Towards **positive energy** and **low carbon buildings**

E+ C−

ÉNERGIE POSITIVE & RÉDUCTION CARBONE

The French Experimentation for new buildings

Ministry for an Ecological and Solidarity Transition - Ministry of Territory Cohesion
Directorate of Buildings, Urban Planning and Landscapes

Towards **positive energy** and **low carbon buildings**

From a thermal to an environmental regulation framework

Technical baselines

Levels to reach – Energy and Carbon footprint

Experimentation and label

Comparison: LEVEL(S) / E+C-

From a thermal to an environmental regulation framework

- **1st step : Broad consultation of the construction sector**
  - *April 2015 - July 2016*

1 steering committee

7 working groups

consultation

Technical baseline
Energy - Carbon

- Rules for LCA of buildings
- Imput data for LCA
- Levels

- **2nd step : National volontary trial programm for new constructions: residential + office building**
  - *Started in November 2016*

From a thermal to an environmental regulation framework

The French Law (Transition Energétique pour la Croissance Verte LTECV) encourages new buildings to be low energy (positive energy buildings) and low carbon

Low energy buildings

- Reduction of the non renewable energy consumption
- Development of efficient solutions (insulation, thermal systems, …)
- Development of onwn use of renewable energy and its exportation towards the network

Low carbon buildings

- Reduction of the GHG emissions on the whole life cycle of the building
- Elaboration of an optimal CO2 balance between the impacts of construction products/devices and energy impact

A challenge for innovation and skills development in the building sector

Towards **positive energy** and **low carbon buildings**

From a thermal to an environmental regulation framework

Technical baseline

Energy

Carbon

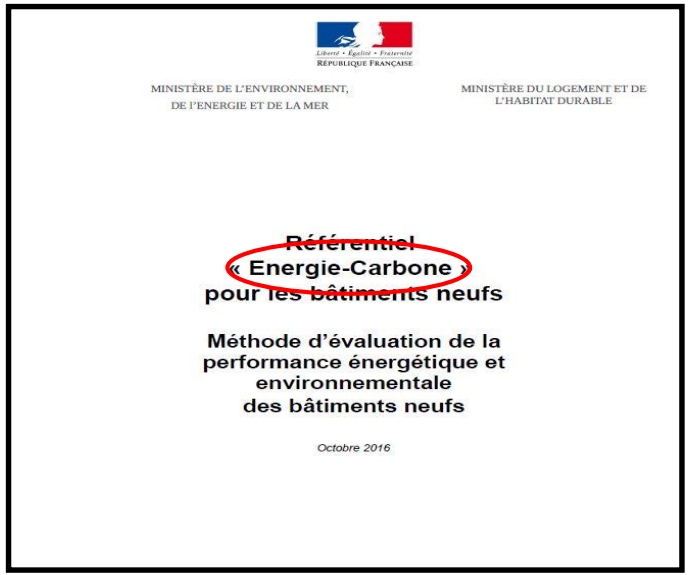
Levels to reach - Energy and Carbon

Experimentation and label

Comparison : LEVEL(S) / E+C-

Technical baseline

A technical baseline has been established on a shared basis with a large panel of stakeholders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RÉPUBLIQUE FRANÇAISE

MINISTÈRE DE L'ENVIRONNEMENT, DE L'ENERGIE ET DE LA MER

MINISTÈRE DU LOGEMENT ET DE L'HABITAT DURABLE

Référentiel « Energie-Carbone » pour les bâtiments neufs

Méthode d'évaluation de la performance énergétique et environnementale des bâtiments neufs

Octobre 2016

This baseline lays down the rules for

- Energy calculations
- Environmental assessment (definition of assumptions for the LCA of buildings)

Baseline available on *www.batiment-energiecarbone.fr*

Technical baseline – Energy

RT 2012

Bbio	Needs of energy during the operation for the building: heating (air and domestic water), cooling and lighting
Cep	Energy consumption during the operation of the building: heating (air and domestic water), cooling, ventilation and lighting

