BIMEPD

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ADAPTED SENIOR TRAINING PROGRAM ON BIM METHODOLOGIES FOR THE INTEGRATION OF EPD IN SUSTAINABLE CONSTRUCTION STRATEGIES

2020-1-ES01-KA204-083128

Module 02

BIM and LCA regulation.

COAMU Colegio Oficial de Arquitectos Región de Murcia

iED institute of Entrepreneurship Development

Centro Tecnológico del mármol, piedra y materiales

Warsaw University of Technology

Bulgarian Green Building Council

cype

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2.1 BIM regulation

2.2 Regulations for environmental management

2.3 Reference standards on Life Cycle Assesment

2.4 Application to the construction sector

2.5 LCA examples

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2.1. BIM regulation

INTRODUCTION

EUROPEAN SCOPE

NATIONAL SCOPE

UNE STANDARDS

ISO STANDARDS

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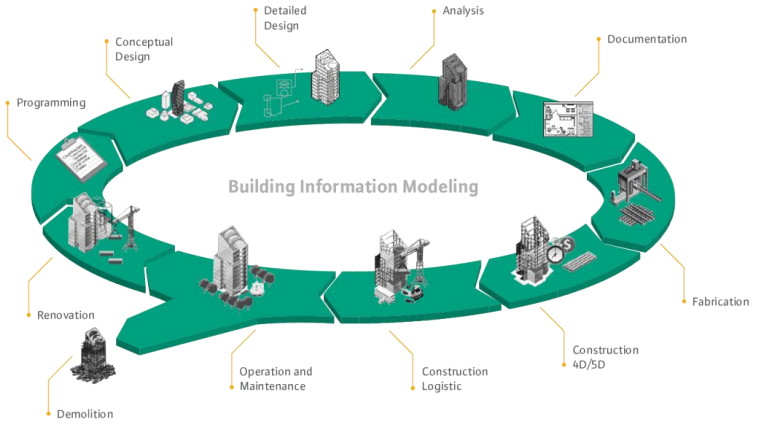
INTRODUCTION

It is estimated that the use of BIM could reduce costs and carbon footprint in the construction and use stages of the built environment by 20%.

In a global environment and with an extremely large amount of data associated with each object, it is strategic for the industry to have open reference standards that support a common language that is exportable and compatible, so that it is possible to share project information between the different agents involved (client, designers, builders, managers).

For these reasons, both at European and national level, BIM standardisation has been encouraged over the last five years to help companies and governments to face the challenges linked to digitalisation.



Source: http://muhendzm.blogspot.com/2018/11/bimbuilding-information-modeling.html

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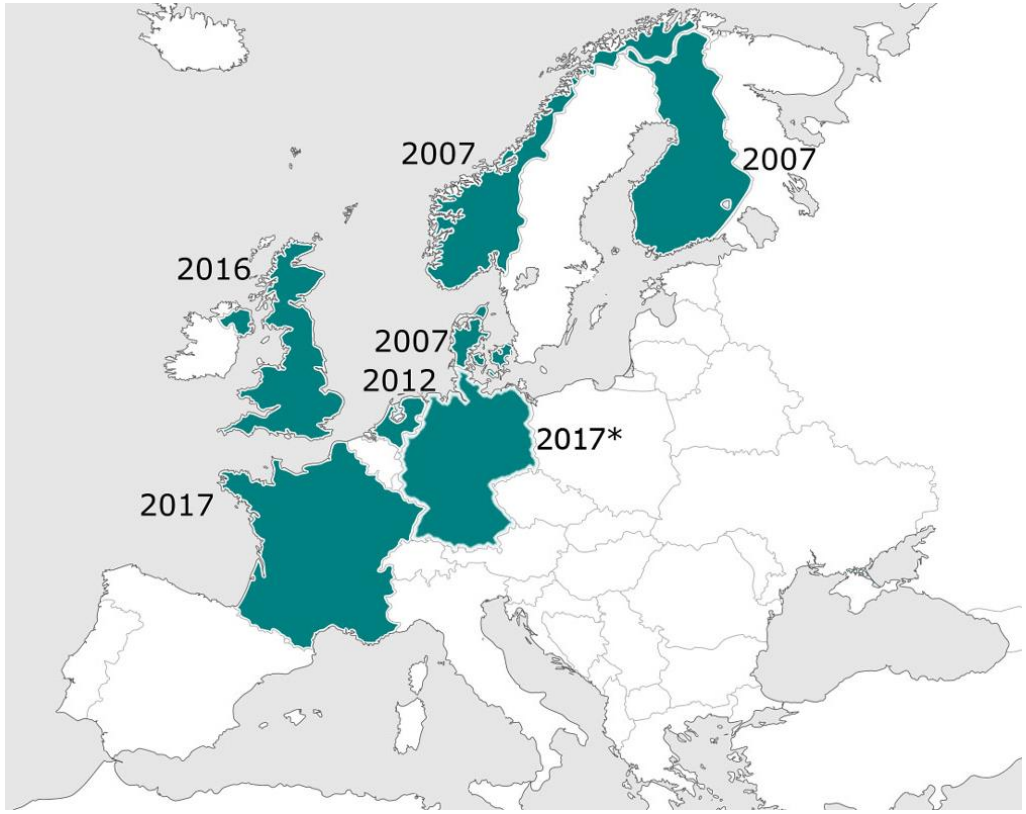
EUROPEAN SCOPE

Regulatory implementation of BIM in European countries.



Source: https://bimtech.eu/bim/

UNITED KINGDOM
Start of implementation 2011. Mandatory in public tenders from 2016 onwards.

FRANCE
Start of implementation 2011. Mandatory in buildings from 2017 onwards.

GERMANY
Start of implementation 2015.

FINLAND NORWAY AND SWEDEN
Mandatory since 2007-2010

NETHERLANDS
Mandatory in buildings from 2012 onwards.

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EUROPEAN SCOPE

DIRECTIVE 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC.

At European level, Directive 2014/24/EU on public procurement establishes the need to use electronic systems (means of communication and tools for modelling building data) in procurement processes for works, services and supplies from September 2018.

In this regard, Article 22.4 of Directive 2014/24/EU states that "For public works contracts and design contests, Member States may require the use of specific electronic tools, such as electronic building design tools or similar tools" (thus alluding to the use of BIM tools).

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EUROPEAN SCOPE

In 2015 the "**EU BIM Task Group**" was set up, representing the interests of public administrations in relation to BIM, to develop common guidelines and policies to help public contracting authorities to introduce the methodology in the most appropriate way in each country.

The work of this group has been co-funded by the European Commission and has resulted in the approval and publication of a "Handbook for the introduction of the BIM methodology by the European public sector. Strategic action for productivity in the construction sector: driving value creation, innovation and growth".

EU BIM TASKGROUP

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EUROPEAN SCOPE

EU BIM Task Group.

BIM VALUE PROPOSITION

	ASSETS		SECTORS	
	Implementation phase	Explotation phase	Construction	Digital
ECONÓMICO	Savings of 10% in execution time	Reduced maintenance costs	Improving the competitiveness of the sector	Growth of the digital services industry
		Reduction of operating costs	Increasing export capacity	Digital Single Market
MEDIOAMBIENTAL	Reducing the volume of waste on construction sites	Optimisation of operational energy consumption	Efficiency in the use of resources	Data infrastructure resource efficiency
		Assessment throughout the life cycle	Circular economy	
SOCIAL	Higher level of health and safety	Better social outcomes (patient care, student learning...)	Safer construction jobs	Data security
	Improved consultation and participation		Attracting the next generation to the sector	Attracting digital talent to construction

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EUROPEAN SCOPE

EU BIM Task Group.

BIM VALUE PROPOSITION

	ASSETS		SECTORS	
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MEDIOAMBIENTAL	Reducing the volume of waste on construction sites	Optimisation of operational energy consumption Assessment throughout the life cycle	Efficiency in the use of resources Circular economy	Data infrastructure resource efficiency
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NATIONAL SCOPE IN SPAIN

Law 9/2017, of 8 November, on Public Sector Contracts, transposing into Spanish law the Directives of the European Parliament and of the Council 2014/23/EU and 2014/24/EU, of 26 February 2014.

Point 6 of the Fifteenth Additional Provision, of Law 9/2017, on "Rules on the means of communication to be used in the procedures regulated in this Law", establishes the following:

> ***"For public works contracts, works concession contracts, service contracts and project tenders, and in mixed contracts combining elements thereof, contracting authorities may require the use of specific electronic tools, such as digital building information modelling (BIM) tools or similar tools.*** *In such cases, they shall offer alternative means of access as provided for in paragraph 7 of this Additional Provision until such time as those tools are generally available to economic operators."*

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NATIONAL SCOPE IN SPAIN

In July 2015 the Ministry of Public Works created the **"BIM Commission"**, which established a roadmap that would make the use of BIM technology mandatory for public tenders, dividing it into two phases:

- **1st Phase: 17 December 2018: for Public Building Tenders.**
- **2nd Phase: 26 July 2019: from this date for Public Infrastructure Tenders.**

es.BIM
Implantación del BIM en España

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NATIONAL SCOPE IN SPAIN

BIM COMMISSION. Its objectives include:

- Establishment of the strategy to reach a certain level of maturity, which will be increased progressively (soft landing) avoiding major changes that could be a trauma for the sector.
- Promoting the use of BIM in the professional and educational sphere.
- To position Spain as a world reference in the use of BIM.
- Representing Spain in different international forums.
- Promotion of innovation in the infrastructure sector.
- Analysis of the best practices carried out by the most successful international initiatives.
- Establishment of the roadmap and implementation schedule.

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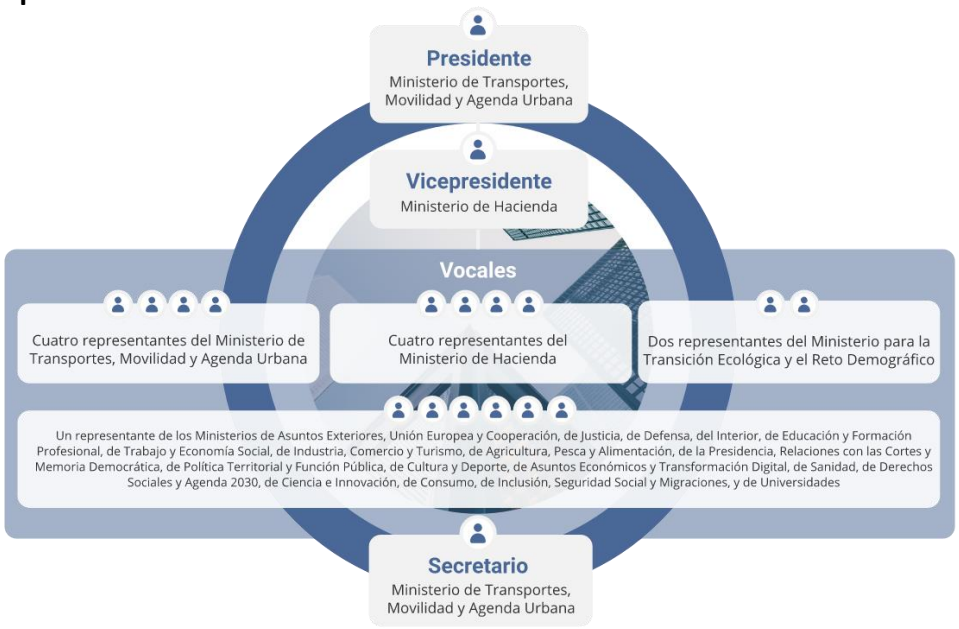
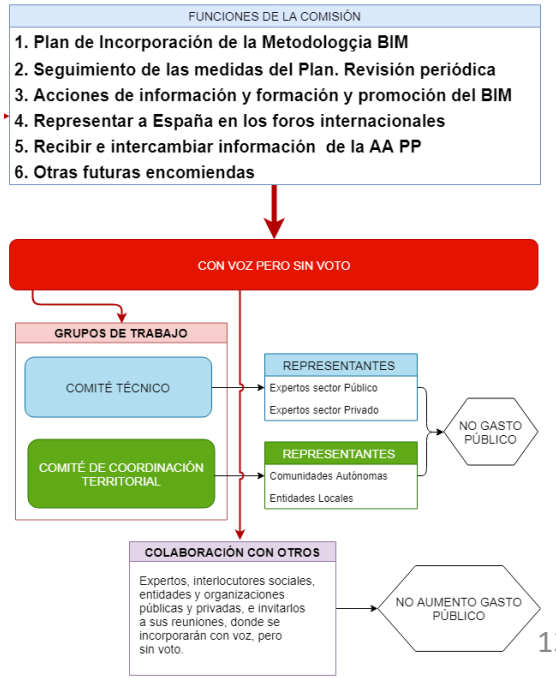
NATIONAL SCOPE IN SPAIN

Royal Decree 1515/2018, of 28 December, creating the Interministerial Commission for the incorporation of the BIM methodology in public procurement.

The purpose of the Commission is to promote and guarantee the coordination of the General State Administration and its public bodies and related or dependent public law entities in the implementation of the BIM methodology in public procurement.





