a landfill and released as methane within a 100 yr timeframe

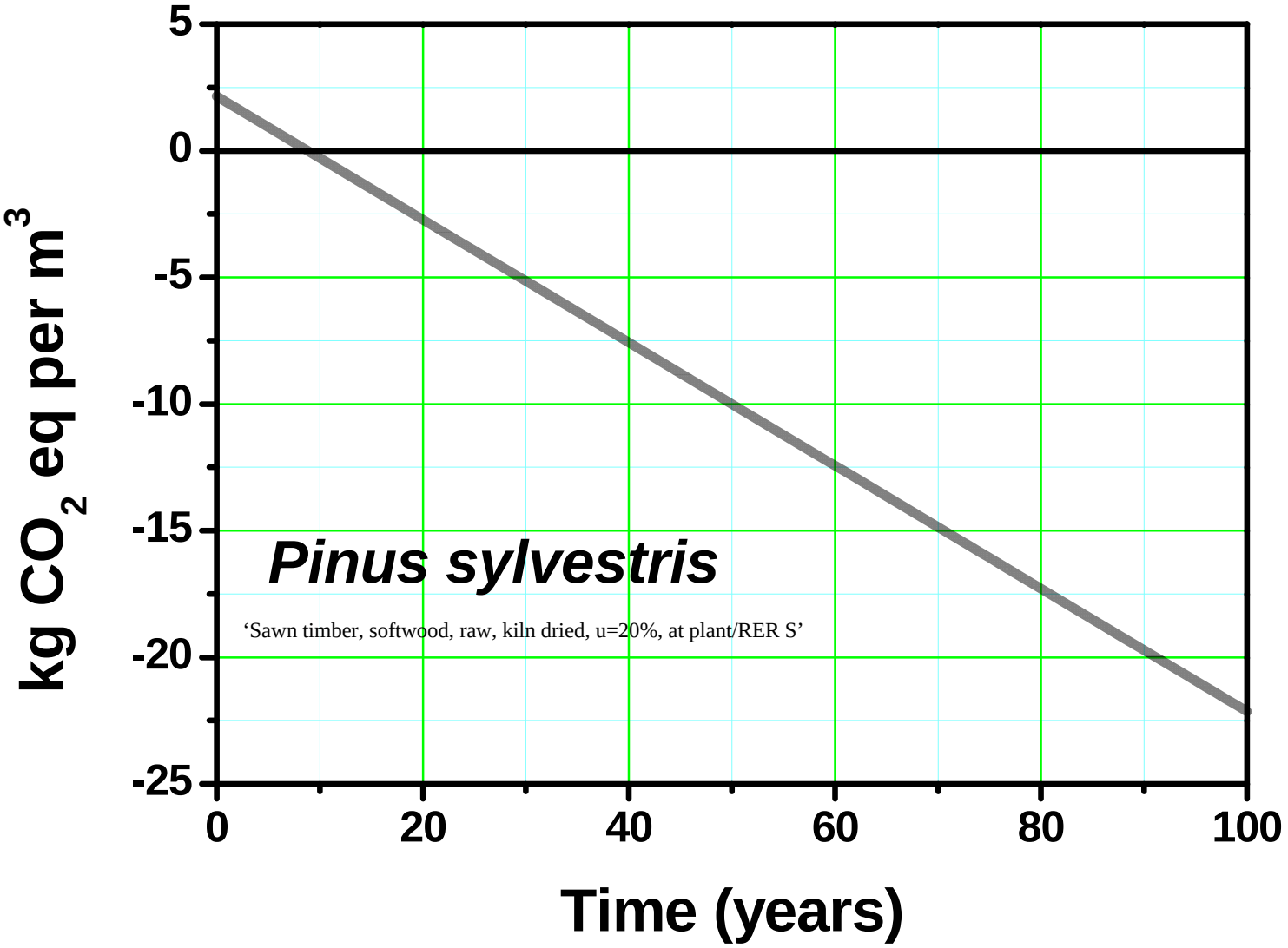
M_{CH4}, M_C being the molecular weights of methane and carbon, respectively.

t_S: Time of temporal removal/storage in years

$GWP_{IPCC,i}$: IPCC GWP for 100-year time horizon for greenhouse gas *i* (Table A.1)

According to the ILCD Handbook[8] the time period of the removals t_S, relative to the year of production of the product, shall be documented separately in the report.