BEPOS Balance = $\sum$

$kWh_{ep}/m^2_{SRT}/an$

All uses of energy are considered

(=uses other than RT2012 including energy consumed by equipment owned by the occupants)

Non renewable energy consumption

Drivers

- Reduction of energy consumption
- Increase of the onwn use of renewable energy

Exported renewable energy in the network

Driver

- Integratation in the network of the local production of renewable energy

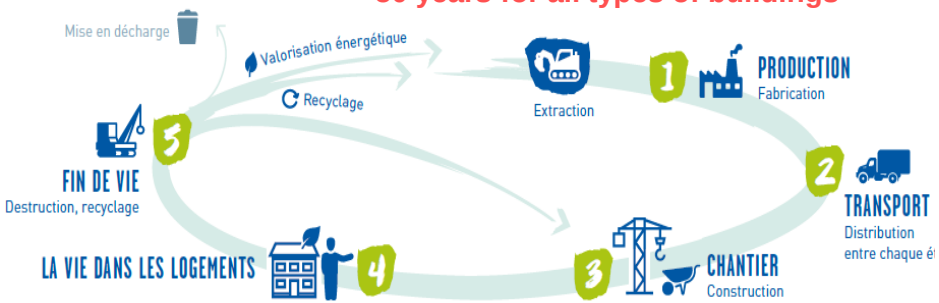
Technical baseline – Carbon

Carbon means GHG emissions related to energy use in operation + embodied carbon in construction products and devices during the reference study period

Based on a LCA environmental assessment

- All environmental impacts are calculated (multi-criteria assessment – NF EN 15804+A1 / PEP 3rd edition and NF EN 15978)
- For each step of the life cycle of the building (multi-steps assessment)