Source: https://cbim.mitma.es/comision-bim

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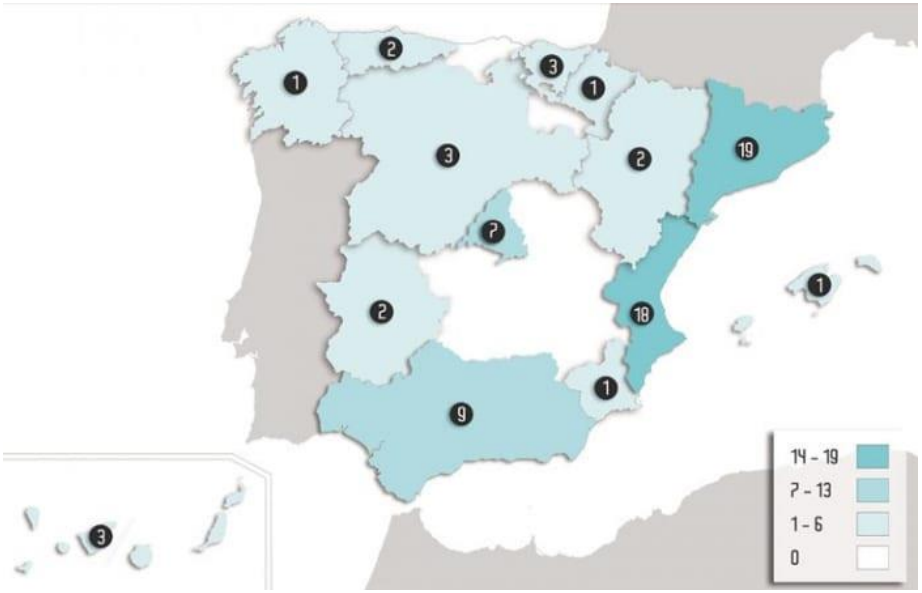
NATIONAL SCOPE IN SPAIN

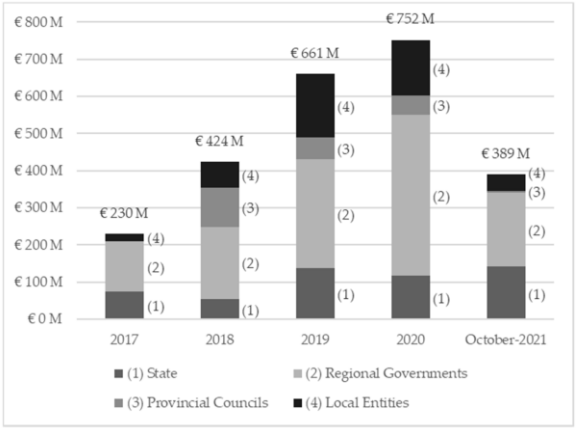
As a result of all these measures, it is worth highlighting the increase in total investment in the tenders published in 2019.

Investments distribution on the Spanish territory outlining the absolute value of the number of public tenders with BIM requirements in each autonomous community.



Source: https://biblus.accasoftware.com/en/bim-in-europe-national-strategy-developments-in-spain/

Evolution of tenders in Spain 2017–2021: (a) Annual investment volumes for the period; (b) Distribution of tenders by level of administration



Source: https://www.mdpi.com/2075-5309/11/12/594

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ISO AND UNE STANDARDS

EN-ISO 19650 SERIE

The EN-ISO 19650 series is a set of international standards that define the framework, principles, and requirements for the acquisition, use and management of information in projects and assets, both building and civil engineering, throughout their entire life cycle, and is primarily intended for:

- Agents involved in the design, construction and commissioning phases of built assets, which in this document and in accordance with ISO we refer to as the development phase.
- Actors involved in activities related to asset management, including operation and maintenance, which in this document and in accordance with ISO we refer to as the operation phase.

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ISO AND UNE STANDARDS

- **EN ISO 19650-1:2018.** **In force**

Organisation and digitalisation of information in building and civil engineering works using BIM (Building Information Modelling). Information management when using BIM. Part 1: Concepts and principles (ISO 19650-1:2018).

- **EN ISO 19650-5:2020**. **In force**

Organisation and digitalisation of information in building and civil engineering works using BIM (Building Information Modelling). Information management when using BIM. Part 2: Asset development phase (ISO 19650-2:2018).

- **EN ISO 19650-3:2021.** **In force**

Organisation and digitalisation of information in building and civil engineering works using BIM (Building Information Modelling). Information management when using BIM. Part 3: Asset operation phase. (ISO 19650-3:2020).

- **ISO/CD 19650-4.** **Under development**

Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) — Information management using building information modelling — Part 4: Information exchange.

- **EN ISO 19650-5:2020.** **In force**

Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 5: Security-minded approach to information management (ISO 19650-5:2020)

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ISO AND UNE STANDARDS

EN ISO 19650-1:2018. In force

Organisation and digitalisation of information in building and civil engineering works using BIM (Building Information Modelling). Information management when using BIM. Part 1: Concepts and principles (ISO 19650-1:2018).

This document provides recommendations for defining an information management framework that includes sharing, recording, version control and organising all actors.

It applies to the entire lifecycle of any built asset, including strategic planning, initial design, engineering, development, documentation and construction, daily operations, maintenance, rehabilitation, repair and end-of-life.

It can be adapted to assets and projects of any scale and complexity, so as not to hinder the flexibility and versatility that characterise the wide range of potential markets and to cover the cost of implementing this standard.

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ISO AND UNE STANDARDS

UNE-EN ISO 19650-2:2018. **In force**

Organisation and digitalisation of information in building and civil engineering works using BIM (Building Information Modelling). Information management when using BIM. Part 2: Asset development phase (ISO 19650-2:2018).

This document specifies the requirements for information management, in the form of a management process, in the context of the asset development phase and the information exchanges within that phase, using BIM.

This document can be applied to all types of assets and all types and sizes of organisations, irrespective of the chosen acquisition strategy.

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ISO AND UNE STANDARDS

EN-ISO 12006 SERIE

- **EN ISO 12006-2:2020. In force**

  Building construction - Organization of information about construction works. Part 2: Framework for classification (ISO 12006-2:2015).

- **EN ISO 12006-3:2016. In force**

  Building construction - Organization of information about construction works. Part 3: Framework for object-oriented information (ISO 12006-3:2007).

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ISO AND UNE STANDARDS

- **UNE-EN ISO 12006-3:2016. In force**

Building construction - Organization of information about construction works. Part 3: Framework for object-oriented information (ISO 12006-3:2007).

This part of ISO 12006 specifies a language-independent information model, which can be used for the development of dictionaries used to store or provide information about construction works.

It allows referencing classification systems, information models, object models and process models within a common framework.

In summary, the mapping of terms used in OpenBIM is given by the International Framework for Dictionaries (IFD), the structure of which is defined in this Standard.

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ISO AND UNE STANDARDS

EN-ISO 29481 SERIE

EN ISO 29481-1-2017. In force

Building information modelling. Information delivery manual. Part 1: Methodology and format.

EN ISO 29481-2:2016. In force

Building information modelling. Information delivery manual. Part 2: Framework for interaction.

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ISO AND UNE STANDARDS

- **EN ISO 29481-1-2017. In force**

Building information modelling. Information delivery manual. Part 1: Methodology and format.

This part of ISO 29481 specifies:

- A methodology that links the processes that take place during the construction of buildings or infrastructure with the information required in these processes, and
- A way of mapping and describing the information processes throughout the life cycle of construction works.

It facilitates **interoperability** between software applications used during all phases of the construction lifecycle, including **planning, design, documentation, construction, operation and maintenance, and demolition**. It promotes digital collaboration between actors in the construction process and provides a basis of accuracy, reliability, repeatability and high quality for information exchange.

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ISO AND UNE STANDARDS

- **EN ISO 29481-2:2016. In force**

Building information modelling. Information delivery manual. Part 2: Framework for interaction.

This part of ISO 29481 specifies:

- A methodology that describes a framework for interaction,
- An appropriate way of assigning responsibilities and interactions, which provides a process context for the flow of information,
- A format in which an interaction framework should be specified.

It facilitates **interoperability** between software applications used in the construction process. It promotes digital collaboration between actors in the construction process and provides a basis for accurate, reliable, repeatable and high quality information exchange.

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ISO AND UNE STANDARDS

EN-ISO 16757 SERIE

- **EN ISO 16757-1-2019. In force**

  Data structures for electronic product catalogues for building services. Data structures for electronic product catalogues for building services - Part 1: Concepts, architecture and model (ISO 16757-1:2015). (ISO 16757-1:2015).

- **UNE-EN ISO 16756-2:2019. In force**

  Data structures for electronic product catalogues for building services - Part 2: Geometry (ISO 16757-2:2016).

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ISO AND UNE STANDARDS

- **EN ISO 16757-1-2019. In force**

Data structures for electronic product catalogues for building services. Data structures for electronic product catalogues for building services - Part 1: Concepts, architecture and model (ISO 16757-1:2015).

The main objective of this international standard is to provide data structures for digital product catalogues to automatically transmit building product data to information models in building software applications. This includes a metamodel for specifying product classes and their properties and a metamodel for product data to be exchanged in product catalogues. The product data must comply with the specifications of their product groups. The set of standards is divided into two areas:

- The basic concepts, such as conceptual models, languages, geometric representations and XML schemas for data exchange, are provided in the conceptual parts of the standard set (the parts with a single digit number).
- Using these resources, the content parts of this international standard define, for various building product groups, concrete models for product description and exchange.

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ISO AND UNE STANDARDS

- **EN ISO 29841-2:2019. In force**

Data structures for electronic product catalogues for building services - Part 2: Geometry (ISO 16757-2:2016).

This part of ISO 16757 describes the modelling of the geometry of building services products. The description is optimised for the exchange of product catalogue data and includes:

- Forms to represent the product itself.
- Symbolic forms to visualise the function of the product in the form of diagrams.
- Spaces for functional requirements.
- Surfaces for visualisation.
- Connections to represent the connectivity between different objects.

It does not describe the internal structure and functionality of the product or manufacturing information, as these elements are not usually published in a product catalogue.

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ISO AND UNE STANDARDS

OTHER NOTEWORTHY STANDRS

- **EN ISO 16739-1:2020. In force**

  Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries - Part 1: Data schema (ISO 16739-1:2018)

- **EN ISO 21597-1:2020. In force**

  Information container for linked document delivery - Exchange specification - Part 1: Container (ISO 21597-1:2020)

- **EN ISO 23386:2020. In force**

  Building information modelling and other digital processes used in construction. Methodology for describing, creating and maintaining properties in interconnected dictionaries (ISO 23386:2020)

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ISO AND UNE STANDARDS

OTHER N

- **UNE-**
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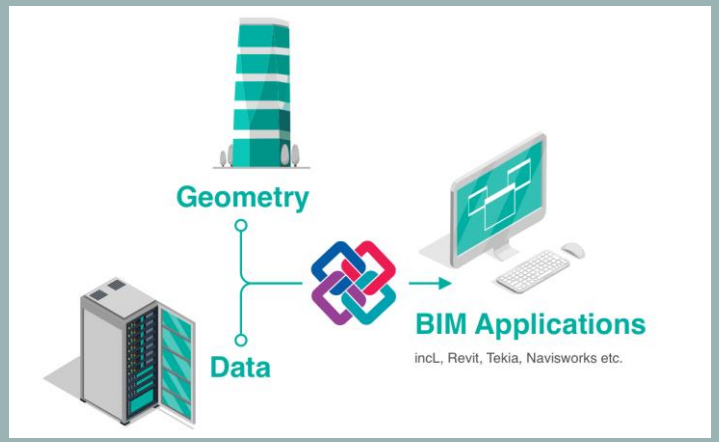
EXPLANATORY NOTE

The most widely recognised BIM standard is the Industry Foundation Class (IFC), which contains processes, data, terms, dictionaries and specifications for the coordination of changes. The IFC format is an open standard for BIM specifications that are exchanged and shared between various participants in the project life cycle, and is defined by UNE-EN ISO 16739, Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries. The IFC specifications are a data schema, which can be presented in EXPRESS or XML.



Source: https://cad.kz/articles/format_ifc_kak_instrument_kontrolya-_tselepolaganie-_ustroystvo-_interoperabelnost/

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ISO AND UNE STANDARDS

OTHER NOTEWORTHY STANDRS

- **UNE-EN ISO 23387:2020. In force**

  Building information modelling (BIM) - Data templates for construction objects used in the life cycle of built assets - Concepts and principles (ISO 23387:2020)

- **PNE-prEN 17473. Processing**

  Building information modelling (BIM) - Data templates for construction objects used in the life cycle of any built asset - Data templates based on harmonised technical specifications under the Construction Products R egulation (CPR).

- **PNE-prEN 17412. Processing**

  Building Information Modelling - Level of Information Need - Part 1: Concepts and principles.

- **PNE 41606 IN. Processing**

  State of the art on BIM (Building Information Modeling)

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ISO AND UNE STANDARDS

OTHER NOTEWORTHY ISO STANDRS

- **ISO/TS 12911:2012.** In force

Framework for building information modelling (BIM) guidance.

- **ISO 16354:2013.** In force

Guidelines for knowledge libraries and object libraries.

- **ISO 21597-1:2020.** In force

Information container for linked document delivery -- Exchange specification -- Part 1: Container.

- **ISO 22263:2008.** In force

Organization of information about construction works -- Framework for management of project information.

- **ISO 29481-1:2016.** In force

Building information models -- Information delivery manual -- Part 1: Methodology and format.

- **ISO 29481-2:2012.** In force

Building information models -- Information delivery manual -- Part 2: Interaction framework.

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2.2. Regulations for environmental management

ENVIRONMENTAL MANAGEMENT SYSTEMS

ENVIRONMENTAL AUDIT

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ENVIRONMENTAL MANAGEMENT SYSTEMS

EN ISO 14001:2015. In force

Environmental management systems. Requirements with guidance for use.

This International Standard specifies requirements for an environmental management system that an organisation can use to improve its environmental performance.

- It helps an organisation to achieve the intended outcomes of its environmental management system, thereby providing value to the environment, the organisation itself and its stakeholders. Consistent with the organisation's environmental policy, the expected results of an environmental management system include:
  - Improvement of environmental performance;
  - Compliance with legal and other requirements;
  - Achievement of environmental objectives.

It is applicable to the environmental aspects of **activities, products and services** that any organisation, regardless of its size, type and nature, determines it can control or influence, considering a life cycle perspective.

It can be used in **whole or in part** to systematically improve environmental management. Declarations of conformity to this International Standard, however, are not acceptable unless **all requirements** are incorporated into an organisation's environmental management system and are met without exclusions.

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ENVIRONMENTAL MANAGEMENT SYSTEMS

EN ISO 14004:2016. In force

Environmental management systems. General guidelines on implementation.

This International Standard provides guidance for an organisation in establishing, implementing, maintaining and improving a robust, credible and reliable environmental management system. The guidance provided is intended for an organisation seeking to manage its environmental responsibilities in a systematic way that contributes to the environmental pillar of sustainability.

- It helps an organisation to achieve the intended outcomes of its environmental management system, thereby providing value to the environment, the organisation itself and its stakeholders. Consistent with the organisation's environmental policy, the expected results of an environmental management system include:
  - Improvement of environmental performance;
  - Compliance with legal and other requirements;
  - Achievement of environmental objectives.

It is applicable to the environmental aspects of **activities, products and services** that any organisation, regardless of its size, type and nature, determines it can control or influence, considering a life cycle perspective.

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ENVIRONMENTAL MANAGEMENT SYSTEMS

EN ISO 14006:2020. In force

Environmental management systems. Guidelines for incorporating ecodesign.

