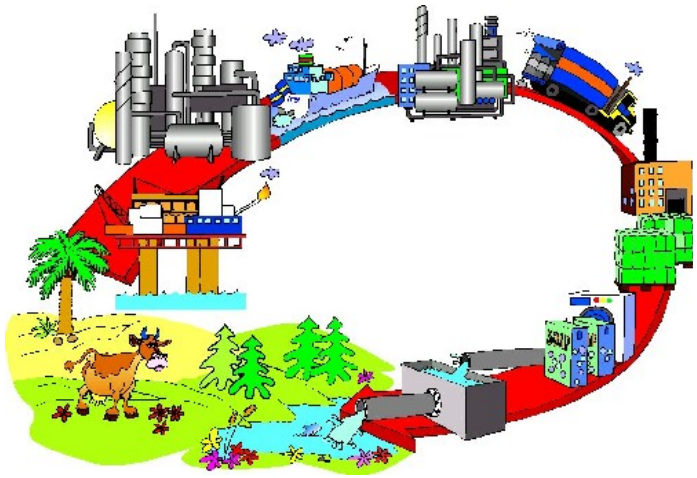
NC STATE UNIVERSITY

Environmental Life Cycle Assessment
PSE 476/WPS 576/WPS 595-005

Lecture 15: Environmental Product Declarations



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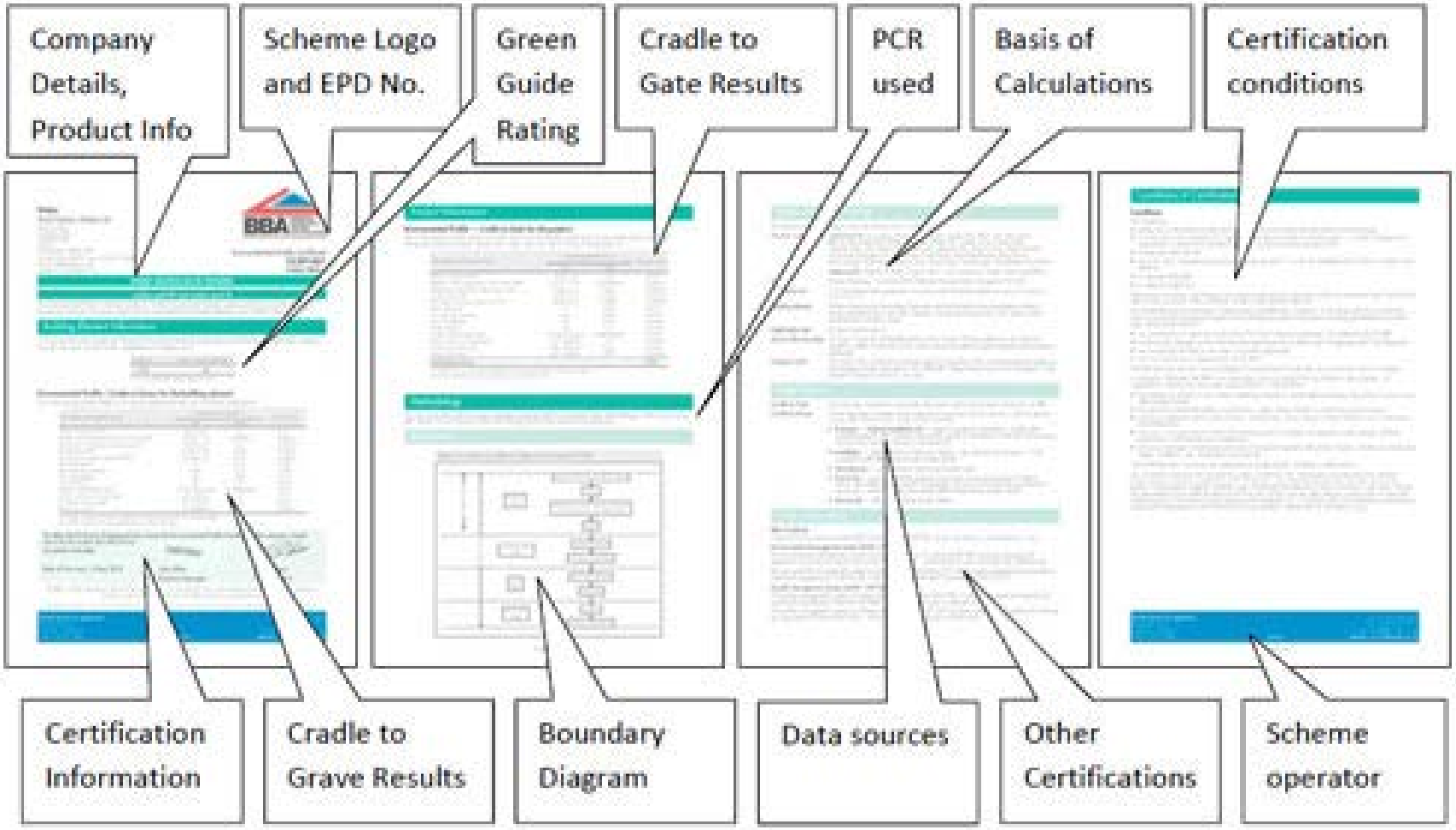
Environmental Product Declarations (EPDs):

- Ecolabels that disclose the environmental performance of products based on an environmental life cycle assessment (LCA).
-
  - Similar to nutrition labels disclose nutritional performance.
  - provide the consumer with a way to evaluate their choices.

http://www.interfacecutthefluff.com/tag/life-cycle-assessment-lca/page/2/

ENVIRONMENTAL PRODUCT DECLARATION (EPD)



http://www.pe-international.com/topics/what-are-environmental-product-declarations/

EXAMPLE EPD:

Sample of Carbon footprint

エコプロダクツ2008出展
カーボンフットプリント暫定表示

Provisional mark for
EcoProducts 2008 Exhibition

Enterprise	KOKUYO S&T Co.,Ltd.
Product of the carbon footprint	Pipe Type File, "EcoTwin-R", (7-RT650B),
Quantity	A4-size, Paper Capacity; 5cm

Stage	Material Production	Product Manufacturing	Transportation	Retailing	Usage	Disposition /Recycling	Total
GHG Emission g-CO_2/P	1003.8	27.3	50.9	155.9	0	99.5	1337
Calculation condition	-The GHG emission in Material Production Stage was calculated using design weight and secondary data prepared by the secretariat, where loss ratio of sheet type material was considered. -The GHG emission in Retailing Stage was calculated using given value of GHG per sales price, which was prepared by the secretariat. -The GHG emission in Usage Stage was identified as zero due to no energy consumption in this stage.						