Reference study period
50 years for all types of buildings



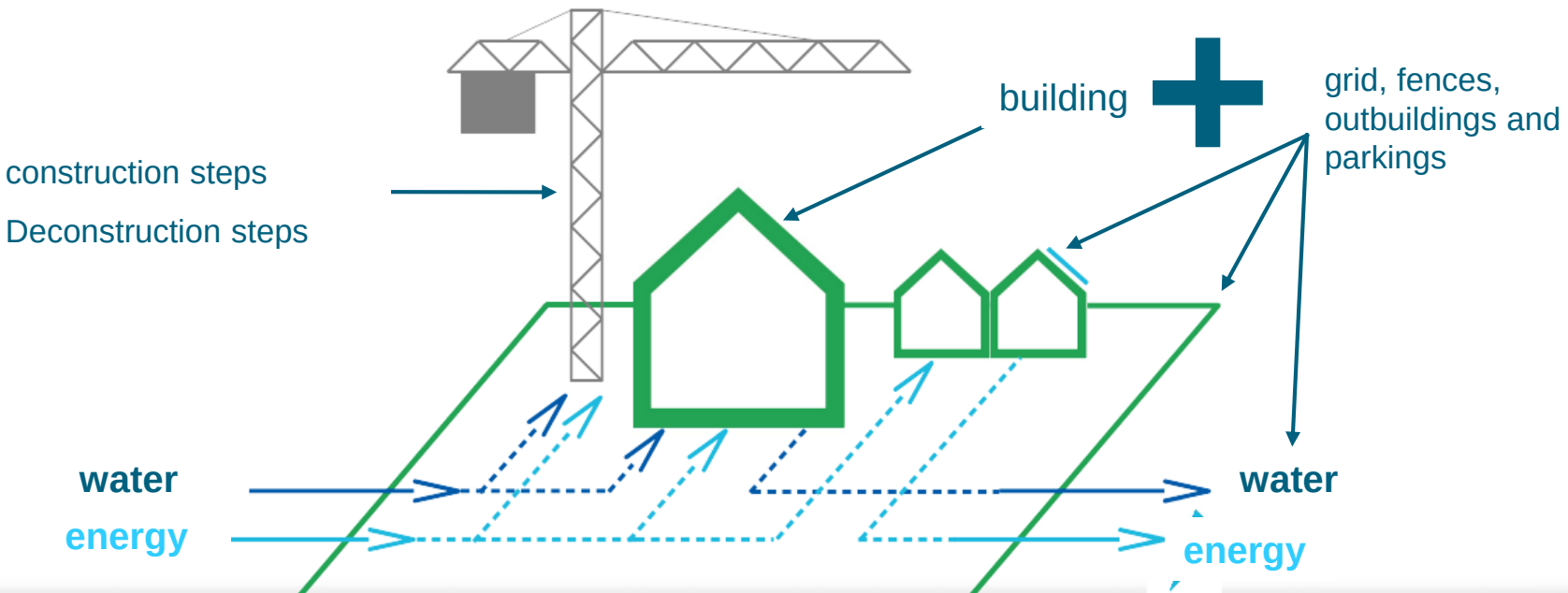
Objectives

- Limit the transfer of impacts between the various steps of the LCA
- Identify drivers to reduce environmental impacts (optimization)

Prerequisites

- A repeatable assessment
- An operating/quick and reliable assessment

Which boundaries for the environnemental assessment?

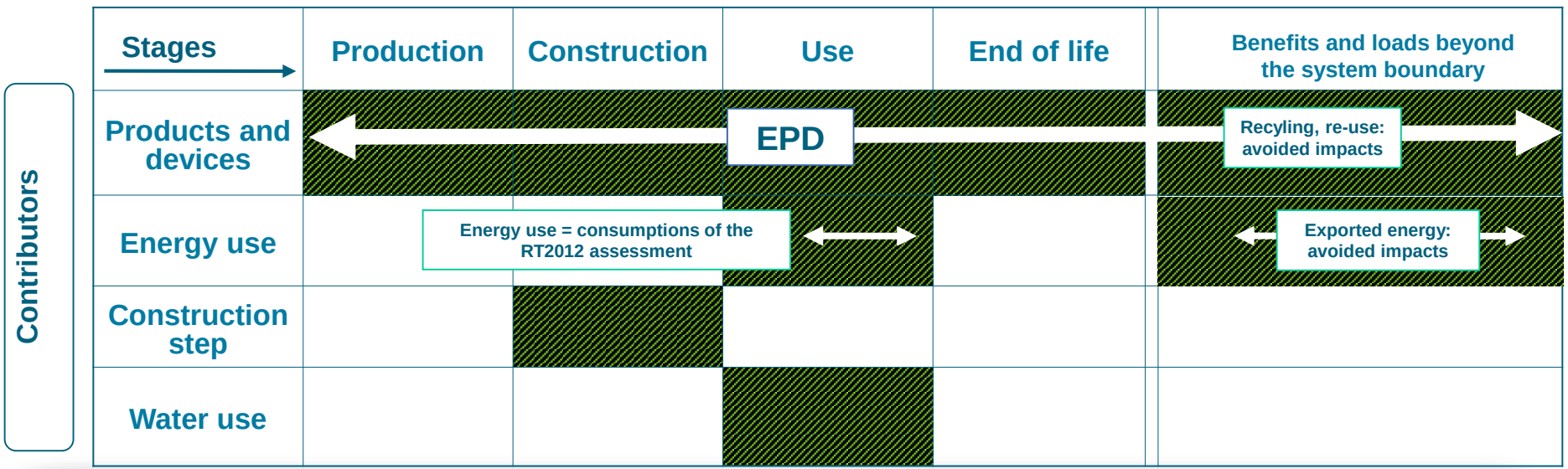


Technical baseline - Carbon

Computed stage

Building LCA

Reference study period = 50 years



Technical baseline - Carbon

A comprehensive method

- Using EPD for 1 to 13

Comprehensive building description

1. External works (works sections, includings roads, distribution and collective service or utilities plus landscaping)
2. Foundations and infrastructure
3. Superstructure - Masonry
4. Roofing - Framing - Zinc works
5. Partitioning - Lining - Suspended ceilings - Interior woodwork
6. Facades and exterior joinery
7. Floor, walls and ceilings coverings - Screed -Paintings - Decorative Products
8. HVAC (Heating - Ventilation - Cooling - DHW)
9. Sanitary facilities
10. Electrical and communications power systems (high current and low current)
11. Safety of people and buildings
12. Lifts
13. Equipment of local electricity generation

Which indicators are calculated?