This International Standard provides guidelines to help organisations establish, document, implement, maintain and continually improve their **ecodesign management** as part of an environmental management system (EMS).

It is intended to be used by those organisations that have implemented an EMS according to ISO 14001, but can also be useful for integrating **ecodesign** into other management systems. The guidelines apply to any organisation regardless of size or activity.

It applies to those **product**-related environmental aspects over which the organisation may have control or influence.

This Standard does not in itself establish specific environmental performance criteria and is not intended to be used for certification purposes.

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LIFE CYCLE ASSESSMENT (LCA)

EN ISO 14045:2012. In force

Environmental management. Eco-efficiency assessment of product systems. Principles, requirements and guidelines.

This International Standard describes the principles, requirements and guidelines for the assessment of the eco-efficiency of the product system including:

- Environmental assessment;
- Assessment of the value of the product system;
- Quantification of eco-efficiency;
- Interpretation (including quality assurance);
- Communication of results;
- Critical review of eco-efficiency assessment.

Requirements, recommendations and guidelines for specific selections of environmental impact categories and values are not included. The intended use of the eco-efficiency assessment is considered at the stage of defining the objectives and scope, but the actual use of the results is outside the scope of this International Standard.

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LIFE CYCLE ASSESSMENT (LCA)

EN ISO 14046:2016. In force

Environmental management - Water footprint - Principles, requirements and guidelines

This International Standard specifies the principles, requirements and guidelines related to the assessment of the water footprint of products, processes and organisations based on life cycle analysis (LCA).

It provides the principles, requirements and guidelines for conducting and reporting a single or individual **water footprint assessment**, or as part of a more comprehensive environmental assessment.

Only **emissions to air and discharges to land** with impacts on water quality are included in the assessment and not all emissions to air or discharges to land are included.

The result of the water footprint assessment is an individual value; or a profile of the impact indicator results.

Although reporting is within the scope of this International Standard, the communication of water footprint results, e.g. in the form of labels or declarations, is outside the scope of this International Standard.

NOTE: Specific requirements and guidelines for organisations are provided in Annex A of this Standard.

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ENVIRONMENTAL MANAGEMENT SYSTEMS

EN ISO 14050:2010. In force

Environmental management. Vocabulary. (ISO 14050:2009)

This International Standard defines the terms for **fundamental concepts** related to **environmental management,** published in the ISO 14000 series of Standards.

This Standard provides equivalent terms to those used in the three official ISO languages (English, French and Russian) in Spanish, Arabic, German, Finnish, Italian, Dutch, Norwegian, Portuguese, Spanish and Swedish. Only official terms can be considered as ISO terms and definitions.

To facilitate the understanding of the concepts described, certain definitions are accompanied by explanatory notes or examples.

The terms and definitions are presented in a systematic order, with an alphabetical index. A term in a definition or a note that is defined elsewhere is indicated by bold type followed by its reference number in brackets. These terms may be replaced by their full definition.

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ENVIRONMENTAL AUDIT

EN ISO 14015:2010. In force

Environmental management - Environmental assessment of sites and organizations (EASO) (ISO 14015:2001)

This International Standard provides guidance on how to lead an EASO through a systematic process of identifying environmental aspects and issues and determining, if necessary, their economic and business consequences.

- This Standard does not provide guidance on how to carry out other types of environmental assessment, such as:
  - Initial environmental reviews;
  - Environmental audits (including environmental management system and legal compliance audits);
  - Environmental impact assessments; or
  - Environmental performance assessments.

Intrusive and remedial site investigations, and the decision to carry them out, are outside the scope of this International Standard.

It is not intended for use as a specification standard for certification or registration purposes, nor for the establishment of environmental management system requirements.

The use of this Standard does not imply that other standards and legislation should be imposed on the client or the assessed party.

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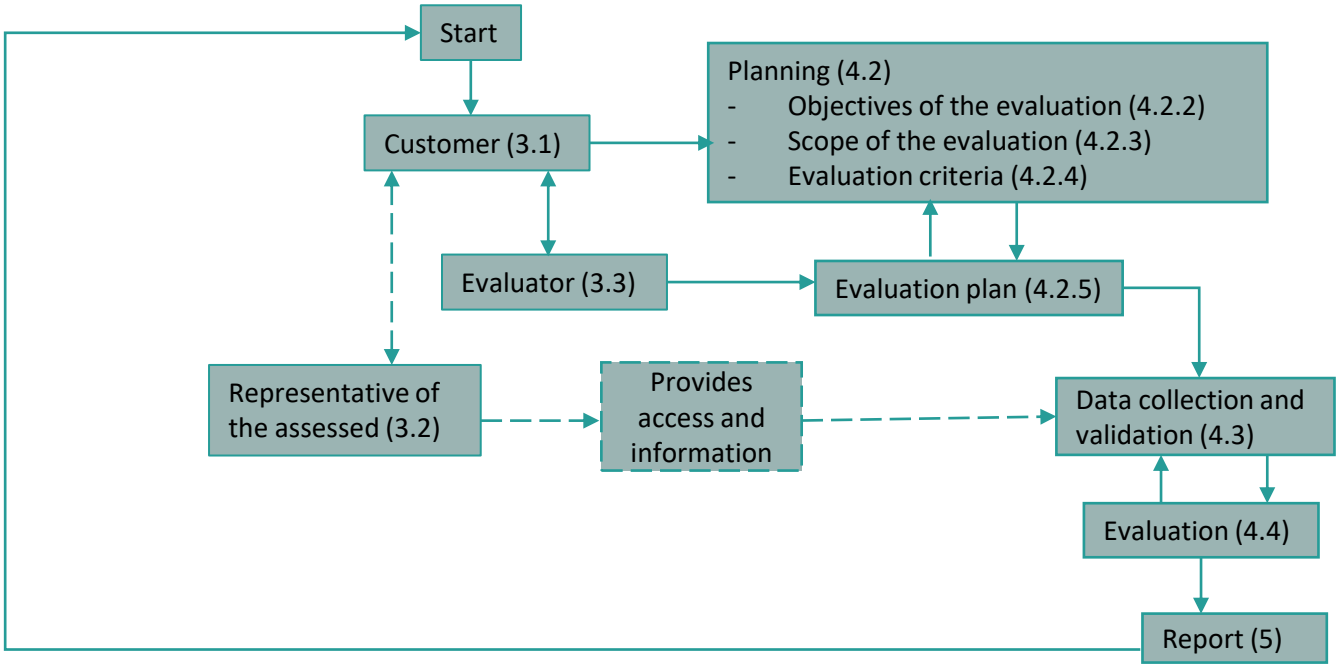
ENVIRONMENTAL AUDIT

- It covers the roles and responsibilities of the parties involved in the assessment (the client, the assessor and the representative of the assessed), and the stages of the assessment process (planning, information collection and validation, assessment and reporting). The process for conducting an EASO is shown in the figure below.



NOTE: Numbers in brackets refer to chapters and sections of this International Standard. Dashed lines indicate that the assessed person is not necessarily involved in such an EASO as described in this International Standard.

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ENVIRONMENTAL AUDIT

EN ISO 19011:2018. In force

Guidelines for auditing management systems (ISO 19011:2018)

This Standard provides **guidanc**e on the auditing of management systems, including the principles of auditing, the management of an audit programme and the conduct of management system audits, as well as guidance on the assessment of the competence of persons involved in the audit process. These activities include those responsible for the management of the audit programme, auditors and audit teams.

- It is applicable to all organisations that need to plan and conduct internal or external **audits** of management systems, or manage an audit programme.
- The application of this standard to other types of audits is possible, provided that special attention is paid to the specific competence required.

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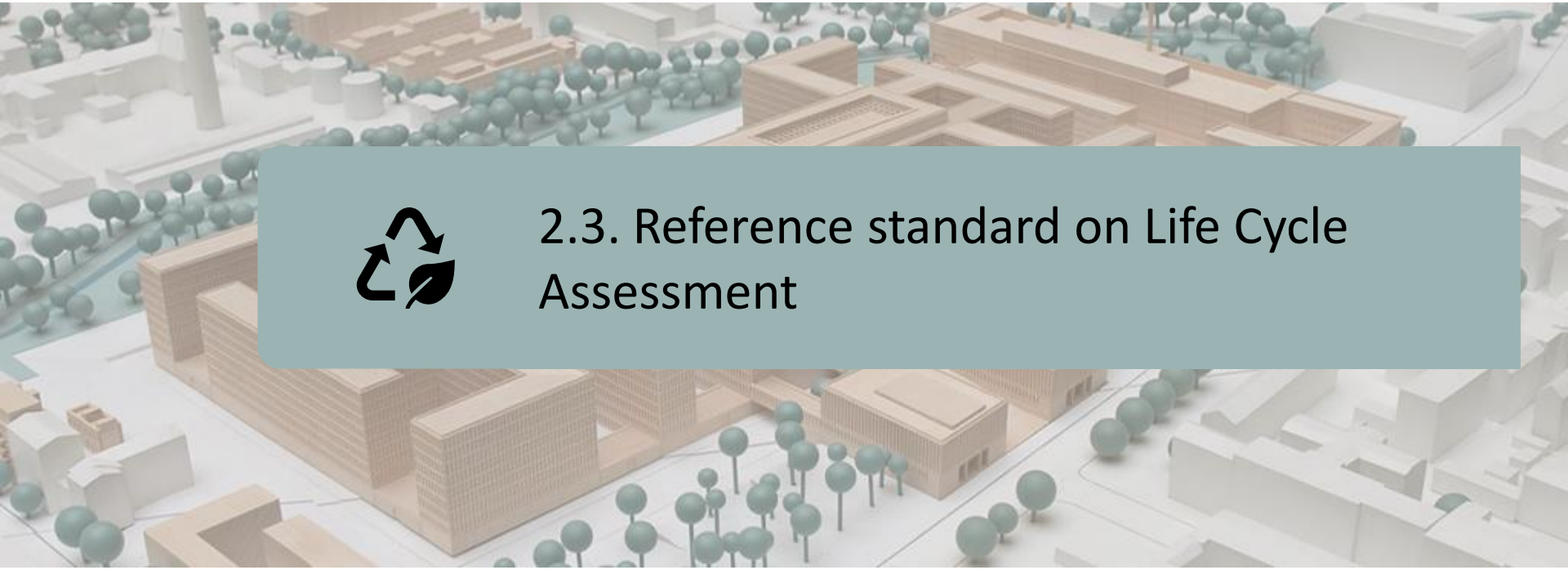

2.3. Reference standard on Life Cycle Assessment

INTRODUCTION

LIFE CYCLE ASSESSMENT (LCA)

ENVIRONMENTAL PRODUCT DECLARATION (EPD)

SUSTAINABILITY STANDARDS IN CONSTRUCTION

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INTRODUCTION

Life Cycle Assessment (LCA).

It is the **basis** for the subsequent drafting of the **EPD**. It is defined as the methodology that develops an objective process for assessing the environmental impact of products or services from the perspective of their **complete Life Cycle.**

Environmental Product Declaration (EPD).

An EPD, being a type III ecolabel, does not require minimum environmental values to be met by the product like other ecolabels, but shows the results of the **LCA** study, making it a useful instrument for the environmental improvement of products or processes.

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INTRODUCTION

- **LCA** → EN ISO 14040 and EN ISO 14044.
- **DAP** → EN ISO 14025.

In order to carry out a EPD, the ISO 14025 standard must be followed, and for LCA the ISO 14040 and ISO 14044 standards must be followed. For some products it may be the case that the different EPD/ EPD Certification Programmes have created Product Category Rules (PCR). In these cases, the PCR will be the reference document indicating how to perform the LCA for that type of product, and what content the EPD will have to show.

- **Product Category Rules (PCR)** → EN 15804.

Managers of **EPD** Certification programmes create **PCRs** indicating how to carry out the **LCA** of that type of product, and what content the EPD will have to show.

- **Definition and presentation of the phases of an LCA applied to the building** → EN 15978.

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LIFE CYCLE ASSESSMENT (LCA)

EN ISO 14040:2006/A1:2020. In force

Environmental management. Life cycle assessment. Principles and framework. Amendment 1 (ISO 14040:2006/Amd 1:2020)

This International Standard describes the principles and framework for life cycle analysis (LCA) including:

- The definition of the objective and scope of LCA,
- The life cycle inventory (LCI) analysis phase,
- The life cycle impact assessment (LCIA) phase,
- The life cycle interpretation phase,
- The LCA report and critical review,
- The limitations of the LCA,
- the relationship between the LCA phases, and
- The conditions for the use of value judgements and optional elements.

It covers life cycle analysis (LCA) studies and life cycle inventory (LCI) analysis studies. It does not describe the LCA technique in detail, nor does it specify methodologies for the individual LCA phases.

The intended application of LCA or LCA results is considered when **defining the objective and scope,** but the application itself is outside the scope of this International Standard.

This Standard is not intended for contractual or regulatory purposes, nor for registration and certification.

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LIFE CYCLE ASSESSMENT (LCA)

EN ISO 14044:2006/A2:2020. In force

Environmental management. Life cycle assessment. Requirements and guidelines. Amendment 2 (ISO 14044:2006/Amd 2:2020)

This International Standard describes the principles and framework for life cycle analysis (LCA) including:

- The definition of the objective and scope of LCA,
- The life cycle inventory (LCI) analysis phase,
- The life cycle impact assessment (LCIA) phase,
- The life cycle interpretation phase,
- The LCA report and critical review,
- The limitations of the LCA,
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It includes life cycle analysis (LCA) studies and life cycle inventory (LCI) analysis studies.

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LIFE CYCLE ASSESSMENT (LCA)

- **Primary objective: ISO 14040 / ISO 14044.**

To calculate the environmental profile of a product or service, and to be able to compare between products.

The information provided contributes to:

- Identifying opportunities for improving the environmental performance of the product in the design and development phases.
- Setting priorities in strategic product planning.
- Choosing environmental performance indicators, including measurement techniques.
- Carrying out green marketing strategies.

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LIFE CYCLE ASSESSMENT (LCA)

- **Product stages in LCA: ISO 14040 / ISO 14044.**

The LCA of a product assesses the potential environmental impacts associated with all **stages of its life cycle:**

- Raw material extraction.
- Manufacturing: manufacturing, processing and formulation of products.
- Distribution and transport.
- Use, maintenance and reuse during its life cycle in service.
- Recycling or waste management.