According to the ILCD Handbook, when greenhouse gases are removed over more than 100 years, these removals shall be calculated as if they were stored indefinitely.



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Modified wood

- Used published data
- Transport to a construction site in London from site of manufacture

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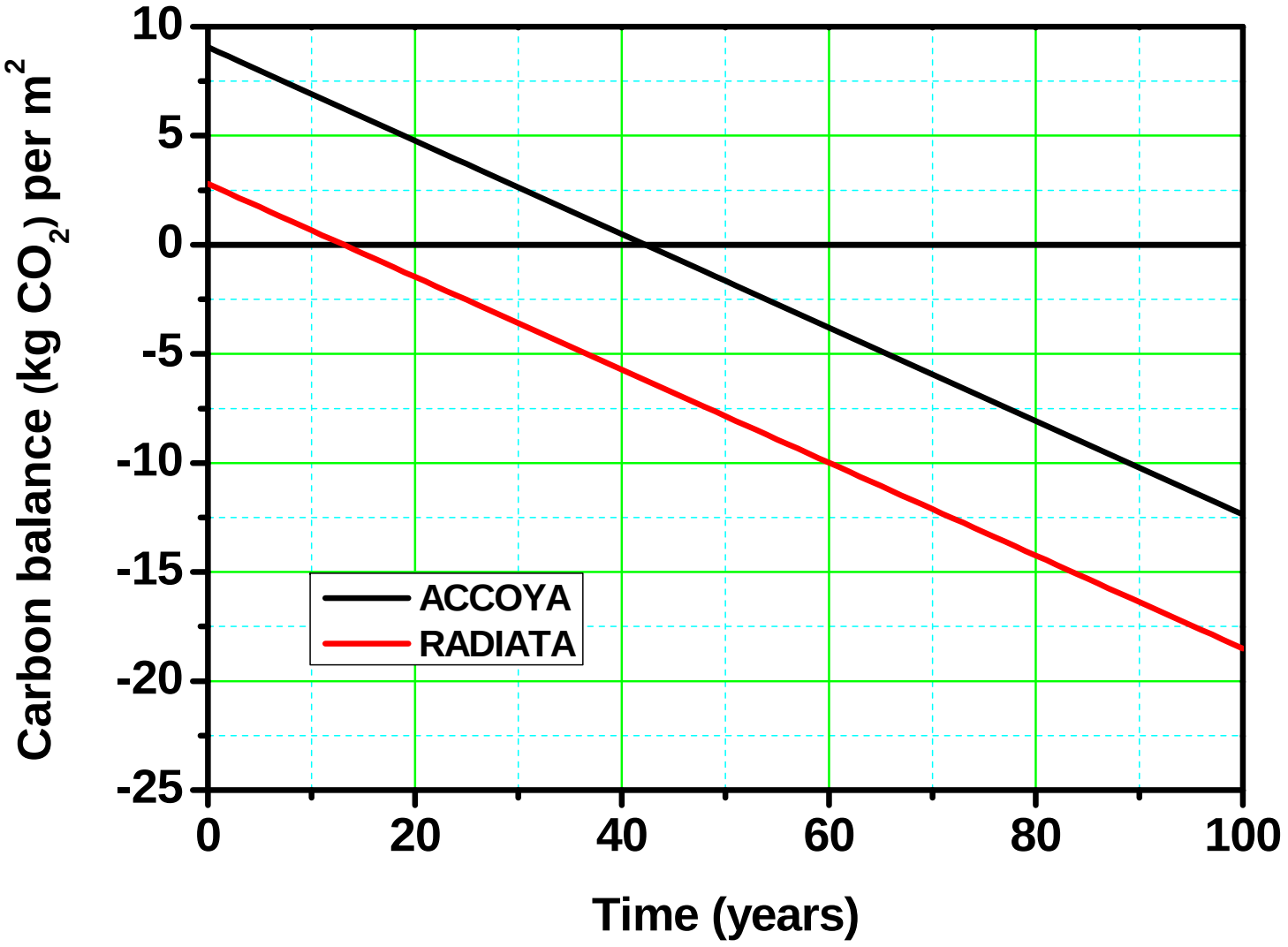