CO2 indicators

- **Eges** measures GHG emissions of the whole building during the reference service life period
- **$Eges_{PCE}$** construction products and equipments (CPE) => measures GHG emissions of products and equipment

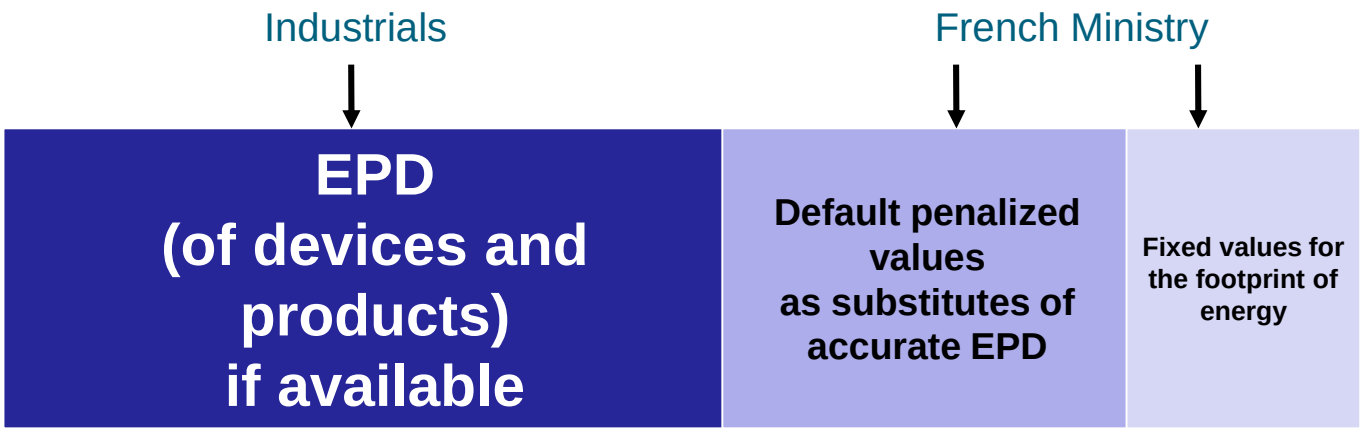
+ **All other** NF EN 15804+A1 / PEP 3rd edition and NF EN 15978 **indicators**

= **27 calculated indicators**

Expression of results

by m^2floor (SPD) and for 50 years

Which input data for the environmental assessment?



2 goals of the French authorities

- **Increase** the amount of **EPD** (NF EN 15804+A1 / PEP 3rd edition with an independent third party review) provided by industrials
- **Improve** the **quality** of those data and their **consistency** with the methodology of the environmental assessment of buildings

Which database for the assessment ?

Environmental and health reference data for building

http://www.inies.fr/home/

Geographical representativeness

The INIES database is run by the **supervisory board** and the **technical committee**

- The **supervisory board**, chaired by the French Ministry ensures that the database operates ethically and professionally
- The **technical committee** oversees the collection and processing of data as well as database content updates

1 database – 2 rewiewing programs

- INIES for FDES (EPD of products)
- PEP ecopassport (EPD of equipments)

