

Level(s) testing Bouygues Construction

Apartment building “Ecoparc Micheville”



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Why testing Level(s) ?

- Growing expectations of our clients towards the environmental performance expression.
- Growing demands in performance guarantees in exploitation (only on energy at the moment).
- Need of a **common reporting format** with indicators for the new thematics (environment / health & comfort / adaptability / flexibility / ...)
- Need for **comparability** of performances on these thematics.

The objectives of testing LEVEL(s) in Bouygues Construction were the following :

- To **analyse** and **assimilate** the LEVEL(s) framework.
- To **compare** this framework with one developed internally.
- To apply LEVEL(s) to a real "**standard**" **project**, with most of the studies usually done.
- To **identify the differences** between what is usually done by the project teams and what is expected in LEVEL(s).
- To identify what it would imply for the project teams if LEVEL(s) was to be applied on all projects.

What did we test ?

Thematic area: Life cycle environmental performance

Macro-objective 1:
Greenhouse gas emissions along a buildings life cycle

1.1 Use stage energy performance (kWh/m²/yr)
✓ Primary energy demand
✓ Delivered energy demand

1.2 Life cycle Global Warming Potential (CO₂ eq./m²/yr)

2.4 Life cycle tool: Cradle to cradle Life Cycle Assessment (LCA) (Impact/m²/yr)
✓ Seven impact categories (EN 15978)
✓ Flows of the four main types of materials
✓ Assessment of the three life cycle scenarios (2.2)

Overarching assessment tool

Macro-objective 2:
Resource efficient and circular material life cycles

2.1 Life cycle tool: Building bill of materials (kg)
✓ The main building elements
✓ Reporting on the four main types of materials

2.2 Life cycle tools: Scenarios for lifespan, adaptability and deconstruction
✓ Design aspect checklists
✓ Semi-quantitative and LCA based assessments

2.3 Construction & demolition waste and materials (kg/m²)
✓ Demolition
✓ Construction
✓ End-of-life

Macro-objective 3:
Efficient use of water resources

3.1 Use stage water consumption (m³/occupant/yr)
✓ Water scarcity by location
✓ Potable waste substitution

Thematic area: Health and comfort

Macro-objective 4:
healthy and comfortable spaces

4.1 Indoor air quality
✓ Good quality indoor air (ventilation, CO₂, humidity)
✓ Concentrations of a target list of pollutants

4.2 Time out of thermal comfort range
% of the time out of range during the heating and cooling seasons

Potential future aspects
4.3 Lighting and visual comfort
4.4 Acoustics and protection against noise

Thematic area: Cost, value and risk

Macro-objective 5:
Adaptation and resilience to climate change

5.1 Life cycle tools: Scenarios for projected future climatic conditions
Protection of occupier health and thermal comfort in 2030/2050

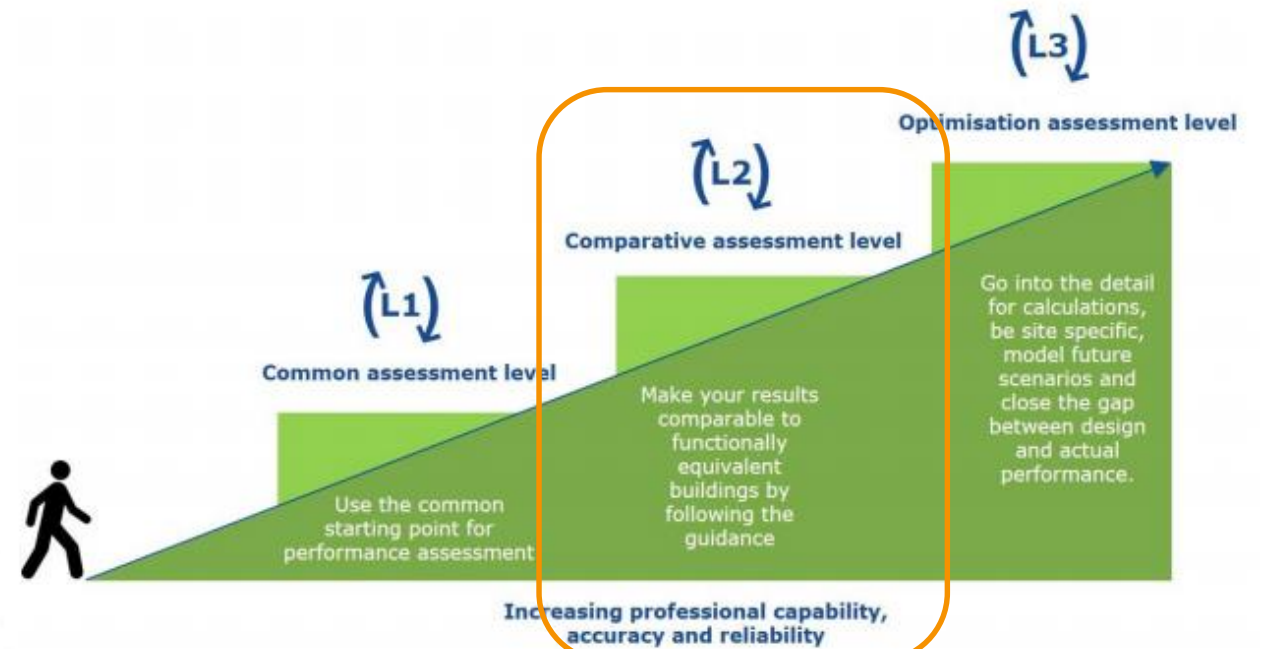
Potential future aspects
5.2 Increased risk of extreme weather events
5.3 Increased risk of flood events