IMPORTANCE OF EPDS

- **Today, every food item in your store has a food label. Soon, every product will have an EPD attached!**
- Five million jobs are endangered by the new EU requirements in U.S. if Europe stops purchasing non-EPD type products.
- Potentially 67,000 new jobs and a better environment with the development of EPD systems.

Ingredients: Whole Corn, Vegetable Oil (Corn, Canola, Soybean and/or Sunflower Oil), Maltodextrin (Made From Corn), Salt, Tomato Powder, Corn Starch, Lactose, Whey, Skim Milk, Corn Syrup Solids, Onion Powder, Sugar, Garlic Powder, Monosodium Glutamate, Cheddar Cheese (Milk, Cheese Cultures, Salt, Enzymes), Dextrose, Malic Acid, Buttermilk, Natural and Artificial Flavors, Sodium Acetate, Artificial Color (Including Red 40, Blue 1, Yellow 5), Sodium Caseinate, Spice, Citric Acid, Disodium Inosinate, and Disodium Guanylate.
CONTAINS MILK INGREDIENTS.

Nutrition Facts

Serving Size 1 oz (28g/About 12 chips)

Amount Per Serving	
Calories 150	Calories from Fat 70
	% Daily Value*
Total Fat 8g	**12%**
Saturated Fat 1g	**5%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 180mg	**8%**
Total Carbohydrate 18g	**6%**
Dietary Fiber 2g	**6%**
Sugars less than 1g	
Protein 2g	

Vitamin A 0%	•	Vitamin C 0%
Calcium 2%	•	Iron 0%
Vitamin E 6%	•	Thiamin 4%
Riboflavin 2%	•	Vitamin B_6 4%
Phosphorus 4%	•	Magnesium 4%

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

Product Category Rules (PCRs)

- Are detailed instructions on how to perform the LCA for EPDs
- Assure that LCAs performed are done in the same way, so that an analysis of the same product will yield the same results no matter who does the analysis.
- Defines the product category
- Includes how to present the data
- Defines the required data quality

http://www.rmagreen.com/environmental-product-declaration/

Product Category Rules (PCRs)

- **Program Operator** is the organization that coordinates stakeholders and ensures adherence to ISO standards.
  - Program Operator oversees creation of PCR.

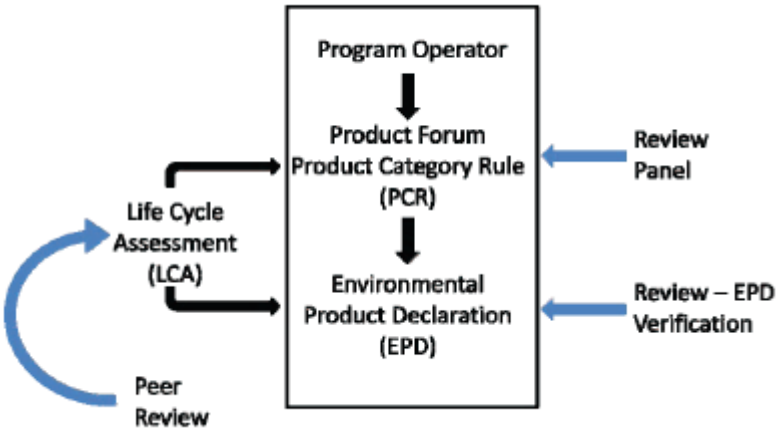
- PCR proposed/reviewed by a team of experts that represent the industries that are affected and other interested parties.

- Third party review (independent experts) of the final rules is also required, as well as periodic review.

EPD Creation

Steps for EPD Creation:

1. **Program Operator** established (can be self-appointed)
2. Program operator defines **Product Category Rules**
3. Review and Comment of PCR
4. LCA performed and data used to create EPD (according to PCR and ISO methods).



Bergman, R., & Taylor, A. (2011). EPD - ENVIRONMENTAL PRODUCT DECLARATIONS FOR WOOD PRODUCTS-AN APPLICATION OF LIFE CYCLE INFORMATION ABOUT FOREST PRODUCTS. *FOREST PRODUCTS JOURNAL*(61), 192-201.

Product Category Rules (PCRs)

- Defines
  - Functional unit
  - Allocation rules
  - Recommended data sources
  - Impact assessment methods
  - Additional relevant environmental information to be included
  - Generic factors to use when primary data is not available
  - Other items that must be present: manufacturing information, location of production
  - Period of validity of the PCR and any EPD based on the PCR

Product Category Rules (PCRs)

CPC Class 2211
Processed Liquid Milk

PCR 2010:12 Vs 1.0
2010-06-24,

excerpts from Chapter 22 of Life Cycle assessment Handbook, Edited by Mary Ann Curran.

- Description of the product – The PCR defines "processed liquid milk" including the types of animals from which the milk can be derived (e.g., cows, sheep, goats, etc.) and the treatment processes it will undergo.
- Functional unit – 1 liter of processed and distributed liquid milk.
- Content of materials and chemical substances – A minimum of 99% of all ingredients are to be listed in the EPD results, including nutritional information.
- System boundaries – Should include the upstream process of milk production including farm inputs and manure or enteric emissions, upstream packaging processes including materials and production, milk processing including pasteurization and packaging, and downstream processes including transportation, use phase and end of life fate. Use phase and end of life are listed as voluntary declarations. Further specifics on the temporal and geographical boundaries are included in the PCR.
- Data requirements – Site-specific data should be used for all core processes – milk processing and filling. If several facilities are included in the EPD, then site-specific data needs to include 90% representative data of these facilities.

Product Category Rules (PCRs)

CPC Class 2211 Processed Liquid Milk

PCR 2010:12 Vs 1.0 2010-06-24,

excerpts from Chapter 22 of Life Cycle assessment Handbook, Edited by Mary Ann Curran.