EPD are verified by an independant third party reviewer

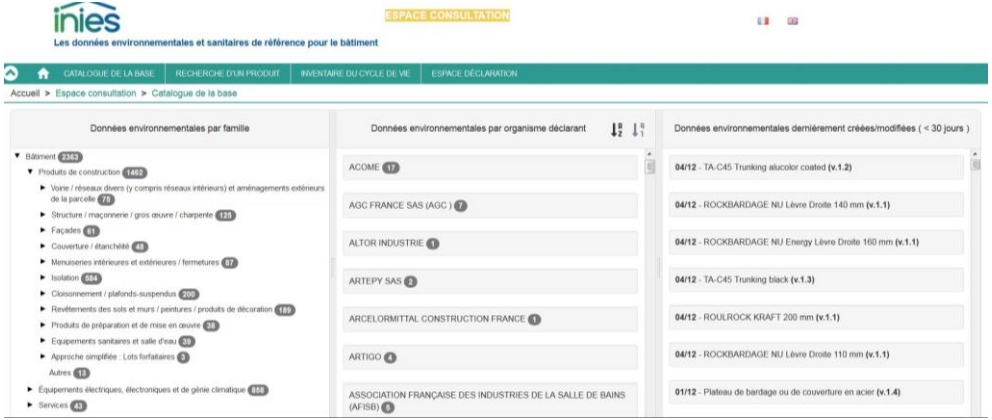
Quality?

1) A procedure exists to control reviewers competences (managed by INIES SC)
- Professional experience (professional 4 years, construction sector 2 years, LCA practice, EPD, critical review, verification in construction sector…)
- Profeciency testing
- Renewal every 3 years