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LIFE CYCLE ASSESSMENT (LCA)

- **Product stages in LCA: ISO 14040 / ISO 14044.**

EXPLANATORY NOTE
Product stages in LCA:
The Life Cycle Assessment of a product evaluates the potential environmental impacts associated at all stages of its existence:
- Raw material extraction.
- Manufacturing: Manufacture, processing and formulation of products.
- Packaging and transport.
- Use, maintenance and reuse during its life cycle in service.
- Recycling or final disposal: Waste management.

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LIFE CYCLE ASSESSMENT (LCA)

ISO/TR 14047:2012. In force

Environmental management. Life cycle assessment. Illustrative examples on how to apply ISO 14044 to impact assessment situations.

The purpose of this Standard is to provide **examples** to illustrate the current practice of **life cycle impact assessment** according to ISO 14044:2006. These examples are only a sample of all possible examples that could satisfy the provisions of ISO 14044.

They offer "a way" or "ways" rather than the "one way" to apply ISO 14044.

They reflect the **key elements** of the life cycle impact assessment (LCIA) phase of LCA.

The examples presented in ISO/TR 14047:2012 are not exclusive and other examples exist to illustrate the methodological issues described.

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LIFE CYCLE ASSESSMENT (LCA)

ISO/TR 14049:2012. In force

Environmental management. Life cycle assessment. Illustrative examples on how to apply ISO 14044 to goal and scope definition and inventory analysis

This Technical Specification provides examples of practices for conducting a life cycle inventory (LCI) analysis as a means of satisfying certain provisions of ISO 14044:2006.

These examples are only a sample of possible cases that comply with the provisions of ISO 14044, in order to improve the understanding of the requirements of ISO 14044.

They offer "one way" or "ways" rather than "only one way" of implementing ISO 14044. These examples reflect only parts of a complete LCA study.

With regard to LCA phases, methodological requirements for conducting LCA studies are provided in ISO 14040 and ISO 14044 (mentioned above).

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ENVIRONMENTAL PRODUCT DECLARATION (EPD)

GENERAL

- **EN ISO 14025:2010. Environmental labels and declarations. Type III environmental declarations. Principles and procedures.**

CONSTRUCTION SECTOR.

- **Regulation (EU) No 305/2011 of the European Parliament, establishing harmonised conditions for the marketing of construction products.**
- **EN 15804:2012+A2:2019. Sustainability in construction. Environmental product declarations. Basic product category rules for construction products.**
- **UNE-EN 15978:2012. Sustainability in construction. Assessment of the environmental performance of buildings. Calculation methods.**

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ENVIRONMENTAL PRODUCT DECLARATION (EPD)

EN ISO 14025:2010. In force

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

This international standard sets out the principles and specifies the procedures for developing Type III environmental declaration programmes, specifying the use of the ISO 14040 series of standards, where they are primarily intended for business-to-business communication, but do not preclude business-to-consumer communication.

An Environmental Product Declaration **(EPD) communicates verifiable, accurate and non-misleadin**g environmental information about products and their applications, thus supporting fair, science-based decision making and developing market-driven possibilities for continuous environmental improvement.

EPD information is expressed in environmental information modules, data throughout the product life cycle. This approach requires the data on which the information is based to be consistent, reproducible and comparable.

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ENVIRONMENTAL PRODUCT DECLARATION (EPD)

Regulation (EU) No 305/2011 of the European Parliament, establishing harmonised conditions for the marketing of construction products. In force

(55) "The basic requirement for construction works on the sustainable use of natural resources should take into account in particular the recyclability of the construction works, its materials and parts after demolition, the durability of the construction works and the use of environmentally compatible raw materials and by-products in the construction works".

(56) "For the assessment of the sustainable use of resources and the environmental impact of construction works, environmental product declarations should, where available, be used."

EUR-Lex

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ENVIRONMENTAL PRODUCT DECLARATION (EPD)

UNE-EN 15804:2012+A2:2019. In force

Sustainability in construction. Environmental product declarations. Basic product category rules for construction products. Document defining the requirements of an environmental claim for a certain product category.

Product Category Rules (PCRs) ensure transparency and comparability between claims.

PCRs are approved and issued by Programme Administrators, following a process involving manufacturing companies and interested third parties. It must be transparent.

All construction EPDs in Europe must conform to the common PCRs set out in UNE-EN 15804.

In turn, each product group may have its own criteria set by the particular PCRs issued by the EPD system to which it belongs.

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ENVIRONMENTAL PRODUCT DECLARATION (EPD)

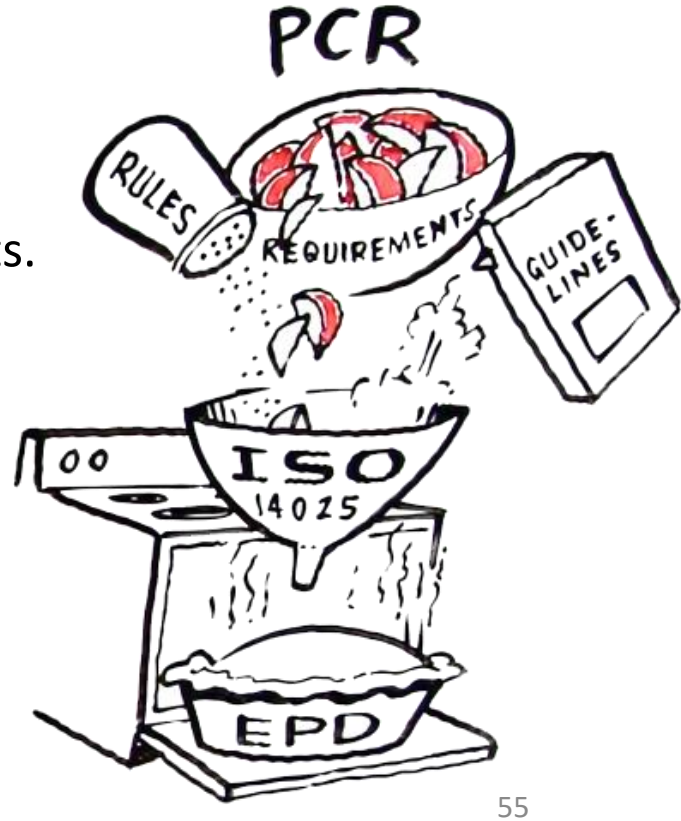
UNE-EN 15804:2012+A2:2019. In force

Sustainability in construction. Environmental product declarations. Basic product category rules for construction products.

The UNE-EN 15804 standard, Sustainability in construction. Environmental product declarations. Basic product category rules for construction products.

NO

establishes the calculation procedure to obtain an EPD but is a guide for the elaboration of PCRs.



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ENVIRONMENTAL PRODUCT DECLARATION (EPD)

OTHER RELEVANT STANDARDS

EN 17074:2019. In force

Glass in building. Environmental product declaration. Product category rules for flat glass products

EN 16908:2017. In force

Cement and building lime. Environmental product declarations. Product category rules complementary to EN 15804.

EN 16757:2017. In force

Sustainability of construction works. Environmental product declarations. Product Category Rules for concrete and concrete elements.

EN 15942:2021. In force

Sustainability of construction works. Environmental product declarations. Communication format business-to-business.

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ENVIRONMENTAL PRODUCT DECLARATION (EPD)

OTHER RELEVANT STANDARDS

CEN/TR 16970:2016. In force

Sustainability of construction works. Guidance for the implementation of EN 15804 (Endorsed by Asociación Española de Normalización in January of 2017.)

CEN/TR 15941:2010. In force

Sustainability of construction works. Environmental product declarations. Methodology for selection and use of generic data.

PNE-prEN 17392-1. Processing

Sustainability of construction works. Environmental product declarations. Core rules for road materials. Part 1: Bituminous mixtures.

ISO 21930:2017. In force

Sustainability in buildings and civil engineering works. Core rules for environmental product declarations of construction products and services.

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ENVIRONMENTAL PRODUCT DECLARATION (EPD)

EN 15978:2011. In force

Sustainability in construction. Assessment of the environmental performance of buildings. Calculation methods.

Its methodological framework applies to all types of buildings, both new buildings in their full life cycle and existing buildings for their remaining useful life and their end-of-life stage. The environmental aspects and impacts of the building on the local, regional and global level are assessed. The assessment is based on a Life Cycle Assessment (LCA) and other quantifiable environmental information.

The **LCA methodology** consists of the collection and evaluation of the inputs, outputs and potential environmental impacts of a product system during its entire life cycle. The **life cycle** is the consecutive and interrelated phases in the life of the object under consideration. **Environmental impacts** are measured at the product stage (raw material supply, transport and manufacturing), construction process (transport and construction-installation), use stage (use, maintenance, repair, replacement, refurbishment, in-service energy and water use) and end-of-life stage (deconstruction, transport, waste treatment and disposal). Environmental impacts are defined as any change in the environment, both negative and positive, produced in whole or in part by environmental aspects. **Environmental aspects** are those aspects of the construction site or part of the construction site, processes or services related to its life cycle that may alter environmental conditions.

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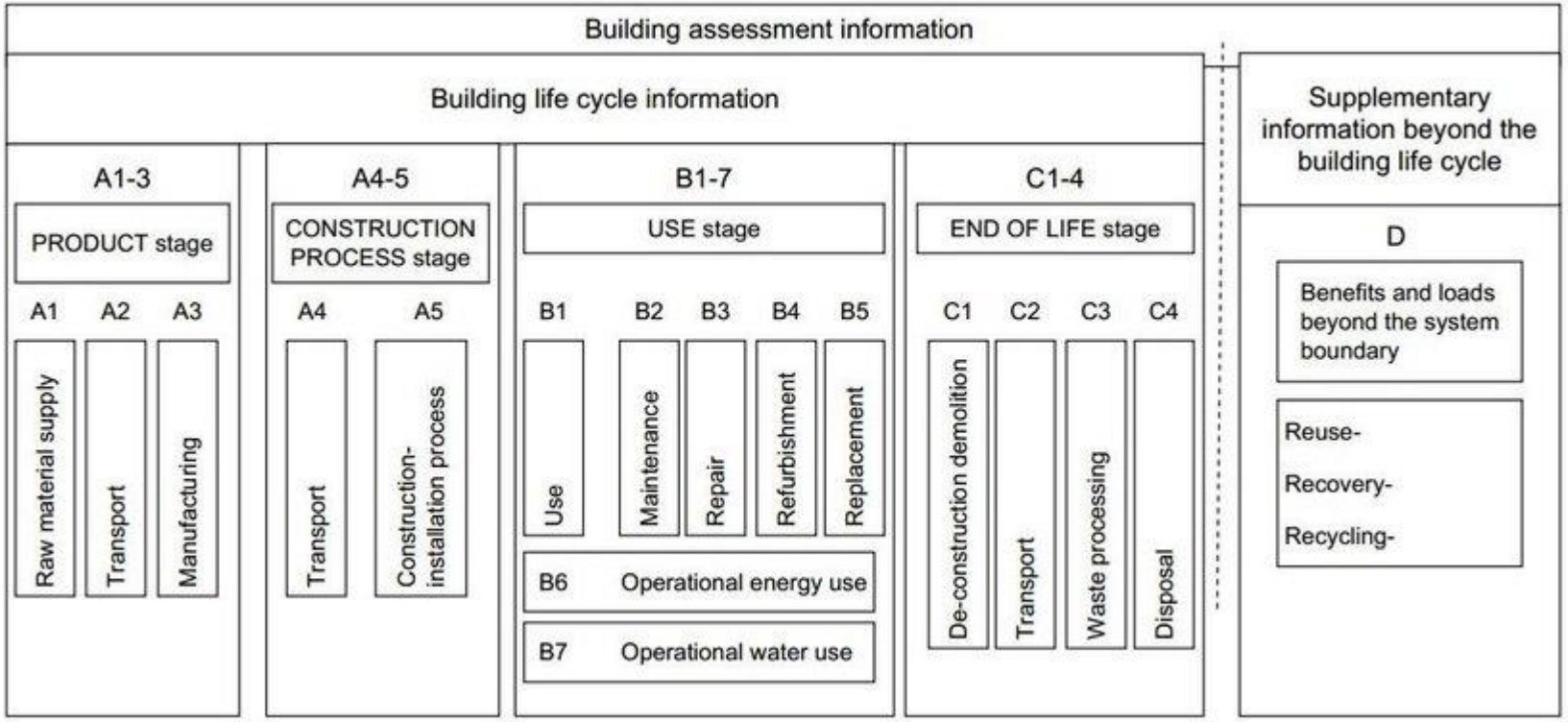
ENVIRONMENTAL PRODUCT DECLARATION (EPD)

UNE-EN 15978:2012. In force

DEFINITION AND DESCRIPTION OF THE PHASES OF AN LCA APPLIED TO A BUILDING.



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SUSTAINABILITY STANDARDS IN CONSTRUCTION

SERIES OF STANDARDS 15643

EN 15643:2021. **In force**

Sustainability of construction works. Framework for assessment of buildings and civil engineering works.

Annuls:

EN 15643-1:2012

EN 15643-2:2012

EN 15643-3:2012

EN 15643-4:2012

EN 15643-5:2018

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SUSTAINABILITY STANDARDS IN CONSTRUCTION

OTHER RELEVANT STANDARDS

EN 16627:2016. In force

Sustainability in construction works. Assessment of the economic performance of buildings. Calculation methods.

EN 16309:2014 +A1:2014. In force

Sustainability in construction works. Assessment of the social performance of buildings. Calculation methodology.

PNE-EN 17472:2022. Processing

Sustainability of construction works. Assessment of the sustainability of civil engineering works. Calculation methods.

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2.4. Application to the construction sector

PROFESSIONAL BIM AND LCA SOFTWARE

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PROFESSIONAL BIM AND LCA SOFTWARE

BIM can become a real LCA lever because it facilitates access to data: project data and component data (whether finished products or raw materials).

However, to date, LCAs carried out based on numerical models are not yet so easy and systematic. First, the analysis is often simplified by the input data that come from the project.

These are mainly nomenclatures of quantities that are extracted from the model to be integrated into the LCA software with an environmental database - the LCA is then dissociated from the model.

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PROFESSIONAL BIM AND LCA SOFTWARE

Some software allows LCA to be carried out directly within the model, but the assumptions considered remain very limited and the databases are not connected.

Very often, only data linked to the surfaces and quantities of the main materials - concrete, steel, wood - are considered. Air conditioning systems and other materials are not considered.