- Allocation rules – Where co-products are produced in the same facility as the milk (e.g., cheese, yogurt) inputs and emissions should be distributed appropriately. This PCR suggests using mass allocation.
- Cut-off values – The PCR indicates a 99% by mass cut-off value.
- Inventory Indicators – The following indicators should be reported and divided into core and upstream processes: Non-renewable Material Resources, Non-renewable Energy Resources, Renewable Material Resources, Renewable Energy Resources and Water Use.
- Impact Indicators – The following indicators shall be reported and divided into core and upstream processes: Greenhouse gas emissions using IPCC 2007 characterization factors and a 100 year time horizon, Ozone-Depleting potential expressed in CFC 11-equivalents and 20 year time horizon, Acidification potential expressed in SO2- equivalents, Ozone-creating Potential expressed in ethane equivalents, and Oxygen depletion in water expressed as PO4 3-.
- Other Indicators – Additional indicators that should be reported include Material recycled, Hazardous waste and Other waste.
- Additional Environmental Information – Ecological Footprinting and Virtual Water Content are listed as optional indicators for the EPD. Their methods are highlighted in the appendices of the PCR.

Three Types of Environmental labels and declarations per ISO 14020

- All based on ISO standards:

Name	Unverified	Verified
Environmental Labels	14021 (Type II)	14024 (Type I)
Self-declared Environmental Claims	14021 (Type II)	-
Environmental Product Declarations	-	14025 (Type III)

Type I: **Environmental Labels** (ISO 14024)

– Multiple-criteria-based 3rd party program which awards a license for ***environmentally preferable products meeting criteria***.

Type I: **Environmental Labels** (ISO 14024)

- Environmental labeling programms which award their environmental label to products which ***meet a set of predetermined requirements***.

- The label thus identifies products which are determined to be environmentally preferable within a particular product category.

INTERNATIONAL STANDARD

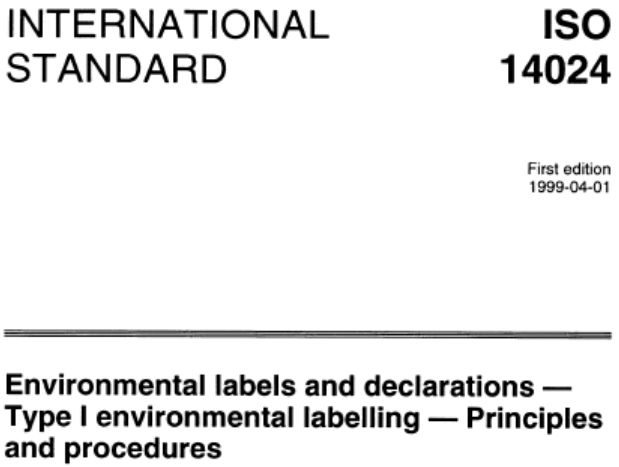
ISO 14024

First edition
1999-04-01

Environmental labels and declarations — Type I environmental labelling — Principles and procedures

Type I: **Environmental Labels** (ISO 14024)

- Iterative procedure
  - Consultation with interested parties
  - Selection of product categories
  - Development review and modification of the environmental criteria
  - Identification of the product function characteristics
  - Establishment of the certification procedures and administration



INTERNATIONAL STANDARD

ISO 14024

First edition
1999-04-01

Environmental labels and declarations — Type I environmental labelling — Principles and procedures

