



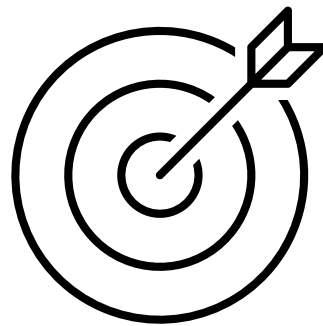
EU-framework for sustainable buildings



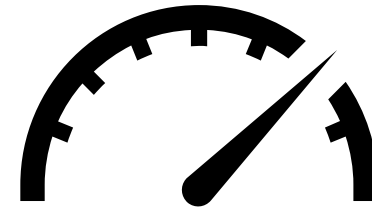
What is Level(s)?



Standardised
reporting framework



Core sustainability
indicators



Common metrics for
life cycle
performance
measurement

Level(s) approach



Level 1 (qualitative): Conceptual design

⇒ Accessible entry point for the use of each indicator, assessments are qualitative



Level 2 (quantitative): Detailed design and construction

⇒ Quantifying the performance of building designs, common units of measurements with reference calculation methods are provided



Level 3 (monitoring): As-built and in-use performance

⇒ Data collection on the real performance of the building project

Level(s) target group



Planning

Public authorities,
policy-makers and
procurers at national,
regional, and local level



Design

Architects, designers,
engineers, and quantity
surveyors



Financing

Clients and investors,
including property owners,
and developers



Execution

Construction companies
and contractors,
asset managers,
facilities managers, and
building occupants

Level(s) macro-objectives

1. Greenhouse gas emissions along the life cycle



4. Healthy and comfortable spaces



2. Ressource efficient and cicular material life cycles



5. Adaption and resillience to climate change



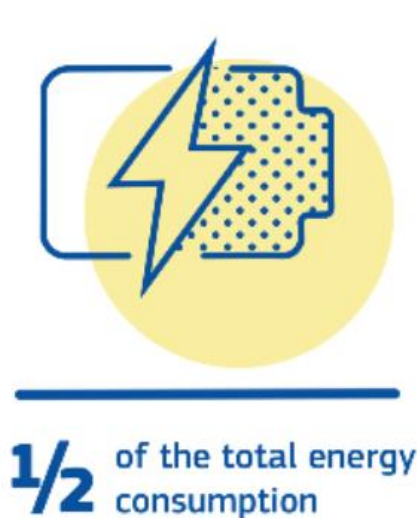
3. Efficient use of water resources



6. Optimised life cycle cost and value



Relevance of macro-objective 1



Operation of buildings accounts for about 30% of all GHG emissions in Germany

- Buildings constructed before 2010: Life cycle focus on use stage primary energy demand
- Newer buildings: Life cycle focus on material use

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



1.1 Use stage energy performance

kilowatt hours per square metre per year
(kWh/m²/yr)

1.2 Life cycle Global Warming Potential

kg CO₂ equivalents per square metre per year
(kg CO₂ eq./m²/yr)

Relevance of macro-objective 2



1/2 of all extracted materials



1/3 of waste generation

- The construction and use of buildings in the EU account for about half of all our extracted materials
- As the energy efficiency of buildings improves, the embodied impacts of materials (e.g. CO₂) and the cost of materials become more significant

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



**2.1 Bill of quantities,
materials and lifespans**

Unit quantities, mass
and years

**2.2 Construction &
demolition waste and
materials**

kg of waste and
materials per m² total
useful floor area

**2.3 Design for adaptability
and renovation**

Adaptability score

**2.4 Design for
deconstruction, reuse and
recycling**

Deconstruction score

Relevance of macro-objective 3



On average each EU citizen uses 160 L/day of water

Macro-objective 3:
Efficient use of water resources



3.1 Use stage water consumption

m³/yr of water per occupant

- Reducing water consumption will reduce the embodied environmental impacts of delivering water to the point of demand
- Growing urban populations are placing more pressure on water supply in urban areas

Relevance of macro-objective 4

~ 200,000
premature deaths
p.a. due to indoor
and outdoor air
pollution (Europe)

We spend
roughly 90% of
our time indoors

Macro-objective 4:
healthy and
comfortable
spaces



- Clean indoor air is a highly important influence on human health and depends on multiple variables but are closely related to pollutant levels (e.g. dust, Volatile Organic Compounds (VOCs) etc.) and air conditions (e.g. CO₂ and humidity).