Gradually this is changing and the performance of BIM software and its capabilities to calculate the Life Cycle Analysis of buildings is increasing.

Several outstanding examples are shown below.

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PROFESSIONAL BIM AND LCA SOFTWARE

COCON-BIM

Cocon-BIM is a programme dedicated to the study of the environmental quality of materials and buildings and life cycle analysis (LCA) using the facilities offered by digital modelling (BIM). Completely rewritten, this software succeeds its predecessor Cocon Excel and makes it possible to take advantage of contemporary technological advances in digital modelling, thanks to the reading of BIM files (Ifc format) and 3D navigation.

Cocon-BIM complies with the European "Sustainability in Construction. Assessment of the environmental performance of buildings" (EN15643: "General framework" and EN 15978: "Calculation methods").

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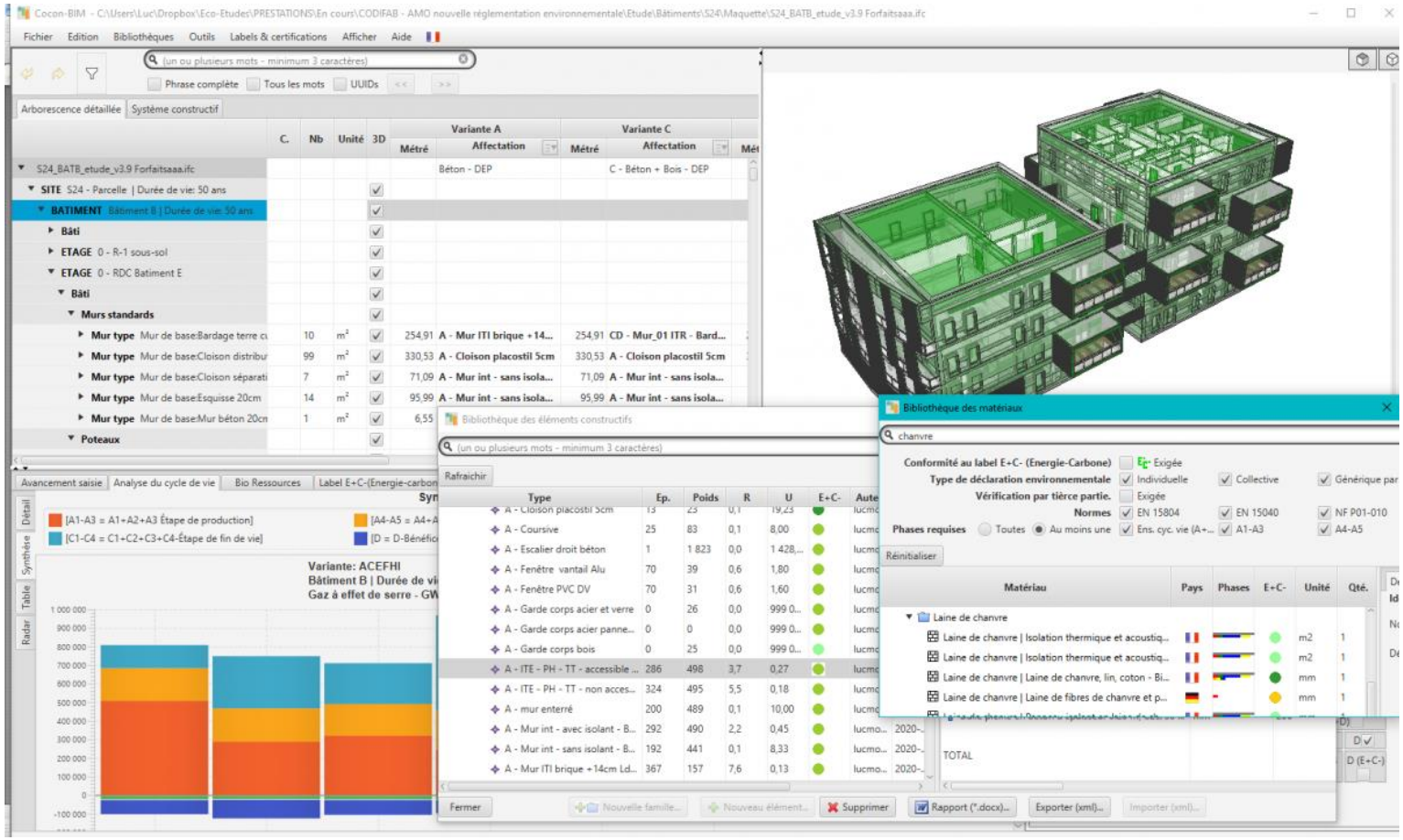
PROFESSIONAL BIM AND LCA SOFTWARE



Source: https://www.construction21.org/france/articles/h/DossierRE2020-realiser-des-ACV-de-batiments-a-partir-de-leur-maquette-numerique-BIM.html

PROFESSIONAL BIM AND LCA SOFTWARE

COCON-BIM

FUNCTIONALITIES

- Compatible with Mac OS y Windows.
- Use any of the current Ifc formats (Ifc 2x3 and Ifc4) - see our tips on modelling digital models here Use any of the current Ifc formats (Ifc 2x3 and Ifc4) - see our tips on modelling digital models here.
- Allows 3D visualisation/manipulation of buildings and their components.
- Allows to study the environmental impact of the construction or renovation of buildings.
- It draws on data from a variety of sources :
- France:
  - FDES (Product Environmental Declaration Sheets) according to NF P01-010, DEP) mainly originating from the database INIES.
  - PEDs (Environmental Product Declarations) according to EN 15804.
  - PEP (Environmental Product Profiles according to EN 14040) mainly originating from the database PEP EcoPasseport.
- Germany - Environmental Product Declarations (EPD), including those of the database OEKEBAU.
- Inglaterra - Declaraciones ambientales de productos (EPD).
- Swiss, including those in the Swiss database Kbob y EcoInvent.

PROFESSIONAL BIM AND LCA SOFTWARE

COCON-BIM

FUNCTIONALITIES

- It includes a database containing the description:
- of more than 3,000 building materials, which contains information on:
  - thermal conductivity, specific heat, density,…).
  - thermal resistance or heat losses through walls.
- inertia and thermal lag of composite walls (in accordance with EN 13786).
- environmental through impact indicators (grey energy, GHG emissions, air and water pollution, resource depletion, water consumption, etc.).
- of installations (lifts, boilers, heat pumps, lighting devices, plumbing, etc.) as well as environmental impacts due to:
  - its production.
  - its use.
  - Its end of life.
- of construction machinery (for excavation, lifting, etc.) and means of transport (car, truck, train, ship, plane, helicopter, etc.) as well as the environmental impacts due to their use.

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PROFESSIONAL BIM AND LCA SOFTWARE

ONE CLICK LCA with BIM

One Click LCA facilitates Life Cycle Assessments (LCA) for BREEAM and LEED certification. The solution proposed by Bionova Ltd. transforms BIM Models into Excel files with LCA reports. In addition to an easy-to-use interface and BIM format reading tool, One Click LCA provides plugins for several programs most common in the building design market.

Life Cycle Assessment quantifies the environmental impact of a building, both in terms of greenhouse gas emissions as well as materials and energy. It plays a central role in LEED v4, BREEAM and other green building projects.

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PROFESSIONAL BIM AND LCA SOFTWARE

ONE CLICK LCA with BIM

Carrying out a life cycle assessment requires specialised knowledge. In contrast, ONE CLICK LCA allows non-specialised LCA users to calculate their calculation for a building in less than an hour using an automated process as well as the platform's web interface.

This plugin allows designers to find out the impact of their choices immediately and achieve the most sustainable results without having to carry out separate detailed studies for each option. In addition to BREEAM, ONE CLICK LCA supports LEED, DGNB, HQE, BNB, GREEN as well as many other certification systems and all common industry standards.

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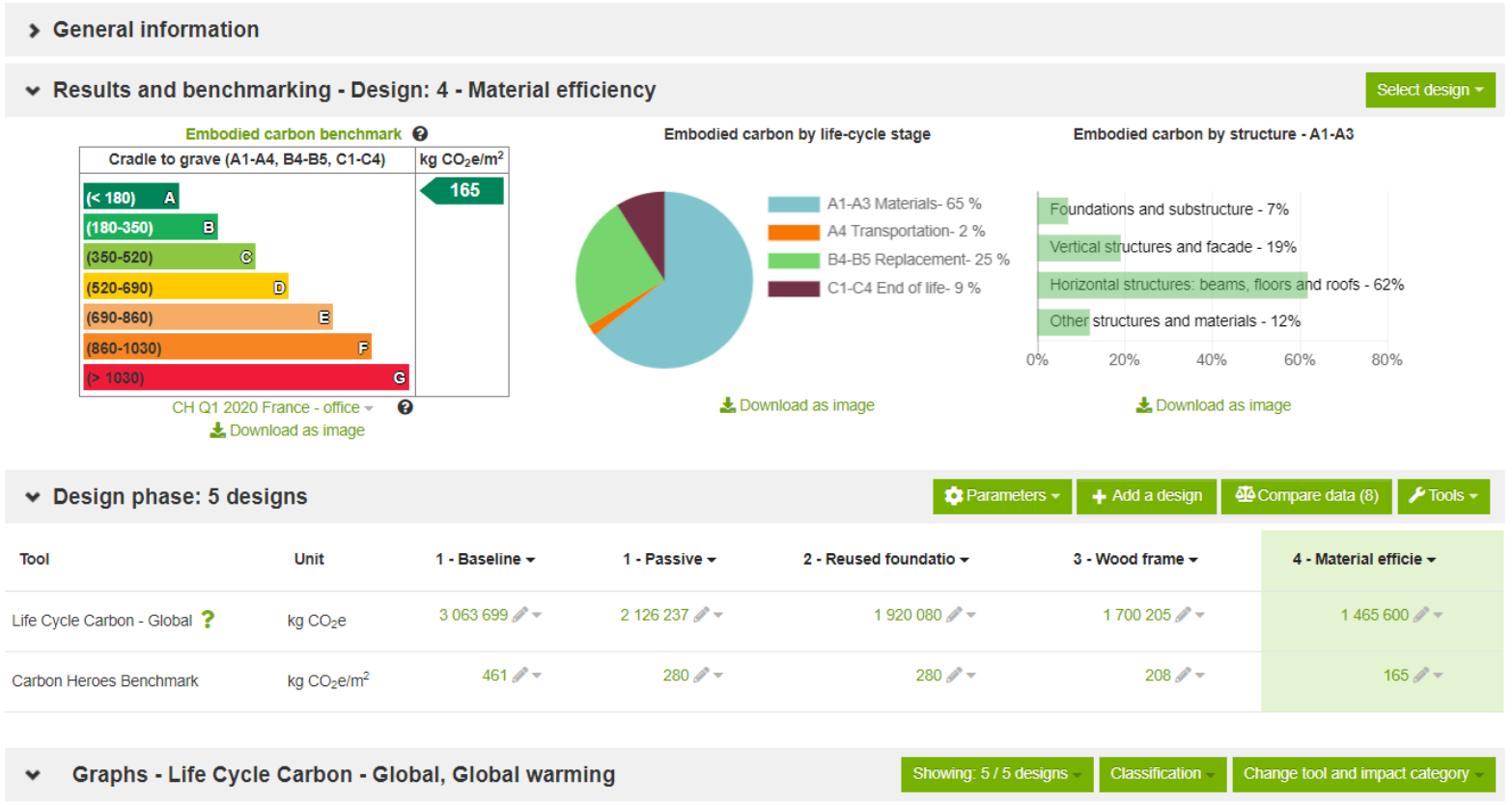
PROFESSIONAL BIM AND LCA SOFTWARE



Source: https://www.oneclicklca.com/one-click-lca-supports-bouygues-batiment-internationals-climate-strategy-to-cut-embodied-carbon-on-a-global-scale/

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PROFESSIONAL BIM AND LCA SOFTWARE

Autodesk Revit

versions 2016, 2017, 2018, 2019 and 2020

IES-VE

version 2017 Feature Pack 4 or higher

Tekla

Tekla Structural Designer – Coming soon

Tekla Structural Designer 2020 Service Pack 5

Excel and CSV formats

Enabling easy import of quantity take-offs or costing data

IFC — Industry Foundation Classes

The international standard (ISO 16739) for BIM. Support for IFC 2×3 and IFC4

Bentley AECOsim

via IFC

IDA ICE

IDA ICE

version 4.8 SP1 and higher

SOLIBRI
A NEMETSCHEK COMPANY

Solibri Model Checker

9.8 and higher

DesignBuilder
SOFTWARE

DesignBuilder

5.1. and upwards

Autocase

Autocase

gbXML

gbXML

The industry standard for sharing data for energy analysis software packages. Supported e.g. by IES-VE

GRAPHISOFT
ARCHICAD

ArchiCAD

native 18-19, higher versions via IFC or Excel

Custom integrations

from XML, JSON, web services and other sources

simplebim®

Simplebim and Naviate Simple

BIM 5.0 and upwards

SketchUp

SketchUp Pro via IFC

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PROFESSIONAL BIM AND LCA SOFTWARE

TALLY

KieranTimberlake's affiliate company, KT Innovations, partnered with Autodesk and thinkstep to create Tally.

Through a Revit plugin, Tally allows Revit users to integrate their BIM model with complete information about the building materials and architectural products that their structures will ultimately contain.

Tally quantifies the embodied environmental impacts of a building or materials used. It is currently approved for use with LEED v4.

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PROFESSIONAL BIM AND LCA SOFTWARE

TALLY

Essentially, Tally adds another layer of detail to BIM by recognising materials that are not explicitly modelled, such as steel in concrete structures, and by considering the diverse range of material classes in a model.

In this way, Tally gives its users the ability to perform LCA of the entire building during design and to use the LCA data to perform comparative analyses of various design options showing their different environmental impacts.