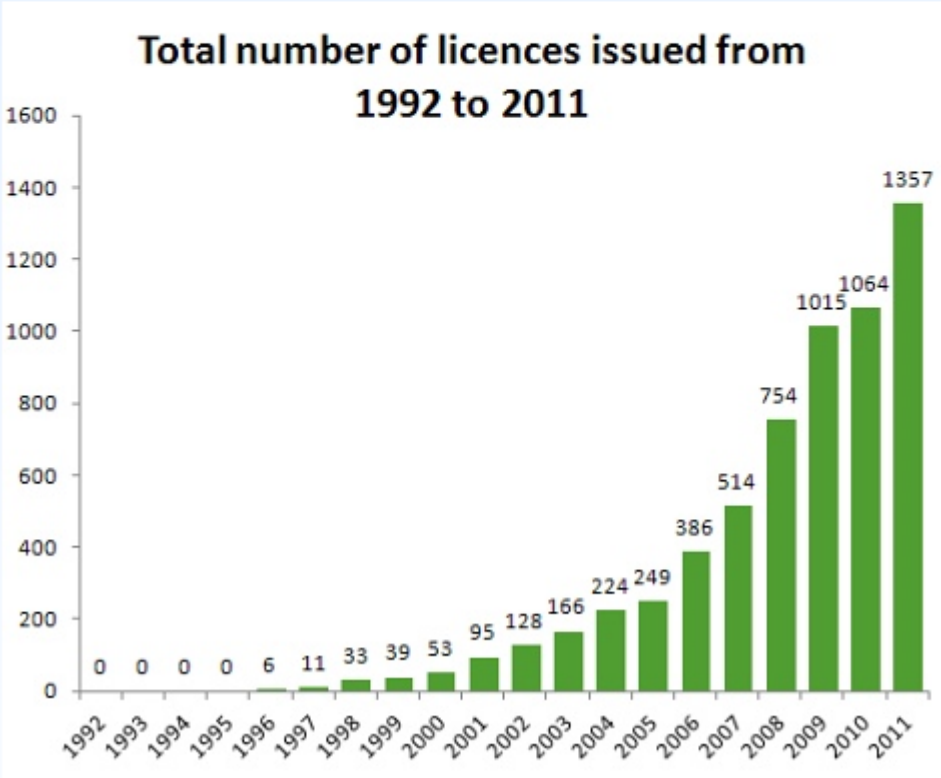
Type 1: EU Ecolabel, www.ecolable.eu

EU Ecolabel
www.ecolabel.eu

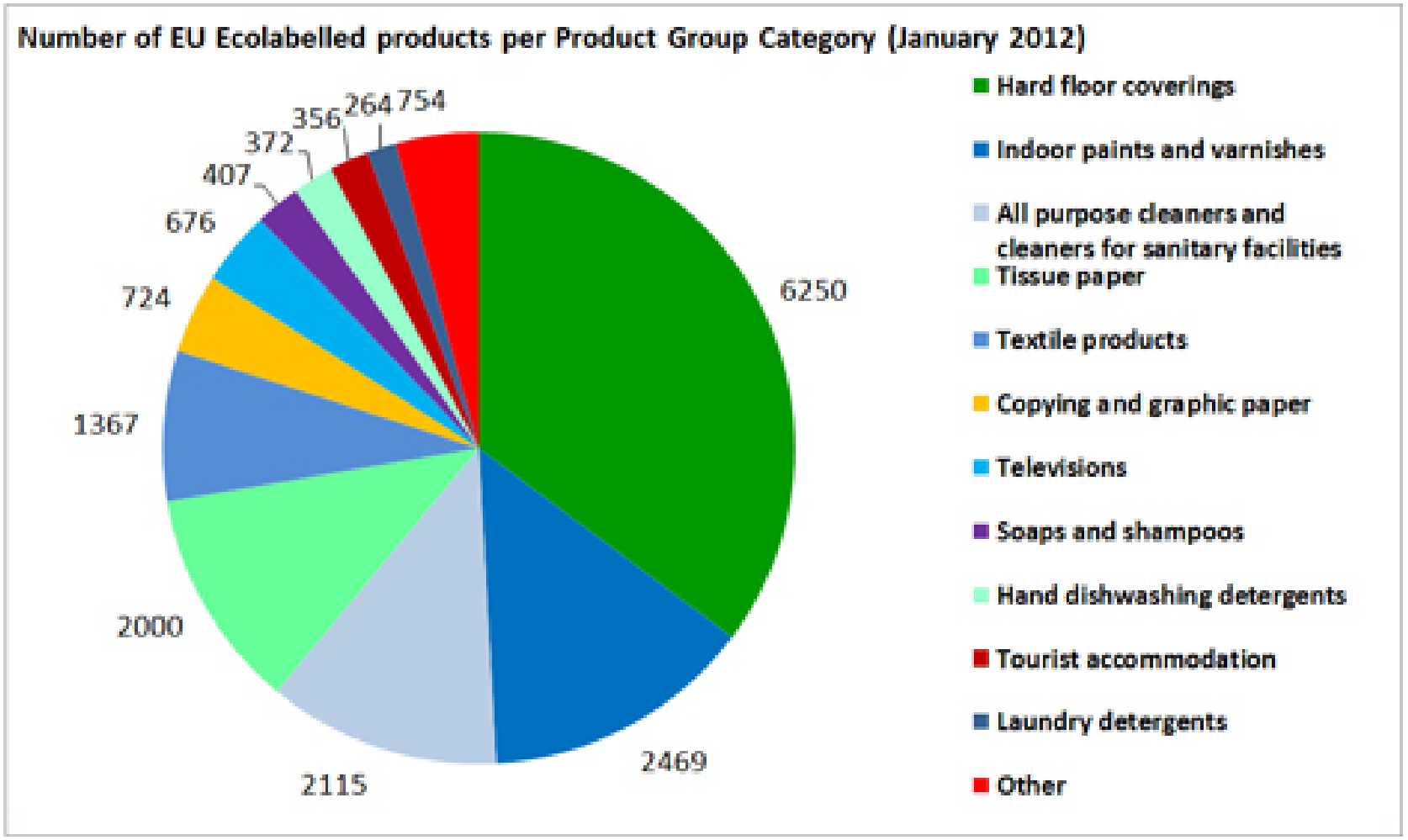
The **Flower** is the official sign of ENVIRONMENTAL INTEGRITY recognised throughout Europe.

Total Number of Licences Issued from 1992 to 2011

The EU Ecolabel was launched in 1992 when the European Community decided to develop a Europe-wide voluntary environmental scheme that consumers could trust. Since then, the number of products and services awarded the EU Ecolabel has increased every year. By the end of 2011, more than 1,300 licences had been awarded, and today, the EU Ecolabel can be found on more than 17,000 products. A licence gives a company the right to use the EU Ecolabel logo for a specific product group.



EU Ecolabel, www.ecolable.eu



The numbers provided are indicative. The exact numbers are under validation and will be updated as soon as possible.

Type 1 Example: Energy Star

- ENERGY STAR is a U.S. Environmental Protection Agency (EPA) voluntary program that helps businesses and individuals save money and protect climate through superior energy efficiency.
- Objective: to identify and promote energy–efficient products and buildings
- Desired outcomes: to reduce energy consumption, improve energy security, and reduce pollution through voluntary labeling of products and buildings that meet the highest energy efficiency standards

ENERGY STAR GHG Reductions Since 2000

GHG REDUCTIONS ($MMTCO_2e$)													
GHGS ADDRESSED: CO_2													
KEY SECTORS: Residential, Commercial, Industrial													
2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	1993 –2012 CUMULATIVE
53.5	64.9	78.1	91.7	103.8	115.5	128.3	144.8	156.2	169.8	195.8	221.2	242.0	1,883

- http://www.energystar.gov/index.cfm?c=about.ab_index

Type 1 Example: Energy Star

TABLE 9. EPA Maintains Efficiency Standards With 176 Product Specifications and Revisions

PRODUCT TYPE	NUMBER OF PRODUCT CATEGORIES	TOTAL NUMBER OF SPECIFICATIONS (NEW AND REVISED)	SPECIFICATION UPDATES IN THE LAST 3 YEARS*	SPECIFICATIONS THAT WENT INTO EFFECT IN 2011
Consumer Electronics	12	36	9	2
Office Equipment	10	37	4	0
HVAC	9	30	4	2
Commercial Food Service Equipment	9	14	6	3
Lighting	6	21	4	2
Building Envelope	3	10	1	1
Appliances	7	20	4	1
Other	3	8	1	0

– http://www.energystar.gov/ia/partners/publications/pubdocs/2011_AnnualReport_Final_low-res_12-13-12.pdf?2b68-0246

Type 1 Example: Energy Star

- 18,000 partners across every sector of the economy
- manufacturers and trade associations, to retailers and efficiency program providers, to home builders and small businesses.
- represent products in more than 65 different categories,
- carry EPA's ENERGY STAR certification:
  - 4.5 billion products sold over the past 20 years.
  - More than 1.4 million new homes
  - more than 20,000 facilities
- ***84% of households recognized the Energy Star Label***

Type I Example: Forestry Stewardship Council

Mission and Vision:

1. The Forest Stewardship Council mission is to promote environmentally sound, socially beneficial and economically prosperous management of the world's forests.

2. Our vision is that we can meet our current needs for forest products without compromising the health of the world's forests for future generations.