Macro-objective 6:
Optimised life cycle cost and value






6.1 Life cycle costs (C/m²/yr)
✓ Use stage energy and water costs
✓ Construction and long-term maintenance, repair and replacement costs

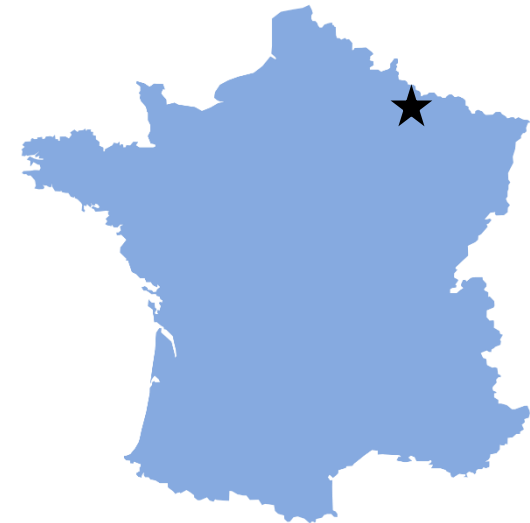
6.2 Value creation and risk factors
✓ Comprehensiveness of a valuation or risk rating
✓ Reliability of the reported performance assessments

**All the indicators, at LEVEL 2
At the design stage**

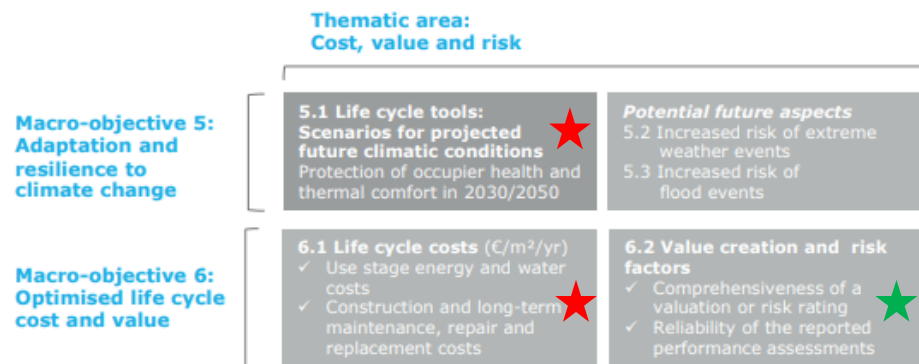
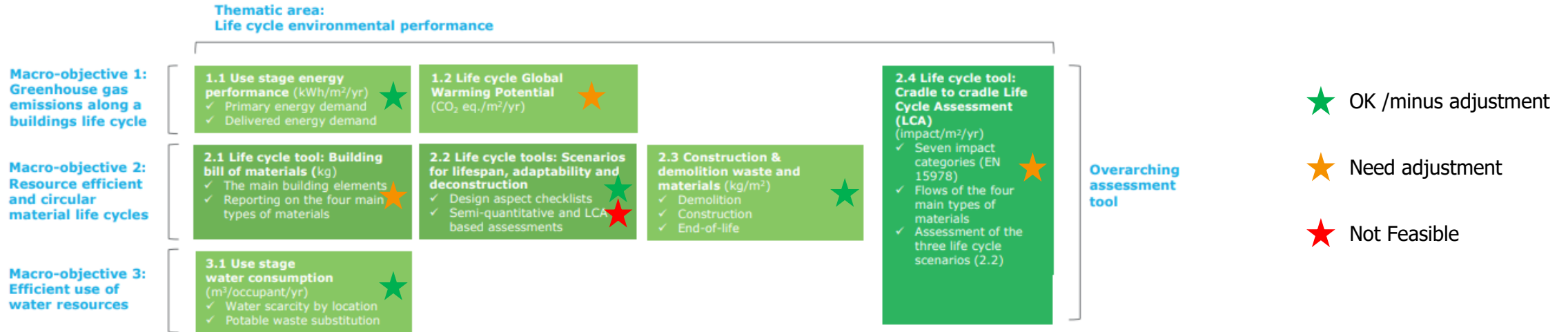