2.3. Reference standard on Life Cycle Assessment

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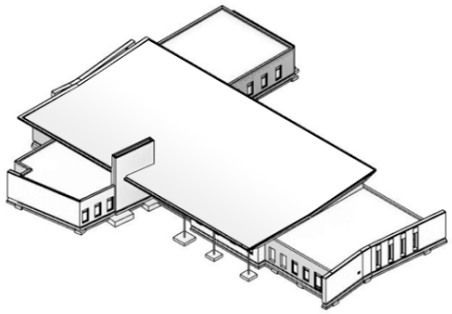

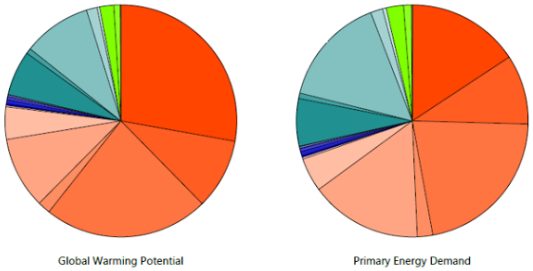

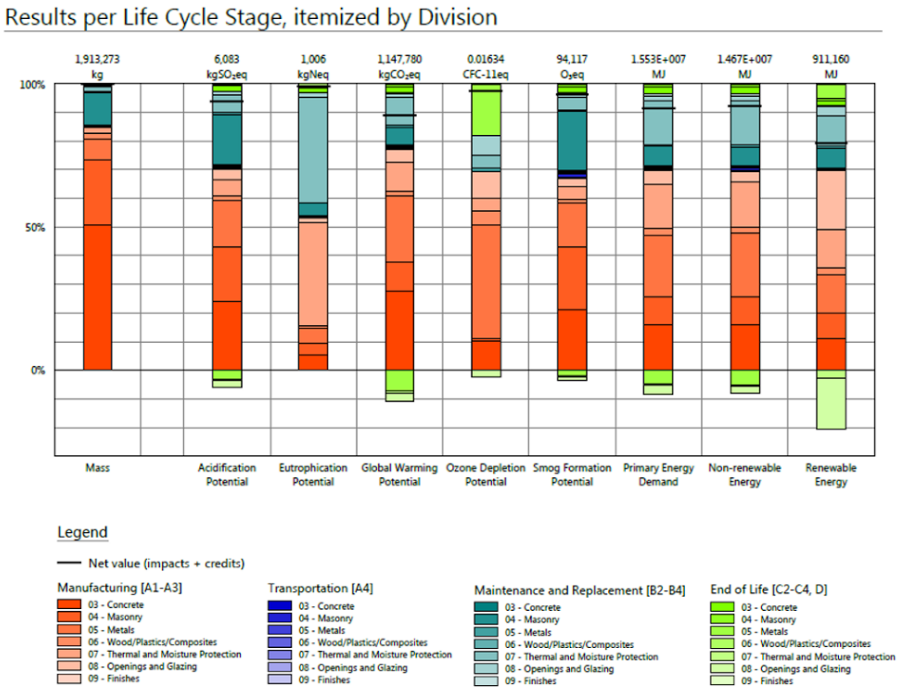

Source: https://www.buildingenclosureonline.com/gdpr-policy?url=https%3A%2F%2Fwww.buildingenclosureonline.com%2Fblogs%2F14-the-be-blog%2Fpost%2F87127-leveraging-life-cycle-assessment-in-the-design-process

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PROFESSIONAL BIM AND LCA SOFTWARE

TALLY

SOURCE AND QUALITY OF DATA

Tally uses an LCA database that combines material attributes, assembly details and architectural specifications with environmental impact data resulting from the collaboration between KT Innovations and thinktep. LCA modelling is carried out in GaBi 8.5 using the GaBi 2018 databases and in accordance with GaBi databases and modelling principles.

The data used are intended to represent 2017 US values. Where representative data were not available, proxy data were used. For each entry, the datasets used, their geographic region and reference year are listed. Whenever possible, proxy datasets were chosen that are technologically consistent with the relevant entry.

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PROFESSIONAL BIM AND LCA SOFTWARE

TALLY

SOURCE AND QUALITY OF DATA

Tally uses an LCA database that combines material attributes, assembly details and architectural specifications with environmental impact data resulting from the collaboration between KT Innovations and thinktep. LCA modelling is carried out in GaBi 8.5 using the GaBi 2018 databases and in accordance with GaBi databases and modelling principles.

The data used are intended to represent 2017 US values. Where representative data were not available, proxy data were used. For each entry, listed techn

EXPLANATORY NOTE

GaBi and SimaPro are the two most widely used software programmes for Life Cycle Assessment (LCA) and for calculating Carbon Footprints, Water Footprints, Water Footprints and Environmental Footprints, such as the European Union.

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PROFESSIONAL BIM AND LCA SOFTWARE

CYPE module IA-ACV

"Environmental Impact - Life Cycle Assessment" is a module of the Budget Generators and Archimedes. The Budget Generators are software tools that, with basic data supplied by the user and the optimisations that the user wishes to make through its graphic environment, automatically generate the budget and measurement of a building work (with chapter structure, breakdown of items and detailed measurement), obtaining the data from the CYPE Construction Price Generator. In addition to the budget and measurement, the Budget Generators provide, among others, the document where the Life Cycle Analysis of the building under consideration is defined, quantified and justified. The data imported into Archimedes can originate from a BIM model in IFC format.

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PROFESSIONAL BIM AND LCA SOFTWARE

CYPE module IA-ACV

To generate this document, the module "Environmental Impact - Life Cycle Analysis" obtains the information from the CYPE Construction Price Generator which is included in each building unit from PHASE A1 to A5 (more phases are currently in the process of being covered):

- The Global Warming Potential (GWP).
- Stratospheric Ozone Depletion Potential (ODP).
- Soil and water resource acidification potential (AP).
- Eutrophication Potential (EP).
- tropospheric ozone formation potential (POCP).
- Abiotic resource depletion potential for non-fossil resources (ADPE).
- Abiotic Resource Depletion Potential for Fossil Resources (ADFP).
- The total primary renewable energy use (PERT).
- Total non-renewable primary energy use (PERNRT).
- Net use of flowing water resources (FW).

2.4. Application to the construction sector

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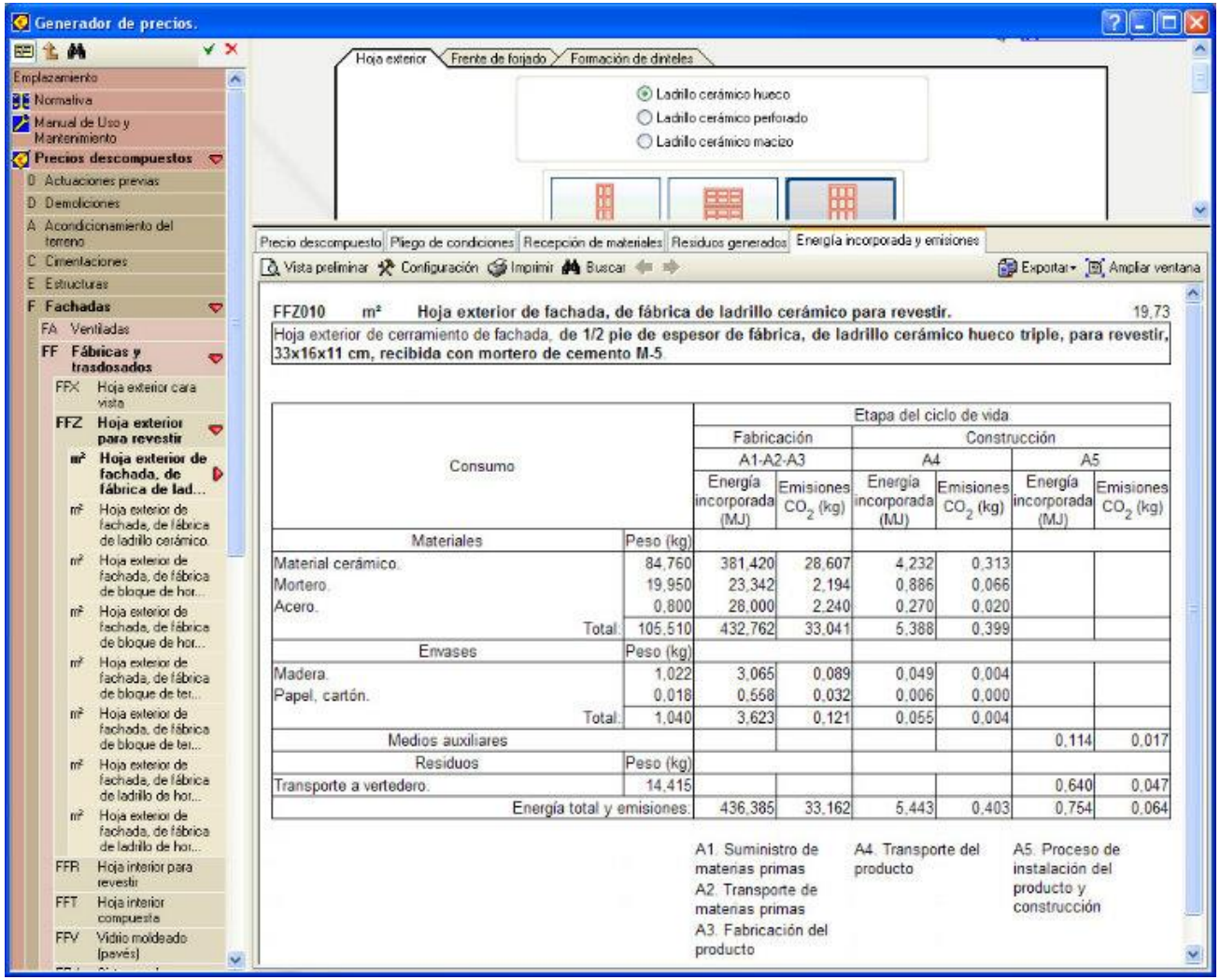

FFZ010 m² Hoja exterior de fachada, de fábrica de ladrillo cerámico para revestir. 19,73

Hoja exterior de cerramiento de fachada, de 1/2 pie de espesor de fábrica, de ladrillo cerámico hueco triple, para revestir, 33x16x11 cm, recibida con mortero de cemento M-5.

Consumo		Etapa del ciclo de vida					
		Fabricación		Construcción			
		A1-A2-A3		A4		A5	
		Energía incorporada (MJ)	Emisiones CO_2 (kg)	Energía incorporada (MJ)	Emisiones CO_2 (kg)	Energía incorporada (MJ)	Emisiones CO_2 (kg)
Materiales	Peso (kg)						
Material cerámico.	84,760	381,420	28,607	4,232	0,313		
Mortero.	19,950	23,342	2,194	0,886	0,066		
Acero.	0,800	28,000	2,240	0,270	0,020		
Total:	105,510	432,762	33,041	5,388	0,399		
Envases	Peso (kg)						
Madera.	1,022	3,065	0,089	0,049	0,004		
Papel, cartón.	0,018	0,558	0,032	0,006	0,000		
Total:	1,040	3,623	0,121	0,055	0,004		
Medios auxiliares						0,114	0,017
Residuos	Peso (kg)						
Transporte a vertedero.	14,415					0,640	0,047
Energía total y emisiones:		436,385	33,162	5,443	0,403	0,754	0,064

A1. Suministro de materias primas
A2. Transporte de materias primas
A3. Fabricación del producto
A4. Transporte del producto
A5. Proceso de instalación del producto y construcción

Source: https://www.obrasurbanas.es/breeam-cype-impacto-ambiental/

2.3. Reference standard on Life Cycle Assessment

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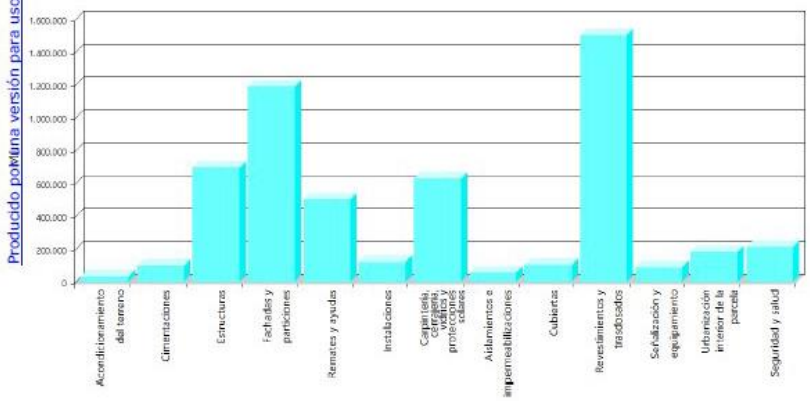
Proyecto:
Situación:
Promotor:

8.8. Uso total de energía primaria renovable. - PERT (MJ)

USO TOTAL DE ENERGÍA PRIMARIA RENOVABLE. (MJ)				
Capítulos	A1-A2-A3 PRODUCTO	A4 TRANSPORTE	A5 CONSTRUCCIÓN	TOTAL
Acondicionamiento del terreno	33.552,93	0,00	0,00	33.552,93
Cimentaciones	99.650,49	0,00	0,00	99.650,49
Estructuras	695.653,37	0,00	0,00	695.653,37
Fachadas y particiones	1.189.485,33	0,00	0,00	1.189.485,33
Remates y ayudas	503.887,22	0,00	0,00	503.887,22
Instalaciones	122.844,74	0,00	0,00	122.844,74
Carpintería, cerrajería, vidrios y protecciones solares	630.304,83	0,00	0,00	630.304,83
Aislamientos e impermeabilizaciones	56.161,00	0,00	0,00	56.161,00
Cubiertas	102.189,60	0,00	0,00	102.189,60
Revestimientos y trasdosados	1.503.016,21	0,00	0,00	1.503.016,21
Señalización y equipamiento	89.989,66	0,00	0,00	89.989,66
Urbanización interior de la parcela	185.750,44	0,00	0,00	185.750,44
Seguridad y salud	213.197,63	0,00	0,00	213.197,63
Total	5.425.683,45	0,00	0,00	5.425.683,45

USO TOTAL DE ENERGÍA PRIMARIA RENOVABLE.



Source: https://www.cype.pe/gestion/arquimedes/modulo-impacto-ambiental-analisis-ciclo-vida/

PROFESSIONAL BIM AND LCA SOFTWARE

CYPE module IA-ACV

The values of all these parameters are the result of the implementation of each work unit from the manufacturing (A1, A2 and A3) and construction (A4 and A5) stages, and are broken down by materials, packaging, machinery, auxiliary means and waste. This information can be consulted in the "Environmental impact indicators" tab of each work unit.

This detail and breakdown of the environmental indicators for each unit of work in the stages indicated allows a very precise analysis of the life cycle of a building work to be obtained. In the section Justification of the determination of the Life Cycle Analysis carried out by the programme, you can consult the validity of the data supplied by the Construction Price Generator.