2) INIES committees may arbitrate verification conflicts

Digitalisation of data and web services for operating LCA

INIES Database - EPD in **XML format**



connected

Industrial softwares for data – to adapt EPD to specific data settings

BETie – Béton et Impacts Environnementaux

SAVE – SOLUTIONS ACIER VALEURS ENVIRONNEMENTALES

DEbois

connected

connected

LCA softwares validated by the Ministry for the E+C- assessment

elodie

One Click LCA

climaWin

nova EQUER

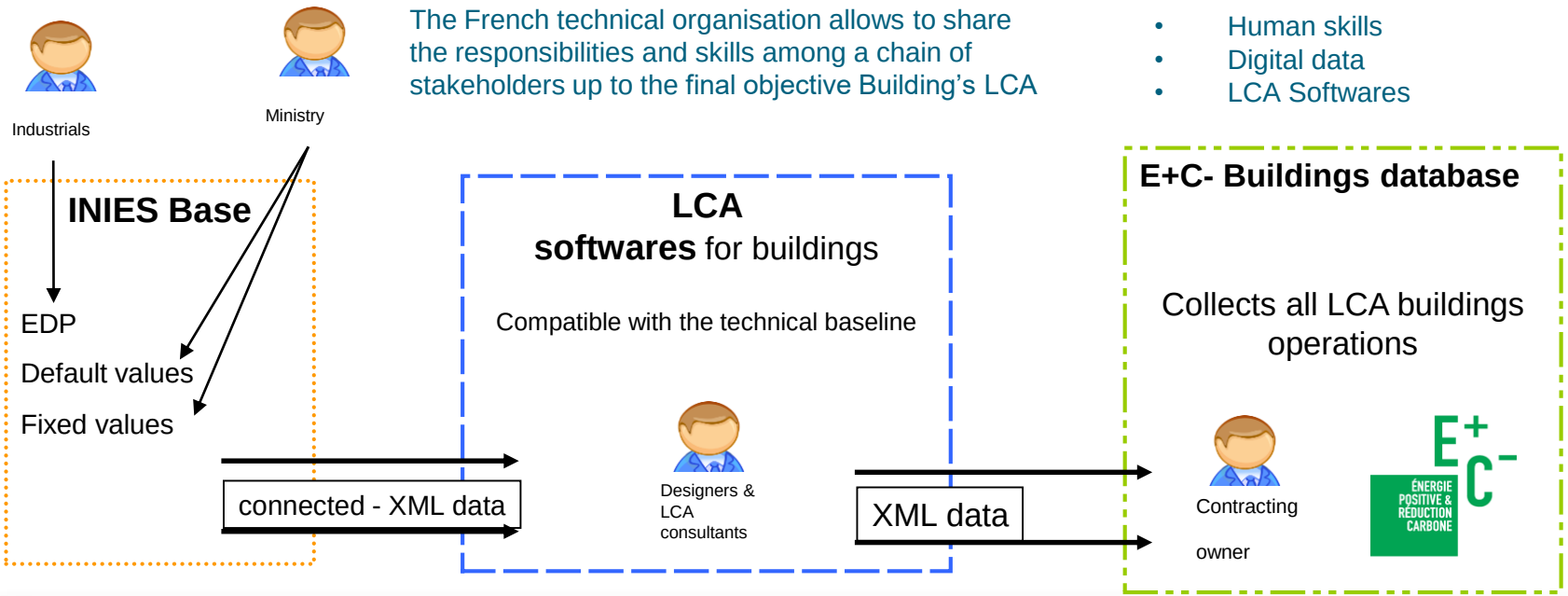
THERM ACV

How to use these digital EPD for building LCA ?

1 - 2 days operating assessment

- Human skills
- Digital data
- LCA Softwares

The French technical organisation allows to share the responsibilities and skills among a chain of stakeholders up to the final objective Building's LCA



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From a thermal to an environmental regulation framework

Technical baseline

Levels to reach – Energy and Carbon

Experimentation and label

Comparison : LEVEL(S) / E+C-

Energy

Energy 1 Energy 2

Reduce energy consumption AND/OR use renewable energy

- **Housing buildings**
  Between -5% and -10% of non renewable energy compared to current RT2012 regulation
- **Office buildings**
  Between -15% and -30%

Energy 3

Reduce energy consumption AND use renewable energy

- **Housing buildings**
  -20% of non renewable energy and +20 kWh/m²an of renewable energy
- **Office buildings**
  -40% and +40 kWh/m²an of renewable energy

Energy 4

Positive energy target

Renewable energy production compensates all uses of non renewable energy consumption (the indicator “BEPOS Balance” is < 0)

Greenhouse gas emissions

- One threshold for all the contributors: use phase, products and devices, water consumption, construction
- One threshold for the contributor “construction products and devices” in order to ensure a minimum effort for this contributor

Carbon 1

- Enable efforts between the energy consumption and the building process
- None constructive way is excluded

Carbon 2

- Strengthen CO_2 reduction by optimizing choices related both to the use phase (energy consumption) and the building process

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Comparison : LEVEL(S) / E+C-

An *in situ* Experimentation and label

3 tools to ensure the deployment of buildings LCA, data quality and repeteability

Technical baseline + levels

\+

Label

\+

Database + stakeholders community

An *in situ* Experimentation and label

Assessment of the technical and economical feasibility of the methodology and the performance levels

- Apply the methodology on real cases
- Fix the “cost optimal” targets
- Calibrate relevant performance levels able to promote innovation without excluding constructive modes and energy vectors
- Expect learning of the LCA concept applied to the building sector (LCA of products and devices, LCA of buildings, development of software, ...)

How ?

- Capitalize on building operations (representative of the building sector) thanks to an observatory and a data basis
- Collect studies about the relevancy of the methodology and targets (various working groups are launched)
- Involvement of stakeholders in the governance of the Experimentation

An *in situ* Experimentation and label

Objectives

- Guarantee the quality
- Represent a control
- Promote the best building solutions

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Requirements

- Both energy consumption and GHG emissions are assessed
- Gradual requirements
- Specific thresholds adjusted to each kind of building, localization, ...
- Six certifying bodies have contracted with the French State