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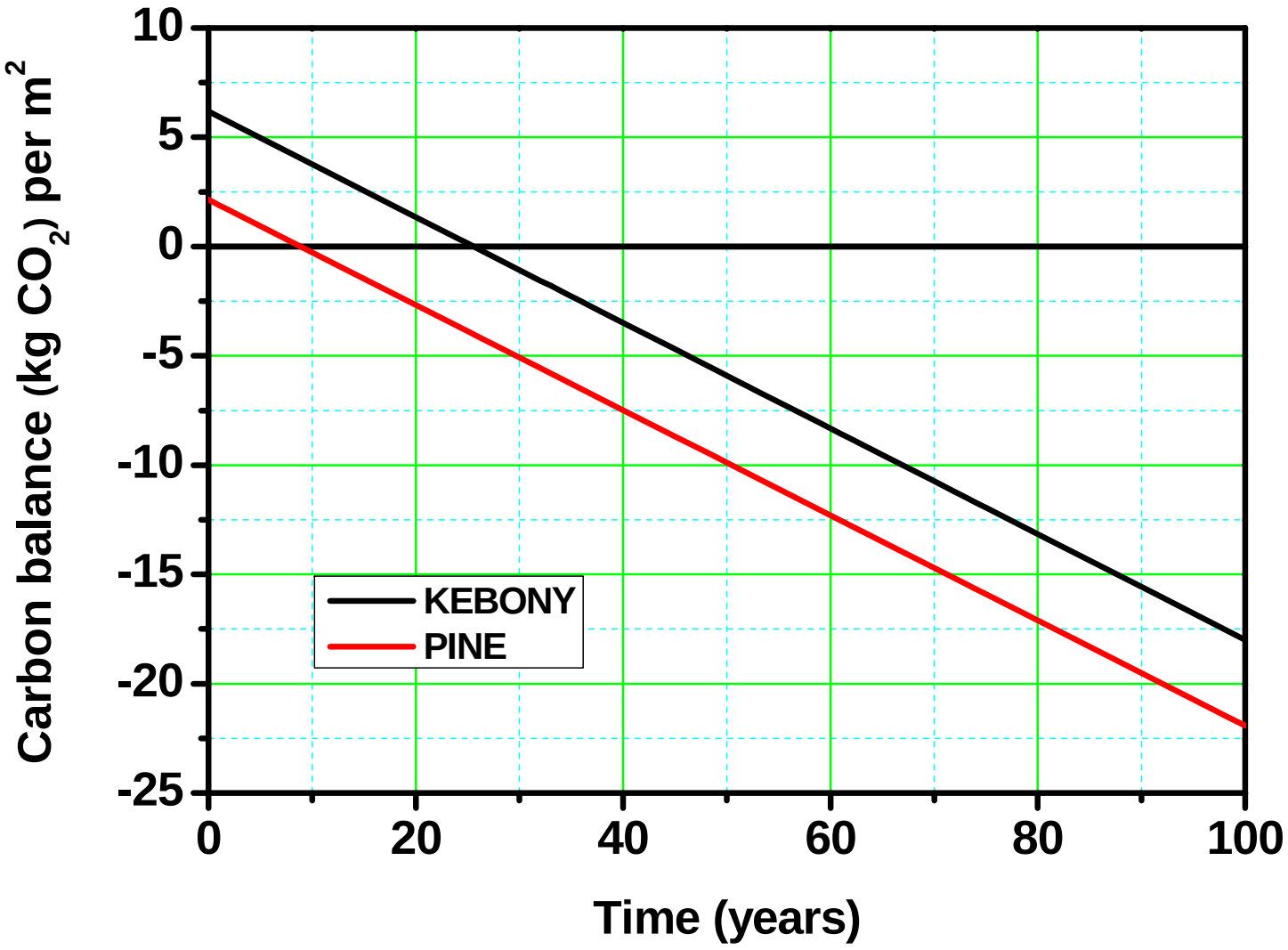