4.1 Indoor air quality	Parameters for ventilation, CO ₂ and humidity <i>Target list of pollutants:</i> TVOC, formaldehyde, CMR VOC, LCI ratio, mould, benzene, particulates, radon
4.2 Time outside of thermal comfort range	% of the time out of range during the heating and cooling seasons
4.3 Lighting and visual comfort	<i>Level 1 checklist</i>
4.4 Acoustics and protection against noise	<i>Level 1 checklist</i>

Relevance of macro-objective 5

19 years since 2001
rank among the 20
warmest years on
record

Extreme weather
as leading global
risk by likelihood
(Global Risks Report 2021)

Macro-objective 5:
Adaptation and
resilience to
climate change



- The design of more climate change proof buildings requires a focus on adaptation measures that can be incorporated into buildings now or, if necessary, are possible to incorporate at a future point in time

5.1 Protection of occupier health and thermal comfort

Projected % time out of range in the years 2030 and 2050 (see also indicator 4.2)

5.2 Increased risk of extreme weather events

Level 1 checklist (under development)

5.3 Increased risk of flood events

Level 1 checklist (under development)

Relevance of macro-objective 6

Up to 85% of all building-related costs are in the use phase

LCC can significantly increase long-term profitability

- LCC is particularly relevant to achieving an improved environmental performance because higher initial capital costs may be required to achieve lower life cycle running costs

Macro-objective 6:
Optimised life cycle cost and value



6.1 Life cycle costs

Euros per square metre per year (€/m²/yr)

6.2 Value creation and risk exposure

Level 1 checklist

Level(s) indicators & parameter

Macro-objectives	Indicators	Parameter
1: Greenhouse gas and air pollutant emissions along a building's life cycle	1.1 Use stage energy performance	kilowatt hours per square metre per year (kWh/m ² /yr)
	1.2 Life cycle Global Warming Potential	kg CO ₂ equivalents per square metre per year (kg CO ₂ eq./m ² /yr)
2. Resource efficient and circular material life cycles	2.1 Bill of quantities, materials and lifespans	Unit quantities, mass and years
	2.2 Construction & demolition waste and materials	Kg of waste and materials per m ² total useful floor area
	2.3 Design for adaptability and renovation	Adaptability score
	2.4 Design for deconstruction, reuse and recycling	Deconstruction score
3. Efficient use of water resources	3.1 Use stage water consumption	m ³ /yr of water per occupant

Level(s) indicators & parameter

Macro-objectives	Indicators	Parameter
4. Healthy and comfortable spaces	4.1 Indoor air quality	Ventilation, CO2 and humidity, TVOC, mould, benzene, particulates, radon
	4.2 Time outside of thermal comfort range	% of the time out of range during the heating and cooling seasons
	4.3 Lighting and visual comfort	Level 1 checklist
	4.4 Acoustics and protection against noise	Level 1 checklist
5. Adaptation and resilience to climate change	5.1 Protection of occupier health and thermal comfort	Projected % time out of range in the years 2030 and 2050
	5.2 Increased risk of extreme weather events	Level 1 checklist
	5.3 Increased risk of flood events L	Level 1 checklist
6. Optimised life cycle cost and value	6.1 Life cycle costs	Euros per square metre per year (€/m2/yr)
	6.2 Value creation and risk exposure	Level 1 checklist

Level(s) project plan



Step 1

Select the macro-objectives and indicators to address

Step 2

Decide to which 'level' project performance will be assessed

Step 3

Planning the workflow requirement to make Level(s) assessments

Building Description

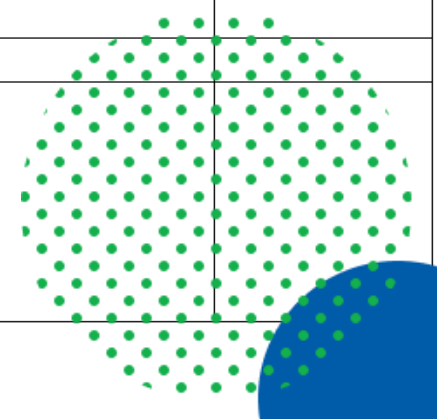


Requirements

Description	Information required
1. Location and climate	1.1 The country and region in which the building is located 1.2 Heating and cooling degree days 1.3 The climatic zone in which the building is located
2. The building typology and age	2.1 The project type 2.2 The year of construction 2.3 The market segment
3. How the building will be used	3.1 The intended conditions of use 3.2 Building occupation and usage patterns 3.3 The intended (or required) service life
4. The building model and characteristics	4.1 The building form 4.2 The total useful floor area within the building and measurement standard used 4.3 The scope of building elements to be assessed and categorisation system used