Type I Example: : Forestry Stewardship Council

Certification types:

1. Forest Management certification is awarded to forest managers or owners whose management practices ***meet the requirements*** of the FSC US Forest Management Standard.
2. Chain-of-Custody certification applies to manufacturers, processors and traders of FSC-certified forest products. It ensures the validity of claims associated with all FSC-certified material and products throughout the production chain.

Type I Example: : Forestry Stewardship Council

FSC: 10 Principles Audited:

Principle 1: Compliance with laws and FSC Principles

Principle 2: Tenure and use rights and responsibilities

Principle 3: Indigenous peoples' rights

Principle 4: Community relations and worker's rights

Principle 5: Benefits from the forest

Principle 6: Environmental impact

Principle 7: Management plan

Principle 8: Monitoring and assessment

Principle 9: Maintenance of high conservation value forests

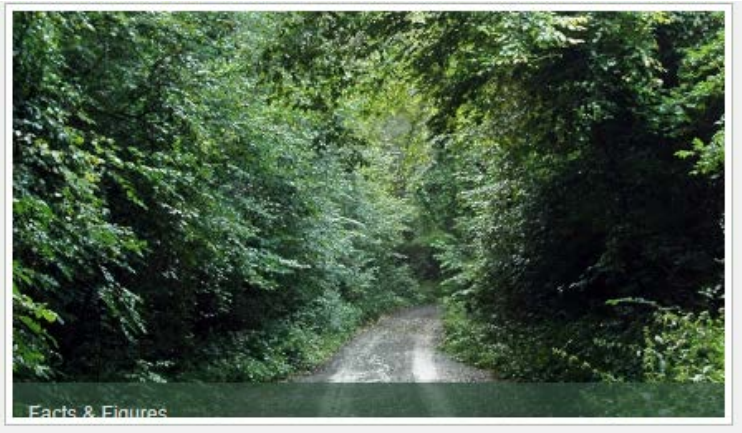
Principle 10: Plantations

http://ic.fsc.org/download.fsc-std-01-001-v4-0-en-fsc-principles-and-criteria-for-forest-stewardship.181.pdf

Type I Example: Forestry Stewardship Council

- Forests are important
  - Forests cover 30% of global land area
  - 70% of terrestrial animals and plants live in forests
  - Currently the world's forests store 283 billion tons of carbon in their biomass

- FSC Statistics, May 2013
  - 35.3 million acres certified in the US
  - 174.7 million acres certified in the US and Canada
  - 3,417 companies Chain-of-Custody certified in the US
  - 4,401 companies Chain-of-Custody certified in the US and Canada



Type I Example: : Forestry Stewardship Council

Steps to Certification:

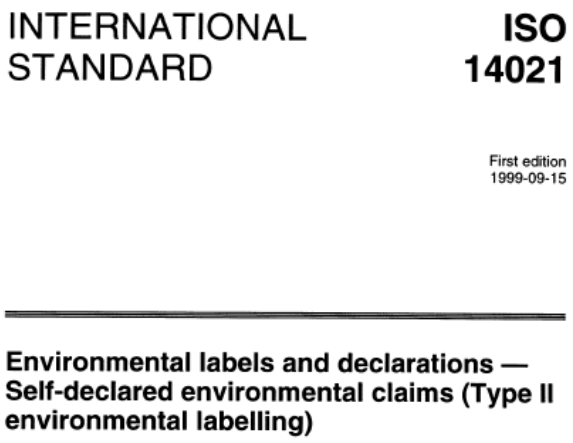
1. Choose from one of several FSC-accredited certification bodies.
2. Certification Audit
3. Audit Report
4. Certification awarded, or suggested changes issued
5. Valid for (5) years with annual surveillance audits.

Type I: **Environmental Labels** (ISO 14024)

- Strengths:
  - Simple, easy for consumers with no technical background to understand.
  - Can be applied across several countries e.g. Ecolabel
  - Selective – criteria is specific to a category and constantly reviewed
  - Can also extend to services
- Weaknesses
  - Complex
  - Costly to obtain
  - Limited to products specifically included (20-30% of products)
  - ***Does not differentiate between multiple products achieving label criteria***
  - Very rigid structure

Type II: **Self-Declared Environmental Claims** (ISO 14021)

- Self-certification and publication by a firm's own products.
- Statement, symbol or graphics on products, labels, literature, advertising……
- Not independently verified, so there is a risk of "**greenwashing**", i.e. using claims to imply a product is more environmentally friendly than it is
- Per ISO, claim must be:
  - Clear and specific
  - Relevant to the product and its use
  - Careful and not misleading
- Not necessarily based on an LCA


INTERNATIONAL STANDARD

ISO 14021

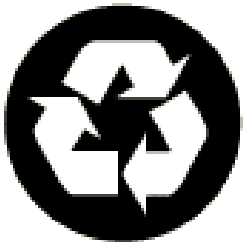
First edition 1999-09-15

Environmental labels and declarations — Self-declared environmental claims (Type II environmental labelling)

Type II: **Self-Declared Environmental Claims** (ISO 14021)

- Examples:

Do you believe these claims? Why or Why Not?



100%
TOTAL RECOVERED FIBER
10% POSTCONSUMER FIBER

Type II: **Self-Declared Environmental Claims** (ISO 14021)

- Commonly used terms in self declared environmental claims

Compostable
Degradable
Designed for disassembly
Extended life product
Recovered energy
Recyclable
Recycled content
Pre-consumer material
Post-consumer material
Recycled material
Recovered [reclaimed] material
Reduced energy consumption
Reduced resource use
Reduced water consumption
Reusable
Refillable
Waste reduction

Type II: **Self-Declared Environmental Claims** (ISO 14021)

- Commonly used terms in self declared environmental claims

7.3 Degradable

7.3.1 ***Usage of term***

A characteristic of a product or packaging that, with respect to specific conditions, allows it to break down to a specific extent within a given time.

NOTE Degradability is a function of susceptibility to changes in chemical structure. Consequent changes in physical and mechanical properties lead to the disintegration of the product or material.

7.3.2 ***Qualifications***

7.3.2.1 The following qualifications refer to all types of degradation, including for instance biodegradation and photodegradation.

a) Claims of degradability shall only be made in relation to a specific test method that includes maximum level of degradation and test duration, and shall be relevant to the circumstances in which the product or packaging is likely to be disposed.

b) A degradable claim shall not be made for a product or packaging, or component of a product or packaging, that releases substances in concentrations harmful to the environment.