PROFESSIONAL BIM AND LCA SOFTWARE

CYPE Y CSTB: ElodieBIM

This software allows to calculate the Life Cycle Analysis of a building in France. The software tool called ElodieBIM by CYPE meets the needs of French professionals who will be required to submit a technical report on the life cycle of buildings as of 1 January 2021 under the new RT2020 regulation.

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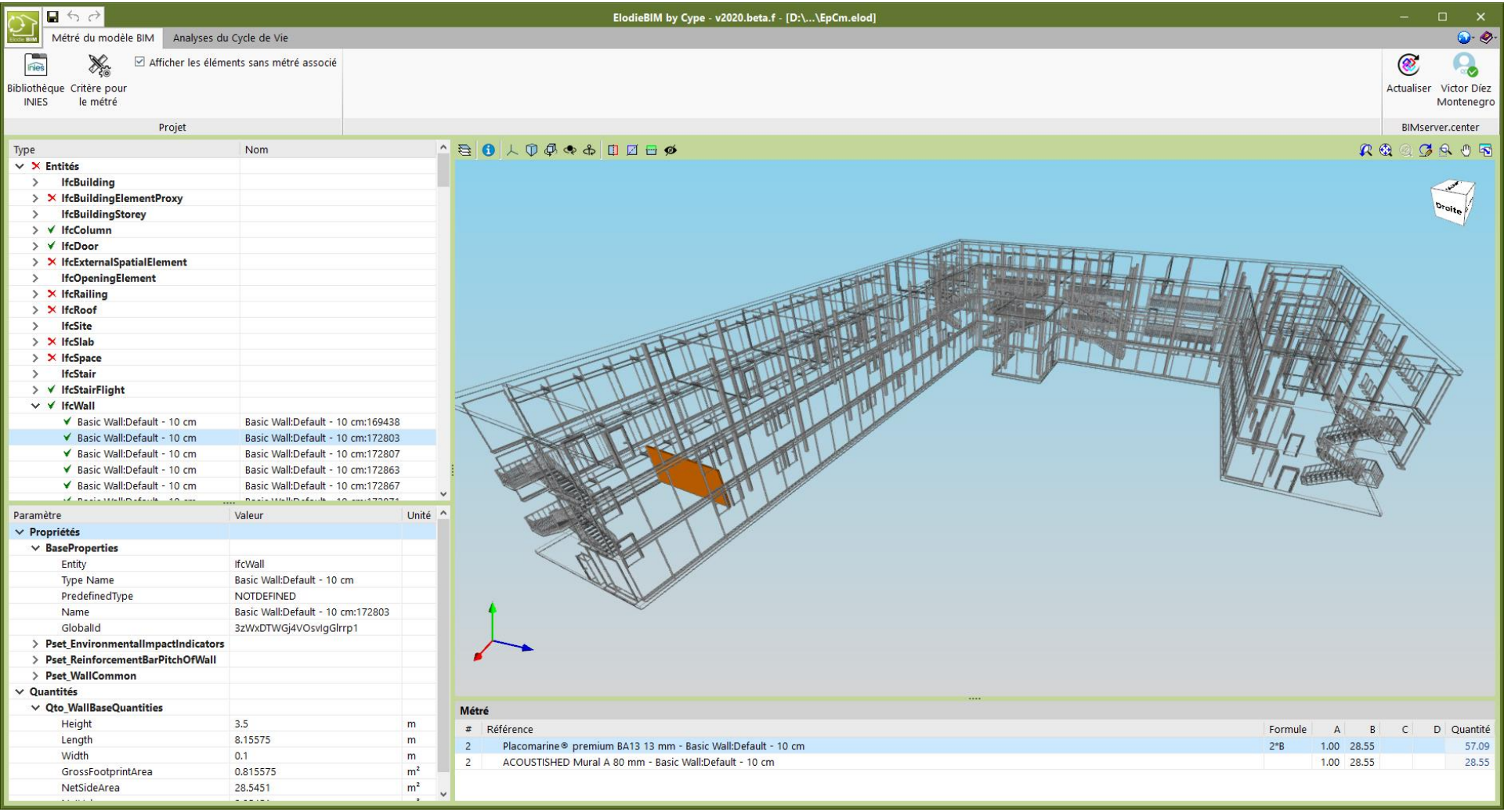
PROFESSIONAL BIM AND LCA SOFTWARE



2.4. Application to the construction sector

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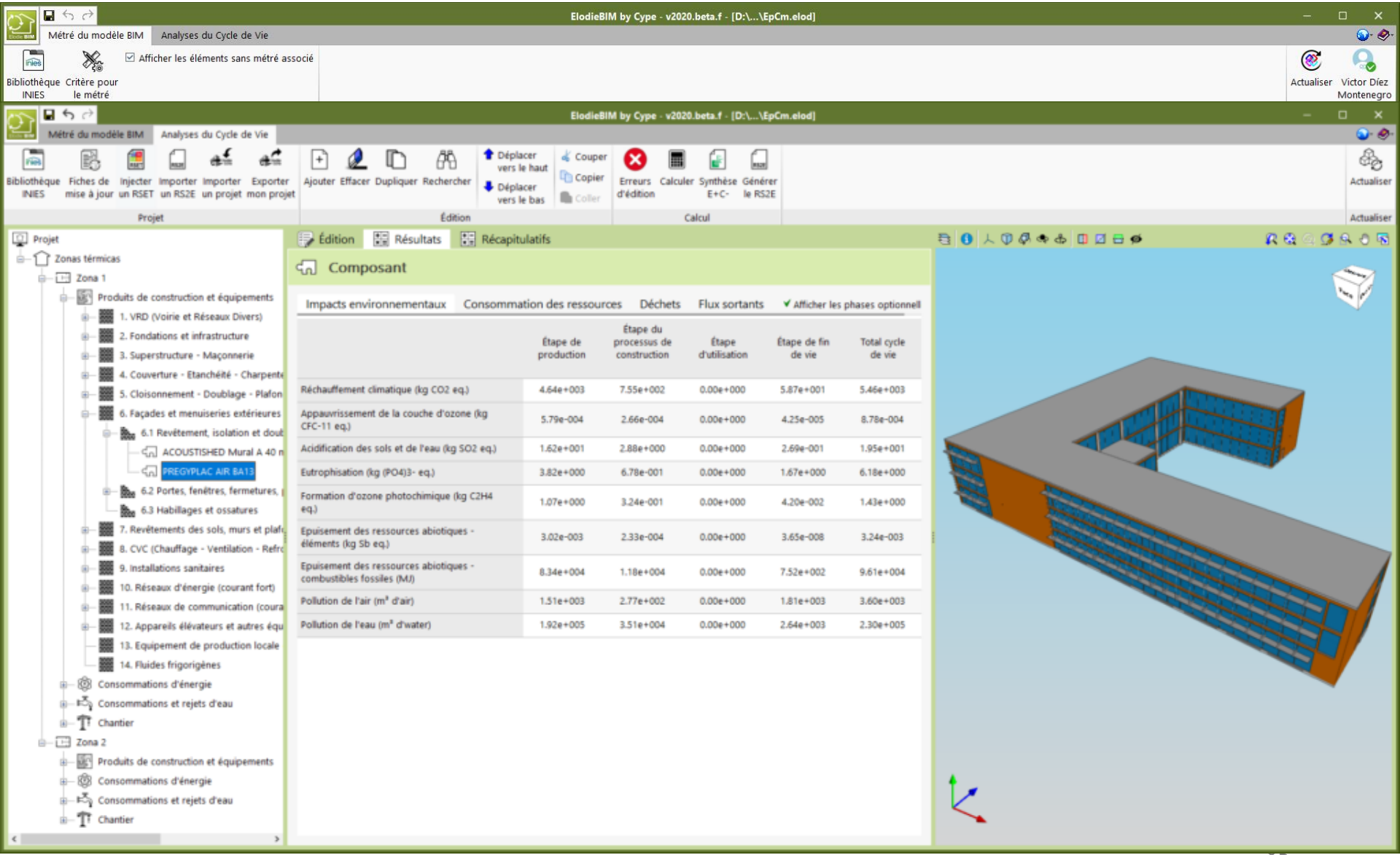

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PROFESSIONAL BIM AND LCA SOFTWARE

CYPE Y CSTB: ElodieBIM

The new RT2020 regulation, which replaces the previous RT2012, is more ambitious from the point of view of sustainability applied to the construction and housing sector, so it includes new sections related to the carbon footprint of buildings, while it is more demanding in terms of the criteria to be considered on thermal performance and energy consumption with the aim of encouraging the construction of near-zero consumption housing.

The ElodieBIM by CYPE software, which has been developed in collaboration with the French Scientific and Technical Centre for Building (CSTB), is able to calculate the impact of the phases of raw material extraction, transport to the factory, manufacture, product transport, product installation and construction thanks to the data provided by the French CSTB. In addition, the software is adapted to the Open BIM workflow.

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2.5. LCA examples

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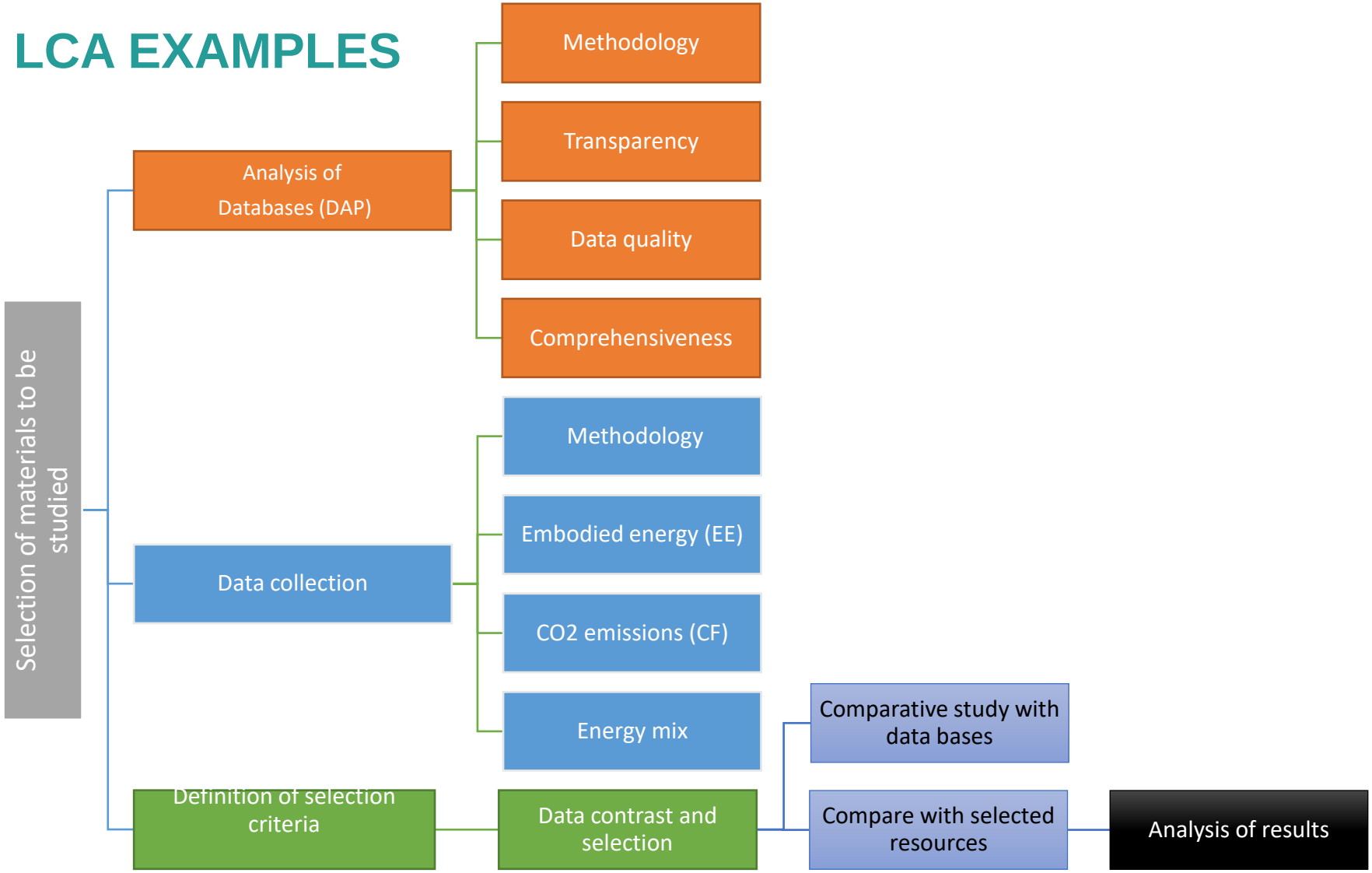
LCA EXAMPLES



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LCA EXAMPLES

LCA with databases PlasticsEurope Eco-profiles

Data obtained from Plastics Europe Eco-profiles:

Embodied energy: 85.5 MJ/kg.

CO2 emissions: 2.5 kgCO2eq/kg.

Energy mix: 94.04% fossil, 4.55% nuclear.