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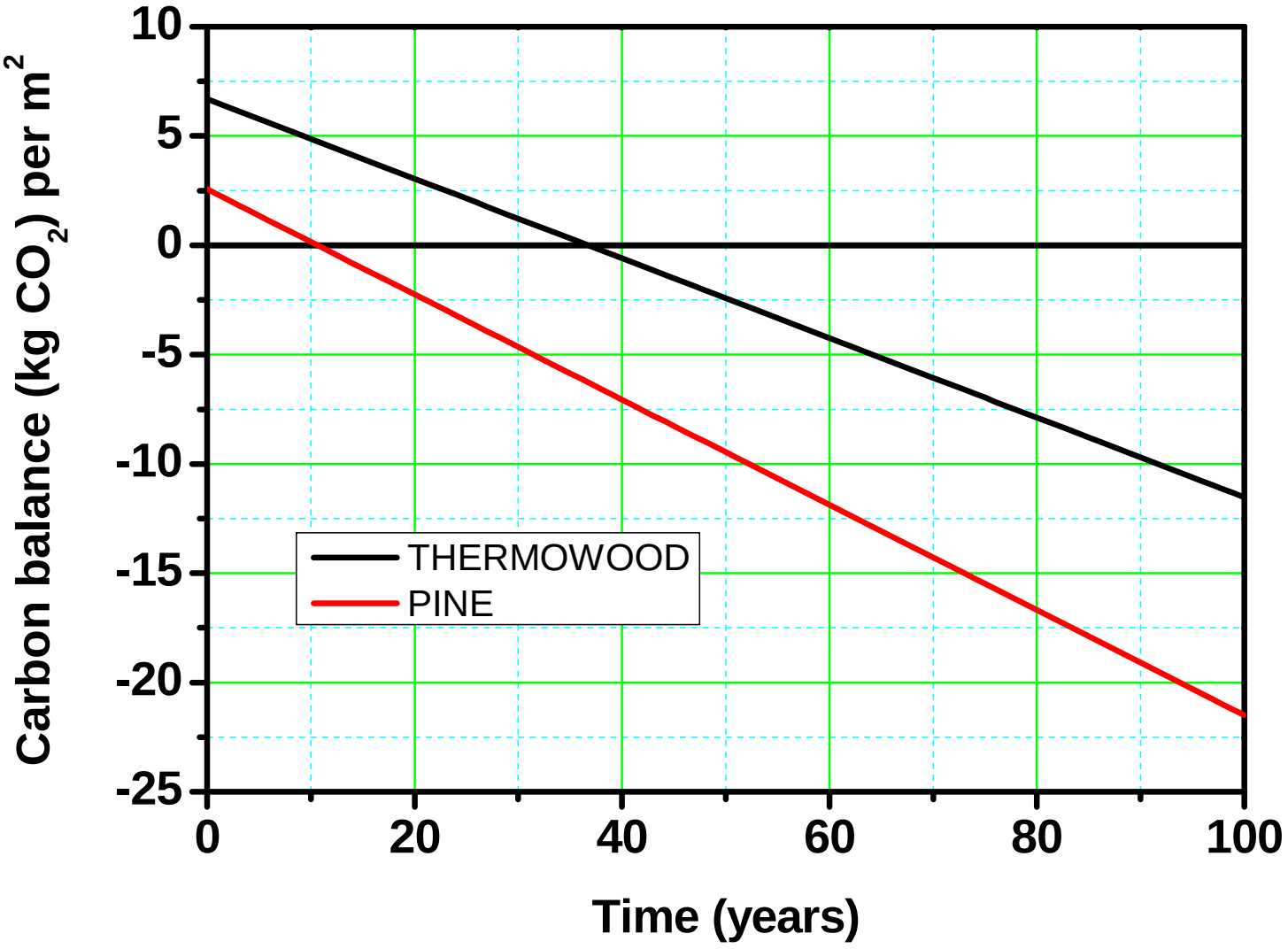

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Conclusions

- There needs to be an agreed temporal accounting method for stored biogenic carbon
- It seems unlikely this will appear in the standards due to lobbying

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