Reporting

Parameter		Office buildings	Residential buildings
1. Location	1.1 Country and region		
	1.2 Heating and cooling degree days		
	1.3 Climate zone		
2. The building typology and age	2.1 New build or major renovation		
	2.2 The year of construction		
	2.3 Market segment		
3. How the building will be used	3.1 Conditions of use		
	3.2 Building occupation and usage patterns		Not applicable
	3.2.1 Projected occupancy density 3.2.2 Projected pattern of occupation		
	3.3 The intended (or required) service life		
4. The building model and characteristics	4.1 The building form		
	4.2 Total useful floor area		
	4.3 The scope of building elements to be assessed and the categorisation system used		
	4.3.1 The scope of building elements to be assessed		
	4.3.2 The building element categorisation system used		





Level(s): Background

Development of Level(s)

2014 

Initiative of the European Commission*

- Aim to reduce the environmental impact caused by buildings through improved resource efficiency

- Need for common EU reporting framework for assessing the environmental quality of buildings

2018 

Circular Economy Package

- Implementation of the Circular Economy Action Plan



2015 

Circular Economy Action Plan**

- Promote design improvements to reduce environmental impacts

- Increasing the durability and recyclability of components

2017 

Publication of the Level(s) framework

- Beta version
- Flexible indicator system
- Possible integration into existing evaluation systems

Level(s)

* [Communication "Resource efficiency opportunities in the building sector"](#) (2014)

** [Circular Economy Action Plan](#)

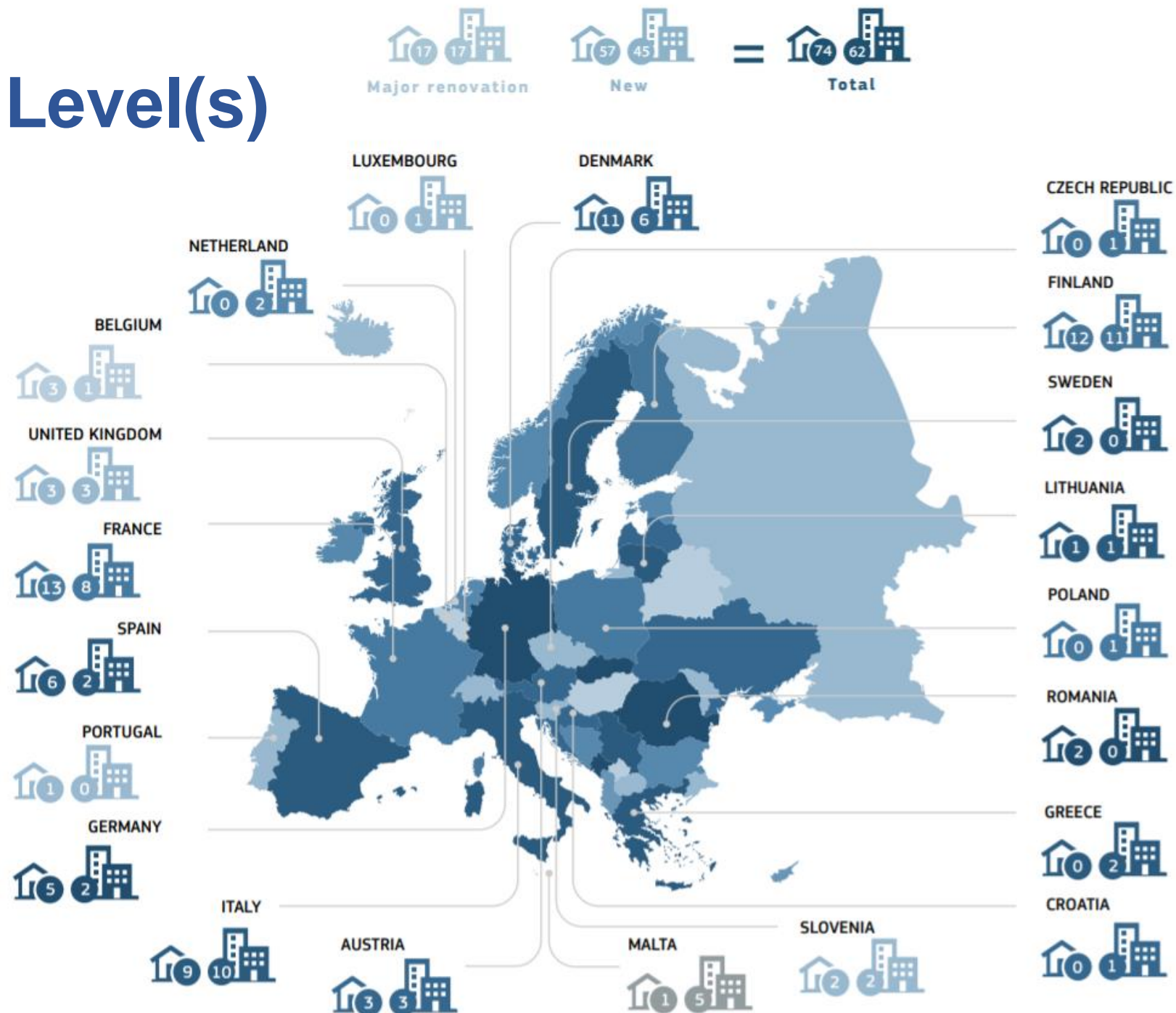
Development of Level(s)