An *in situ* Experimentation and label

www.batiment-energiecarbone.fr

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Consistency LEVEL(S) / E+C-

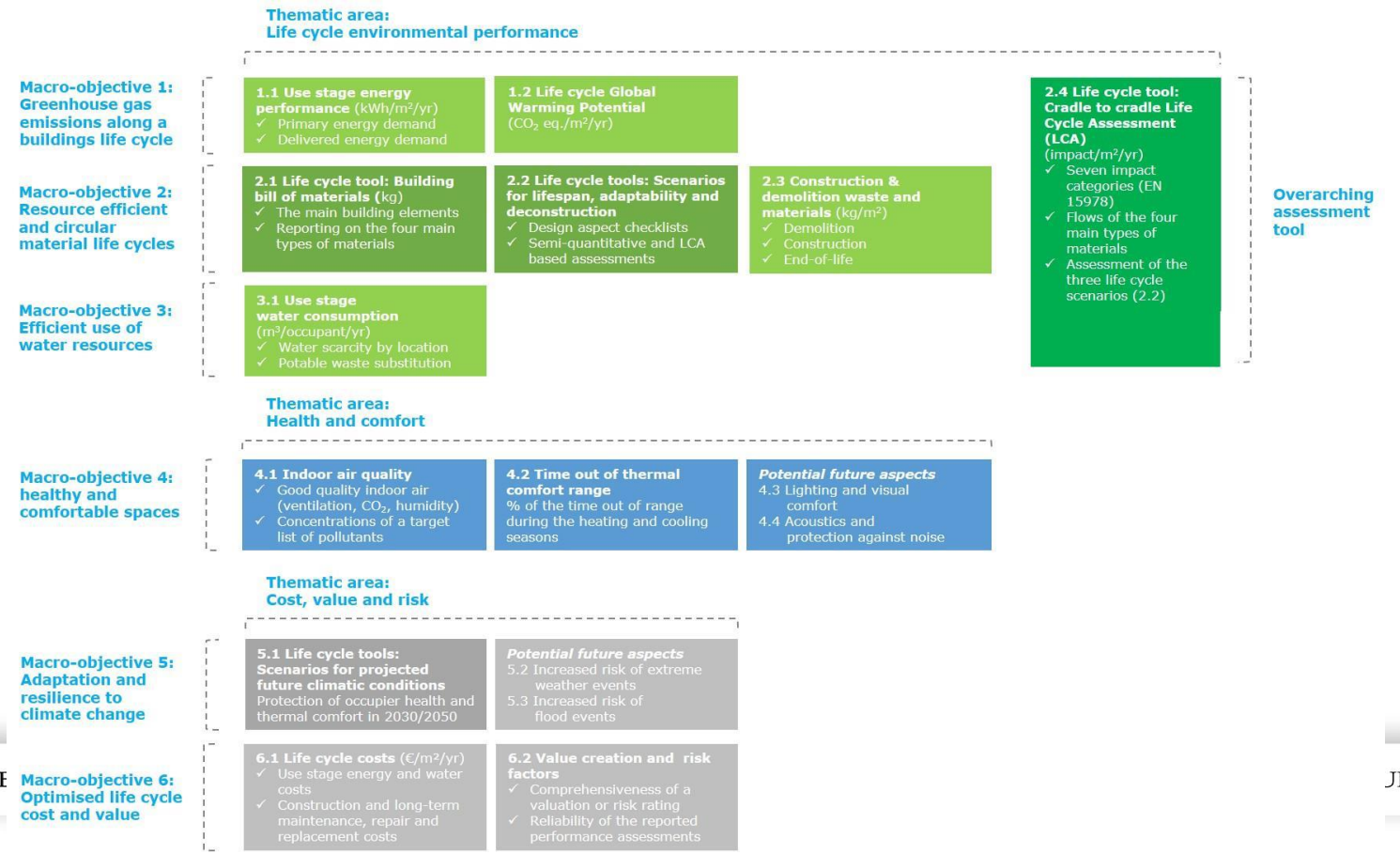

Figure 2.1 Overview of the Level(s) framework

LEVEL(S)	E+C-
Unit: kWh/m2/an **Indicator 1**: Primary energy demand over 5 conventional energy uses Separate quantification of renewable exported energy **Indicator 2**: Final energy demand **Static or dynamic method** **Complementary requirements**: air permeability measurement, network tightness, infrared monitoring, … **Surface**: useful internal floor area from international IPMS	**Unit: kWh/m2/an** **RT2012 indicators**: Bbio, Cep (primary energy demand over 5 uses), … **BEPOS Balance**: primary non-renewable and renewable demand over all uses Towards a **dynamic method** **Surface**: SHON-RT2012 (necessity to clarify the difference with IPMS)