7.3.3 ***Evaluation methodology***

Evaluation shall be undertaken in accordance with clause 6.

Type II: **Self-Declared Environmental Claims** (ISO 14021)

- Requirements
  - 6.1 Claimant is responsible for evaluation and provision of data for verification of the claim
  - 6.2 Ensure reliability of claim and provide documentation
- For comparative claims: Use appropriate comparison example and use same evaluation method for subject and baseline (10% less plastic)
- Verifiable: only if all information is provided or available upon request
- Documentation: test method, test results, if testing done by 3rd party, assurance that the claim is being updated

Type III: **Environmental Product Declarations** (ISO 14025)

Type III environmental declarations present quantified environmental information on the life cycle of a product to enable comparisons between products fulfilling the same function.

EN ISO 14025:2010 (E)

Environmental labels and declarations — Type III environmental declarations — Principles and procedures

Type III: **Environmental Product Declarations** (ISO 14025)

- are provided by one or more organizations,
- are based on independently ***verified life cycle assessment (LCA) data, life cycle inventory analysis (LCI) data or information modules in accordance with the ISO 14040 series of standards*** and, where relevant, additional environmental information
- are developed using predetermined parameters
- are subject to the administration of a program operator
  - such as a company or a group of companies,
  - industrial sector or trade association,
  - public authorities or agencies
  - independent scientific body or other organization.

Type III: **Environmental Product Declarations** (ISO 14025)

- Overall goal is to communicate verifiable and accurate information about environmental aspects of products.
- Intent is to provide a basis of fair comparison of any product in a given category.
- Objective, comparable, and credible.

Type III: **Environmental Product Declarations** (ISO 14025)

- primarily intended for use in business-to-business communication
- but their use in business-to-consumer communication is not precluded.
- data are independently verified either internally or externally
- 3rd party required by ISO if business to consumer
- Product category rules (PCR) are encouraged between programs to meet the principle of comparability

Countries with Type III EPD Programs in place

Area	Initiative
Asia	The Environment and Development Foundation (EDF)—EPD
	Japan Environmental Management Association for Industry (JEMAI)—PCF
	Korean Environmental Industry & Technology Institute (KEITI)—EPD
Europe	The International EPD System—EPD
	The Norwegian EPD Foundation—EPD
	French Agency on Environment and Energy Management (ADEME)—Product Environmental Footprint
	BRE Global Environmental Profiles Scheme (EPD) for construction products—EPD
	German Institute of Construction and Environment (IBU)
North America	FP Innovations—EPD Program on Wood Products
	NSF National Center for Sustainability Standards—EPD
	The Institute for Environmental Research & Education—Earthsure EPD
	The Green Standard—EPD
	The Sustainability Consortium
	UL Environment—EPD

If these countries impose EPD requirements on all products sold, US companies may be forced to create and issue EPDs to continue trade. French government has already passed legislation to require EPDs for all consumer goods.

Type III EPDs in the US

- Several individual, but no national Type III EPD system in the US.
- Type I and Type II eco-labeling much more common.
- First EPD program in the US was Earthsure, part of the Institute for Environmental Research and Education.

earthsure

What should be in a Type III EPD?

The following information shall be included in any Type III environmental declaration according to the PCR:

a) identification and description of the organization making the declaration;

b) description of product;

c) product identification (e.g. model number);

d) name of the programme and the programme operator's address and, if relevant, logo and website;

e) PCR identification;

f) date of publication and period of validity;

g) data from LCA, LCI or information modules (see 7.2.2);

h) additional environmental information (see 7.2.3);

i) content declaration covering 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 the environment, in all stages of the life cycle);

j) information on which stages are not considered, if the declaration is not based on an LCA covering all life cycle stages;

k) statement that environmental declarations from different programmes may not be comparable;

l) information on where explanatory material may be obtained.

m) Information about the review process

What should be in a Type III EPD?

7.2.2 Data from LCA, LCI or information modules

a) data from life cycle inventory analysis (LCI), according to the PCR, including
   - consumption of resources, including energy, water and renewable resources, and
   - emissions to air, water and soil;

b) indicator results of life cycle impact assessment (LCIA), if applied, including
   - climate change,
   - depletion of the stratospheric ozone layer,
   - acidification of land and water sources,
   - eutrophication,
   - formation of photochemical oxidants,
   - depletion of fossil energy resources, and
   - depletion of mineral resources;

c) other data such as quantities and types of waste produced (hazardous and non-hazardous waste).

What should be in a Type III EPD?

7.2.3 Additional environmental information

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);

b) data on product performance, if environmentally significant;

c) the organization's adherence to any environmental management system, with a statement on where an interested party may find details of the system;

d) any other environmental certification programme applied to the product and a statement on where an interested party may find details of the certification programme;

e) other environmental activities of the organization, such as participation in recycling or recovery programmes, provided details of these programmes are readily available to the purchaser or user and contact information is provided;

f) information that is derived from LCA but not communicated in the typical LCI or LCIA based formats;

g) instructions and limits for efficient use;

h) hazard and risk assessment on human health and the environment;

i) information on absence or level of presence of a material in the product that is considered of environmental significance in certain areas [see ISO 14021:1999, 5.4 and 5.7 r)];

j) preferred waste management option for used products;

k) potential for incidents that can have impact(s) on the environment.

Type III: EPD Example

EPD®

ENVIRONMENTAL PRODUCT DECLARATION (EPD)

ENVIRONMENTAL PRODUCT DECLARATION FOR PLAIN MEDIUM DENSITY FIBREBOARDS (MDF) AND FOR MELAMINE-COATED MEDIUM DENSITY FIBREBOARDS (MDF)