Apartment building "Ecoparc Micheville"

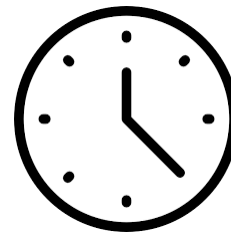
Building characteristics	
Project management	
Builder	 NORD-EST
Floor area (GFA)	2063 m ²
Type of building	24 apartments
Number of floor	5
Heating system	Individual gas
Type of structure	Concrete + CLTI*
Localization	Audun-le-Tiche
LCA tool	
EPD database	
Label & certification	



Feedbacks



General feedbacks



- Requires too much additional time and effort for standard project.
- Should be easier for BREEAM or HQE project.
- Certain indicators are not feasible at the design stage.
- Counterproductive with national standards.
- IPMS unit is not use in France.



- **50 years lifespan** instead of 60 years in LEVEL(s).
- LCA in France are based on **E+C-**, with slight changes from the EN 15978 :
 - Replacement rules (integer vs decimal).
 - Decomposition by sub life cycle phase is not mandatory, only the “macro” one.
- National EPD database **not yet fully EN15978 compatible** :
 - No distinction between biogenic and non biogenic GWP.
 - Some EPDs does not have the decomposition by life cycle phases.
 - Some EPDs are based on NF P01010 (update on the way).
 - Land use and transformation is unknown in France database.
 - Use of non-metallic mineral resources is unknown in France database.

Focus on 4.1 Indoor air Quality



At the design stage :

- No tool or methodology exist to evaluate the requested pollutant emissions
- Tables from the EN16798 are unknown...
- Pollutants emissions' estimations based on French emission class system is not compatible with LEVEL(s)
- No exact values are available
- What about emissions of insulation and wall coverings (not included in LEVEL(s)).

At the completion stage :

- Measurements could be done, but depending on the protocol, results could vary a lot
- Measurements have a big impact on planning, and thus on costs.

CLASSES	C	B	A	A+
Formaldéhyde	* 120	, 120	, 60	, 10
Acétaldéhyde	* 400	, 400	, 300	, 200
Toluène	* 600	, 600	, 450	, 300
Tétrachloroéthylène	* 500	, 500	, 350	, 250
Xylène	* 400	, 400	, 300	, 200
1,2,4-Triméthylbenzène	* 2000	, 2000	, 1500	, 1000
1,4-Dichlorobenzène	* 120	, 120	, 90	, 60
Ethylbenzène	* 1500	, 1500	, 1000	, 750
2-Butoxyéthanol	* 2000	, 2000	, 1500	, 1000
Styrène	* 500	, 500	, 350	, 250
COVT	* 2000	, 2000	, 1500	, 1000

French emissions classes

Focus on 4.2 Time out of thermal comfort range (& 5.1 by extension)



- *4.2 Time out of thermal comfort range :*
 - Not calculated by the regulatory tools.
 - Required a dynamic thermal simulation which are “rarely” done, and nearly never for housing projects.
 - If done, a lot of parameters need to be fixed, and LEVEL(s) do not give any precisions.
- *5.1 Scenarios for projected climatic conditions :*
 - Weather files for this time period does not exist...

Focus on 2.2.S3 Scenarios for building deconstruction and disassembly



- Different tools are suggested...but only TEC1.6 was available at that time.
- Decomposition in the TEC1.6 is different from the one of the bill of materials.
- LCA in France is based on a “product” approach. Decomposition by layers is very difficult / time consuming.

Conclusion & ways of improvement

This experimentation helped us to :

- Understand what is LEVEL(s) and the implications of its deployment.
- Give visibility to the “**global performance approach**”.
- Adjust our internal framework system.
- Identify **bugs** in the common reporting format.

As a way of improvement / evolution, we suggest to :

- Make the reporting format **more user friendly**.
- Whenever relevant, have a reference to **national** regulation / practice, instead of ISO or EN one.
- Go **beyond the reporting** and propose reference buildings (by countries ?).