LEVEL(S)	E+C-
Quantification of global warming potential according to EN15978 over the whole life cycle	**Quantification of all LCA indicators** of EN15978 over the whole life cycle
Cradle to grave approach	**Cradle to grave approach** + module D
Reference study period: 60 years	**Reference study period**: 50 years **Perimeter**: building + plot
Discrete replacement rate of equipments/products	Decimal replacement rate of equipments/products
Limited number of GHGs taken into account	**Exhaustive number of GHGs** taken into account
Generic data (not contextualized)	**Specific data** provided by the industrials (FR EN 15084 + CN for products and PEP Ed. 3 for equipments). Contextualization to the French context.

LEVEL(S)	E+C-
Life cycle tool: Building bill of materials (BoM) Reporting on the Bill of quantities for the building, as well as for the four main types of materials used	**All physical building description (quantities)** **EPD : FDES (NF EN 15804+CN) and PEP (XPC-08-100-1 / 3rd edition)**
Construction and demolition waste and materials kg waste and materials per m2 of total useful floor area (per life cycle and project stage reported on)	**LCA waste indicators (kg/m2SDP for 50 years) : cradle to grave (EN15978)** Hazardous Non hazardous
Overarching assessment tool: Cradle to grave Life Cycle Assessment 7 environmental impact category indicators / per m2 / per year Reference service life : 60 years	**All LCA indicators of EN15978 (indicators / per m2 SDP for 50 years)** Reference service life: 50 years

LEVEL(S)	E+C-
Total water consumption (m3/occupant/yr) Focus on common sanitary devices/fittings and water consuming appliances (default values possible) Usage factors and default occupancy rates (irrigation excluded) Defined baseline scenarios (total/potable/non potable)	**Contributor « Water use » = all uses of water during the service life of the building (consumption and reject)** Focus on common sanitary devices/fittings and water consuming appliances (default values and correction values for water reducing consumptions devices) Usage factors and default occupancy rates (irrigation included) Defined baseline scenarios (total/potable/non potable) **2) LCA indicator on water use (EN15978)**

LEVEL(S)	E+C-
Indicator of indoor air quality Good quality indoor air: Parameters for ventilation (rate), CO2, humidity, benzene, PM, radon, mould Target list of pollutants: Emissions from construction products and external air intake. (VOCs, LCI, F)	**French regulations on :** Ventilation systems and rates Asbestos, lead, radon and carbon monoxyde Indoor air emissions from products
Time outside of thermal comfort range % of the time out of range of defined maximum and minimum temperatures during the heating and cooling seasons	**French regulation RT2012 : thermal comfort indicator (Tic)**

Consistency

- Voluntary test phase (1.5 - 2 years)
- Common language to track the levels of sustainability performances over the whole life cycle
- Quantification of multiple indicators (not only GHG emissions)
- Making the business starts with a good basis, transfers of practices
- Basis of existing standards
- Possible use at different stages of a building project

E+C- specificities

- Regulatory framework/baseline (RT2012)
- Levels for both Energy and Carbon
- Global costs assessment
- Massification: support of a future rule, needs of stability in methods and data

-Overall consistency for the Energy and assessment of LCA indicators
-Easy transfer of E+C- buildings in Levels with some adjustments (bridges)
-Opportunity of sharing feedbacks

LEVEL(S)	E+C-
Indicator of life cycle costs Euros per square metre of useable floor area per year (€/m2/yr) (LCC ISO 15686-5, study period of 50 years) Type of costs by life cycle stage	**Request form on costs from project master (test phase)** Overall cost