FINSA

EPD®

	**Summary Environmental product declaration**
EPD® International System Anxo Mourelle Álvarez. EPD Verifier	**Verified by**
FINANCIERA MADERERA S.A. Carretera (National Road) N-550 km 15890 Santiago de Compostela – A Coruña	**Owner's declaration by**
The product is Medium density fibreboard (MDF), both plain as well as melamine-coated, commercially designated, in the case of plain boards, as: Fibranor, Fibrapan or Iberpan depending on their thickness); and Fibraplast, in the case of coated boards. The present environmental product declaration complies with standards ISO 14025, ISO 14040, ISO 14044 and describes the environmental features and behaviour of the construction product described herein. Its purpose is to promote compatible and sustainable environmental development of related construction methods. All relevant environmental data are disseminated in the present declaration, which has been submitted to independent validation by a third party. Presently there is no specific PCR for MDF boards.	**Construction product declaration**
December 2013(1) (1) Note: unless there is a variation greater than 5% on the environmental effects in any of the categories of impact.	**Validity**
This declaration is complete in itself and contains: - The product definition and physical data related to the preparation for being used in construction - Details of the base materials and on the origins thereof - Descriptions of how the product is manufactured and the intervening processes - Instructions on how to process the product - Data on the conditions of use, unusual effects, and on the end of the product's life cycle - The results from the total life cycle analysis (the model from cradle to gate B2B) - Evidence, verifications and tests supporting the stated features.	**Contents of the declaration**
15 December 2010	**Issuing date**
Sergio Blanco. FINSA Business Unit Director	**Manufacturer**
Anxo Mourelle. EPD Verifier	**Verified by**
 Sergio Blanco. FINSA Business Unit Director  Anxo Mourelle Álvarez. EPD Verifier	**Signatures**

Excerpts from Finsa (Spain) – EPD for plain MDF and Melamine-coated MDF. Issued 2010.

FINSA

EPD®

ype III EPD Example (excerpts)

Plain medium density fibreboards (MDF) or melamine-coated fibreboards are panel-like products that comply with standards EN 622-1, EN 622-5 and EN 14322. They are considered reliable products used as raw material for the construction and furniture industry. MDF boards can easily be coated with decorative paper, by resorting to simple technologies.	**Product description**
MDF boards are homogeneous and provide good results in the most demanding machine work. They are stable, as they keep their form and dimensions despite the changes in environment humidity and temperature. The multiple possibilities they offer in terms of framing, coating and finishing imply a greater quality of the end product and provide greater rationalization in terms of work. With the appropriate coating, they are the ideal support for manufacturing doors, frames, home and office furniture, screens, wall coverings, false ceilings and so on. In smaller thicknesses, it is a high-density board, with good wrap behaviour, and which is very easily stapled and curbed. They have great homogeneity and dimensional stability. These boards have become the strongest allies of different sectors: industrial electronics, backing of items of furniture, curbed structures for furniture and for covering walls, complementary automotive industry, machine packaging, fruit boxes... In greater thicknesses, for architectural applications such as columns, pillars, vaulted passageways, etc. Other possibilities include: shelves, bed heads, steps, benches, interior doors with moulded faces, table legs, etc. They are also used as basic material for wood veneering and PVC coatings.	**Applications**
The Life Cycle Analysis (LCA) was carried out according to standards ISO 14025; ISO 14040; ISO 14044. Both specific data from the production of the product under analysis as well as the following data bases were used: Ecoinvent 2.1 and the U.S. Life Cycle Inventory (USLCI). The methods used for calculating the categories of impact were as follows: the EPD Method (2008); the Environmental Design of Industrial Products Method (EDIP) 2003, and the Method of Cumulative Energy Demand (CED) v.1.07. The life cycle analysis covers the production of raw materials and energy: the transportation of raw materials, and the actual manufacturing stage, all the way to the shipping stage. The functional unit under consideration is 1 m^3 of plain MDF and 1 m^2 of melamine-coated MDF.	**Scope of application of the LCA**
In addition, the environmental product declaration also considers: - That formaldehyde complies with standard EN 120/EN 717-1 (Aitim Certification) - CARB P2 Certification - NAF Certification	**Other evidence and verifications**

Type III EPD Example (excerpts)

Results

	Plain MDF boards (per m^3)		Coated MDF boards (per m^2)	
Variable under assessment	**Unit**	**Total**	**Unit**	**Total**
Emission of Greenhouse gases	kg CO2/ m^3	-818(1)	kg CO2/ m^2	-3,48
Potential depletion of the ozone layer (PDO)	kg R11 eq/ m^3	4,3E-5	kg R11 eq/ m^2	1,9E-7
Potential acidification (PA)	kg SO2/ m^3	4,68	kg SO2/ m^2	2,07E-2
Potential eutrophication (PE)	kg phosphate eq/ m^3	0,336	kg phosphate eq/ m^2	1,5E-3
Potential formation of photochemical oxidants (PFPO)	kg ethylene eq/ m^3	0,621	kg ethylene eq/ m^2	2,7E-3
Primary energy, non renewable	MJ/ m^3	11044	MJ/ m^2	51,37
Primary energy, renewable	MJ/ m^3	4919	MJ/ m^2	22,63
Electricity consumption	Kwh/ m^3	501	Kwh/ m^2	2,25

Type III EPD Example (excerpts)

Table 2: Consumption of primary energy for manufacturing 1 m^3 of MDF and 1 m^2 of melamine-coated MDF.

	Plain MDF board (per m^3)		Coated MDF board (per m^2)	
Variable under assessment	Unit	Total	Unit	Total
Non-renewable primary energy with energy contents	MJ/m^3	9.327	MJ/m^2	42,07
Renewable primary energy with energy contents	MJ/m^3	4.566	MJ/m^2	21,03

Table 3: Waste generation

	Plain MDF boards (per m^3)		Coated MDF boards (per m^2)	
Variable under assessment	Unit	Total	Unit	Total
Non-hazardous Waste	kg	20,29	kg	9,02E-2
Hazardous Waste	kg	0,03	kg	1,6E-4

Table 4. Categories of impact for manufacturing 1 m^3 of plain MDF board and 1 m^2 of melamine-coated MDF board:

	Plain MDF boards (per m^3)		Coated MDF boards (per m^2)	
Variable under assessment	Unit	Total	Unit	Total
Emission of green house gases	kg CO2/ m^3	-818(1)	kg CO2/ m^2	-3,48
Potential depletion of the ozone layer (PDO)	kg R11 eq/ m^3	4,3E-5	kg R11 eq/ m^2	1,9E-7
Potential acidification (PA)	kg SO2/ m^3	4,68	kg SO2/ m^2	2,07E-2
Potential eutrophication (PE)	kg phosphate eq/ m^3	0,335	kg phosphate eq/ m^2	1.5E-3
Potential formation of photochemical oxidants (POFP)	kg ethylene eq/ m^3	0,621	kg ethylene eq/ m^2	2,7E-3
Primary energy, non renewable	MJ/ m^3	11044	MJ/ m^2	51,37
Primary energy, renewable	MJ/ m^3	4919	MJ/ m^2	22,63
Electricity consumption	Kwh/ m^3	501	Kwh/ m^2	2,25

9. Validity of the declaration

The validity established for the environmental declaration for medium density fibreboards (MDF), both plain and melamine-coated, is 3 years (until December 2013) as the sensitivity of former years has been tested and there are no variations over 5% regarding the environmental effects in any of the categories of impact.