High density polyethylene (HDPE)				
Database	**Eim (MJ/kg)**	**Model**	**Emissions (kgCO2eq)**	**Energy mix**
Base Carbone	-	Cradle-to-gate	1.914	-
BEDEC	102.00	Cradle-to-gate	15.05	-
ELCD	72.20	Cradle-to-gate	1.92	94.74% fossil 4.34% nuclear
GaBi (PE)	72.60	Cradle-to-gate	1.76	96.11% fossil 3.49% nuclear
Plastics Europe (Pipes)	85.50	Cradle-to-gate	2.50	94.04% fossil 4.55% nuclear
Plastics Europe (Resin)	78.00	Cradle-to-gate	1.94	95% fossil 4.01% nuclear
U.S.LCI	76.20	Cradle-to-gate	1.31	100% fossil
Solís et al.	85.00	Cradle-to-gate	-	-

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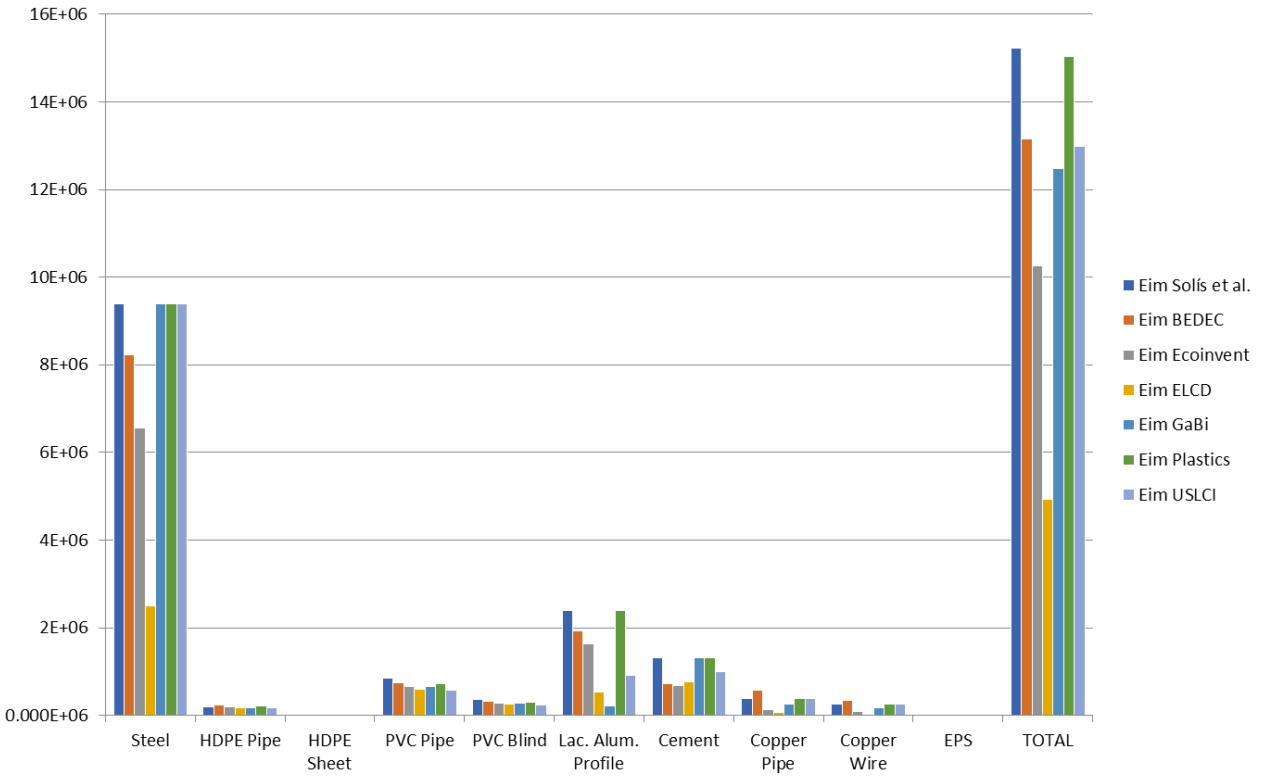
LCA EXAMPLES

Variations between DBs

Comparable data in our case study:

1. Corrugated polyethylene pipe diam. 32 mm. 85,00 MJ/kg.
2. Polyethylene corrugated pipe diam. 25 mm. 85,00 MJ/kg.
3. Polyethylene pipe diam. 90 mm PESOA PN-10. 85,00 MJ/kg.
4. Polyethylene pipe diam. 110 mm PE5OA PN-10. 85,00 MJ/kg.
5. Other polyethylene pipes, various diam. 85,00 MJ/kg.



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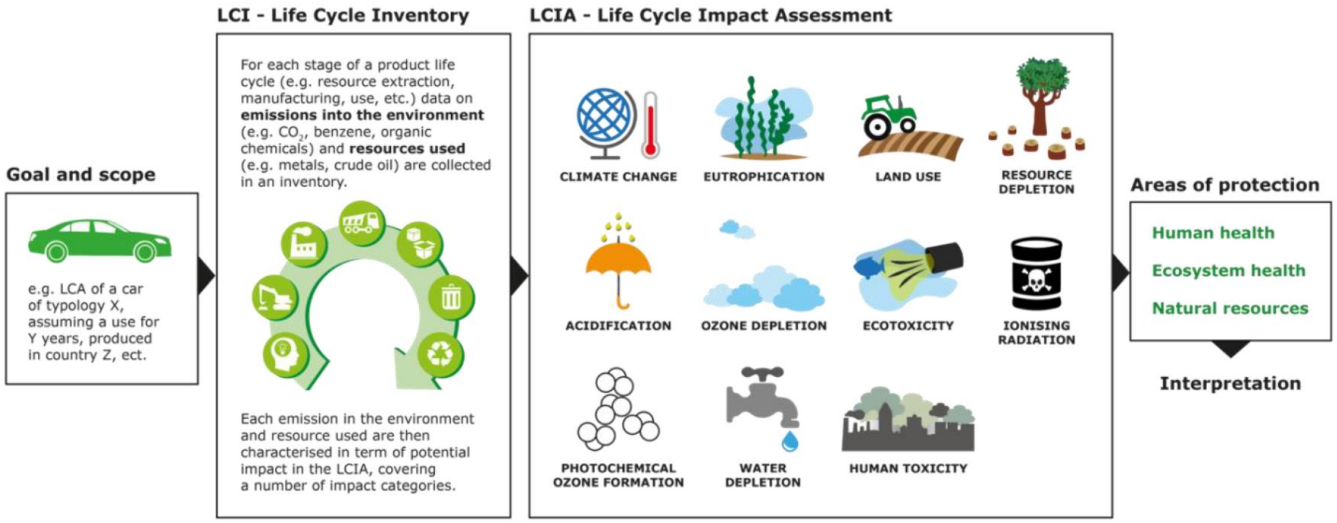
LCA EXAMPLES

LCA examples: EPD content



Source https://eplca.jrc.ec.europa.eu/lifecycleassessment.html

GlobalEPD
A VERIFIED ENVIRONMENTAL DECLARATION

AENOR

Source:
https://gremirajolersvalencia.es/declaracion-ambiental-de-producto/

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LCA EXAMPLES

LCA examples: EPD product construction

CERTIFIED
ENVIRONMENTAL
PRODUCT DECLARATION

EPD **Transparency Summary**

COMPANY NAME	**Spray Polyurethane Foam Alliance**
PRODUCT TYPE	**Building Envelope Insulation**
PRODUCT NAME	Closed-Cell, Medium-Density Spray Polyurethane Foam Insulation
PRODUCT DEFINITION	Closed-cell, medium-density (2.0 lb/ft3) spray polyurethane foam insulation. Spray polyurethane foam is made on the jobsite by combining methylene-diphenelene diisocyanate (MDI or A-side) with an equal volume of a polyol blend (B-side).
PRODUCT CATEGORY RULE (PCR)	**Building Envelope Thermal Insulation** ULE 2011
CERTIFICATION PERIOD	**10/10/2013 – 10/10/2018**
DECLARATION NUMBER	**13CA29310.101.1**

Source: https://www.constructionspecifier.com/environmental-product-declarations/

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LCA EXAMPLES

LCA examples: EPD product construction

LIFECYCLE IMPACT CATEGORIES

The environmental impacts listed below were assessed throughout the product's lifecycle – including raw material extraction, transportation, manufacturing, packaging, use, and disposal at end of life.

ATMOSPHERE			WATER		EARTH	
Global Warming Potential refers to long-term changes in global weather patterns – including temperature and precipitation – that are caused by increased concentrations of greenhouse gases in the atmosphere.	**Ozone Depletion Potential** is the destruction of the stratospheric ozone layer, which shields the earth from ultraviolet radiation that's harmful to life, caused by human-made air pollution.	**Photochemical Ozone Creation Potential** happens when sunlight reacts with hydrocarbons, nitrogen oxides, and volatile organic compounds, to produce a type of air pollution known as smog.	**Acidification Potential** is the result of human-made emissions and refers to the decrease in pH and increase in acidity of oceans, lakes, rivers, and streams – a phenomenon that pollutes groundwater and harms aquatic life.	**Eutrophication Potential** occurs when excessive nutrients cause increased algae growth in lakes, blocking the underwater penetration of sunlight needed to produce oxygen and resulting in the loss of aquatic life.	**Depletion of Abiotic Resources (Elements)** refers to the reduction of available non-renewable resources, such as metals and gases, that are found on the periodic table of elements, due to human activity.	**Depletion of Abiotic Resources (Fossil Fuels)** refers to the decreasing availability of non-renewable carbon-based compounds, such as oil and coal, due to human activity.
TRACI: 316.00 kg CO2 eq.	0 kg CFC-11 eq.	35.54 kg O3 eq.	188.78 H+ moles eq.	0.1496 kg N eq.	1.02 kg	5987.91 MJ
CML:						

FUNCTIONAL UNIT: The declared unit is 1 cubic meter of Particleboard which is equal to 565 square feet (3/4" thickness). The average density of North American Particleboard including resin is 709.79 kg/m3 excluding moisture content. Results are expressed for a cradle-to-gate analysis and exclude use phase and end of life impacts.

UL Environment

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SOURCES

Standards in support of BIM. UNE. https://www.une.org/normalizacion_documentos/informe-bim.pdf

DIRECTIVE 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC. https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=celex%3A32014L0024

EU BIM TASK GROUP. http://www.eubim.eu/

Handbook for the introduction of BIM methodology by the European public sector. Strategic action for productivity in the construction sector: driving value creation, innovation and growth. EU BIM TASK GROUP. http://www.eubim.eu/wp-content/uploads/2018/02/GROW-2017-01356-00-00-ES-TRA-00.pdf

Law 9/2017 of 8 November on Public Sector Contracts, transposing into Spanish law the Directives of the European Parliament and of the Council 2014/23/EU and 2014/24/EU of 26 February 2014. https://www.boe.es/buscar/act.php?id=BOE-A-2017-12902

BIM Commission. https://www.esbim.es/

Royal Decree 1515/2018, of 28 December, creating the Interministerial Commission for the incorporation of BIM methodology in public procurement.

https://www.boe.es/buscar/doc.php?id=BOE-A-2019-1368

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Tender Observatory. Analysis of the Inclusion of BIM Requirements in Spanish Public Tendering. Report 08. Third Quarter 2019. https://www.esbim.es/wp-content/uploads/2020/04/Informe-Licitaciones-3trim2019.pdf

Introduction to EN-ISO 19650. BuildingSMART. Link.

UNE Standards. https://www.une.org/encuentra-tu-norma/

ISO Standards. https://www.iso.org/home.html

BIMEPD

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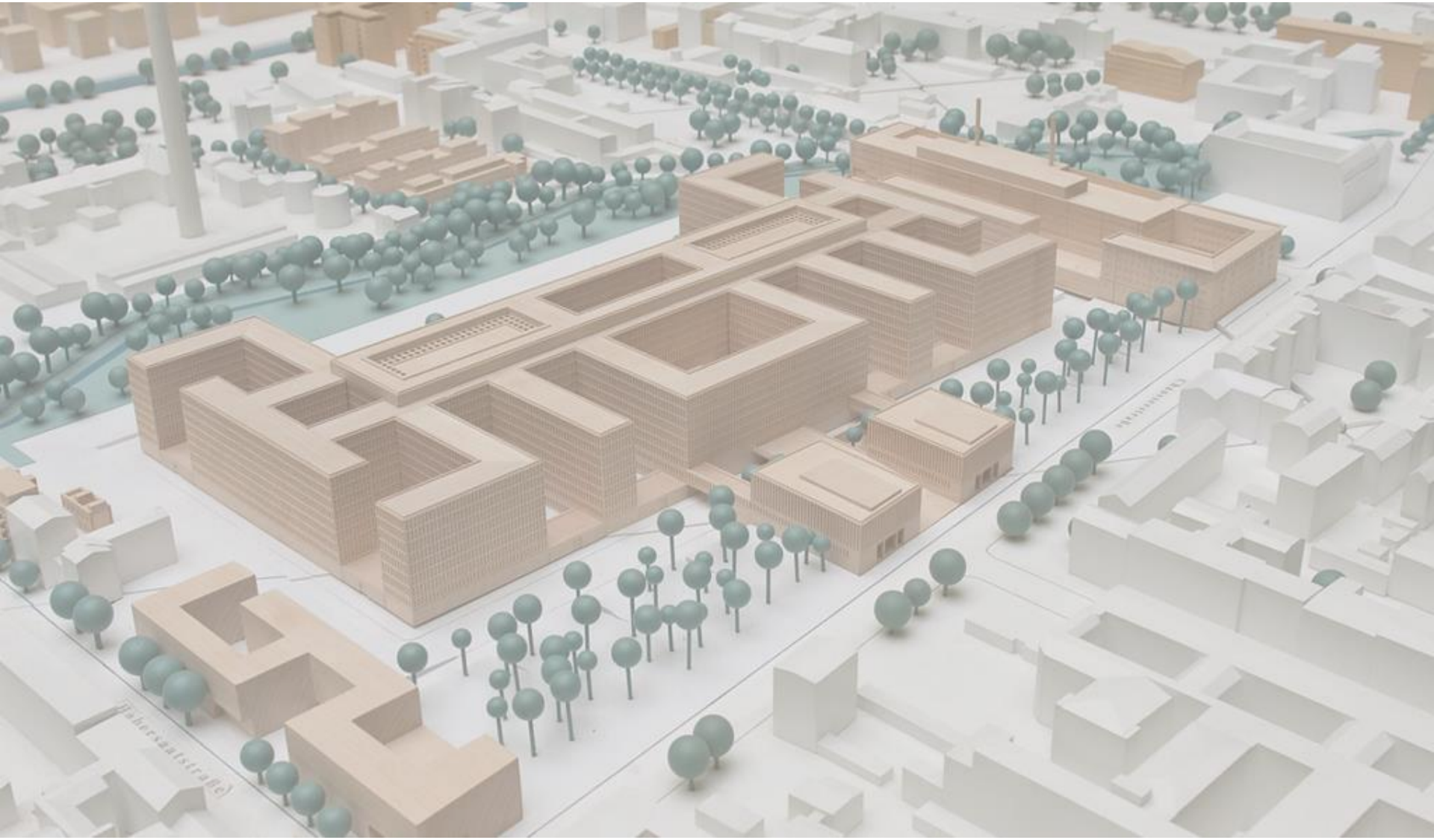

COAMU COLEGIO OFICIAL DE ARQUITECTOS REGIÓN DE MURCIA

iED institute of Entrepreneurship Development

CTm Centro Tecnológico del mármol, piedra y materiales

Warsaw University of Technology

BULGARIAN GREEN BUILDING COUNCIL

cype

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