10. Verification

The present declaration has been developed according to standards ISO 14025, ISO 14040, and ISO 14044.

Independent verification according to ISO 14025:

☐ internal ☒ external

Validation of the present declaration by:

Anxo Mourelle Álvarez

Excerpts from Finsa (Spain) – EPD for plain MDF and Melamine-coated MDF. Issued 2010.

Type III EPD Example (excerpts)

- Can you tell if this is a "good" product or not?
- If not, how could you use the data to decide?
- Why might the Greenhouse gases value be negative?

	Plain MDF boards (per m^3)	
Variable under assessment	**Unit**	**Total**
Emission of Greenhouse gases	kg CO2/ m^3	-818(1)
Potential depletion of the ozone layer (PDO)	kg R11 eq/ m^3	4,3E-5
Potential acidification (PA)	kg SO2/ m^3	4,68
Potential eutrophication (PE)	kg phosphate eq/ m^3	0,335
Potential formation of photochemical oxidants (PFPO)	kg ethylene eq/ m^3	0,621
Primary energy, non renewable	MJ/ m^3	11044
Primary energy, renewable	MJ/ m^3	4919
Electricity consumption	Kwh/ m^3	501

Excerpts from Finsa (Spain) – EPD for plain MDF and Melamine-coated MDF. Issued 2010.

Strengths and Weaknesses of Type III EPDs

- Strengths
  - Transparent
  - Quantified Data – no vague claims
  - Directly comparable with other EPDs performed within the same category
  - Verified and credible
  - Same data could possibly be used in obtaining a Type I eco-label

Strengths and Weaknesses of Type III EPDs

Several different assessment tools for buildings:

Name	Developer	References
ATHENA™ *Environmental Impact Estimator*	ATHENA Sustainable Material Institute; Canada	ATHENA Institute (2003); ATHENA™; DOE (1996/2006); Trusty and Meil (2002a,b)
BEAT 2002	Danish Building Research Institute (SBI), Denmark	BEAT (2002); Forsberg and von Malmborg (2004); Hansen (2005); IEA Annex 31 (2001); Petersen (2002a,b)
BeCost (previously known as LCA-house)	VTT, Finland	BeCost; CRISP (2004); IEA Annex 31 (2001)
BEES 4.0	U.S. National Institute of Standards and Technology (NIST), USA	BEES 4.0; DOE (1996/2006); IEA Annex 31 (2001); Lippiatt (2002); Trusty (2003)
BREEAM	Building Research Establishment (BRE), UK	BREEAM; BREEAM fact file; CRISP (2004); Grace (2000); IEA Annex 31 (2001)
EcoEffect	Royal Institute of Technology (KTH), Sweden	CRISP; EcoEffect; Forsberg and von Malmborg (2004); Glaumann (2000); IEA Annex 31 (2001)
EcoProfile	Norwegian Building Research Institute (NBI), Norway	Boonstra and Pettersen (2003); IEA Annex 31 (2001); Pettersen (2000a,b); Pettersen et al. (2000)
Eco-Quantum	IVAM, the Netherlands	CRISP; EcoQuantum; IEA Annex 31 (2001); Peuportier and Putzeys (2005)
Envest 2	Building Research Establishment (BRE), UK	DOE (1996/2006); CRISP; Envest 2; IEA Annex 31 (2001); Peuportier and Putzeys (2005)
Environmental Status Model (Miljöstatus)	Association of the Environmental Status of Buildings, Sweden	Boonstra and Pettersen (2003); Environmental Status Model; Carlson (2000); Carlson and Lundgren (2002)
EQUER	École des Mines de Paris, Centre d'Énergétique et Procédés, France	DOE (1996/2006); EQUER; IEA Annex 31 (2001); Nibel and Rialhe (2000); Peuportier and Putzeys (2005)
ESCALE	CTSB and the University of Savoie, France	ESCALE; Gerard et al. (2000); IEA Annex 31 (2001)
LEED®	U.S. Green Building Council, USA	CRISP; IEA Annex 31 (2001); LEED®; LEED® (2005)
LEGEP® (previously known as Legoe)	University of Karlsruhe, Germany	IEA Annex 31 (2001); Kohler et al. (2005); LEGEP; Peuportier and Putzeys (2005)
PAPOOSE	TRIBU, France	IEA Annex 31 (2001); Nibel and Rialhe (2000); PAPOOSE
TEAM™ [a]	Ecobilan, France	IEA Annex 31 (2001); Nibel and Rialhe (2000); TEAM™

Developed for specific purposes (old, new, refurbished, single family, multi-unit)

EPDs cannot be compared if they are provided by different tools.

Strengths and Weaknesses of Type III EPDs

- Weaknesses
  - Focused more on business-to-business than business-to-consumer. Purchaser must have some technical knowledge of product being purchased, and time to compare EPDs.
  - Can be prohibitively expensive and time-consuming if specific data (recommended over generic data) is used.
  - Currently, no universal standard for EPDs (even within specific categories), so EPDs from different countries may not be comparable.

Homework

1. Download (2) EPDs for energy production:
   a) http://gryphon.environdec.com/data/files/6/7562/epd144en_v2.pdf
   b) http://gryphon.environdec.com/data/files/6/8789/epd176_Axpo_Otelfingen_Kompogas_Facility_2012.pdf
2. Use the data in the introductory summary table, prepare a table comparing the environmental impacts of the 2 forms of power production.
3. Based only on the data, which form of power has less environmental impact?
4. Choose (3) other categories from the tables in section 3.3 “Ecoprofile” and add them to the table.
5. What other factors not quantified in the EPD might affect which form of power is preferable?
6. Is it fair to compare these EPDs? Why or why not?

Vocabulary

- Environmental Product Declaration
- Program Operator
- Third Party
- Verified/Unverified
- Product Category Rule
- Environmental Label (Type I)
- Self-Declared Environmental Claim (Type II)
- Greenwashing
- Environmental Product Declaration (Type III)