Testing phase

2018 – 03/2020

Revised version

06/2020



Upcoming objectives



**„Renovation Wave“
for Europe**
strategy publication
2020

„Green Public Procurement criteria“
Based on Level(s) for offices and
schools, for new build and renovation,
2022



**„Sustainable Finance –
tackling climate change“**
Delegated Act adoption: 2020
Implementation: 2021

Research –
„Green Deal Call 2020“
(Horizon 2020),
New **Public Private
Partnership** 2021 (Horizon
Europe)

**Web-based
support tool to
work with Level(s)
and web-based
training material**
2021

Derivation of macro-objectives

**Existing EU policy
framework for
resource efficiency
buildings**

**Macro-scale
environmental 'hot
spots' along the life
cycle of buildings**

**Priorities, scope and
boundaries of
existing assessment
and reporting tools**

The key indicators are based on research in 3 areas



Level(s) Indicators: Introduction



Level(s) indicators

1.1: Use stage

energy performance



NOTE: This project has received funding from LIFE Programme under the Grant Agreement number LIFE 18 GIE/ES/000911 Life for LLL(s).



DISCLAIMER: The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Level(s) Key indicators

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



1.1 Use stage energy performance

kilowatt hours per
square metre per year
(kWh/m²/yr)

1.2 Life cycle Global Warming Potential

kg CO₂ equivalents per
square metre per year
(kg CO₂ eq./m²/yr)

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



2.1 Bill of quantities, materials and lifespans

Unit quantities, mass
and years

2.2 Construction & demolition waste and materials

kg of waste and
materials per m² total
useful floor area

2.3 Design for adaptability and renovation

Adaptability score

2.4 Design for deconstruction, reuse and recycling

Deconstruction score

Macro-objective 3: Efficient use of water resources



3.1 Use stage water consumption

m³/yr of water per
occupant

Macro-objective 4: healthy and comfortable spaces



4.1 Indoor air quality

Parameters for
ventilation, CO₂ and
humidity

Target list of pollutants:
TVOC, formaldehyde,
CMR VOC, LCI ratio,
mould, benzene,
particulates, radon

4.2 Time outside of thermal comfort range

% of the time out of
range during the heating
and cooling seasons

4.3 Lighting and visual comfort

Level 1 checklist

4.4 Acoustics and protection against noise

Level 1 checklist

Macro-objective 5: Adaptation and resilience to climate change



5.1 Protection of occupier health and thermal comfort

Projected % time out of
range in the years 2030
and 2050 (*see also*
indicator 4.2)

5.2 Increased risk of extreme weather events

*Level 1 checklist (under
development)*

5.3 Increased risk of flood events

*Level 1 checklist (under
development)*

Macro-objective 6: Optimised life cycle cost and value

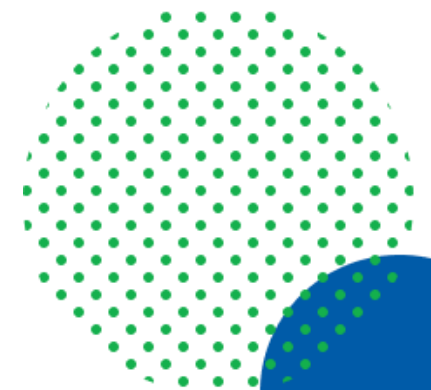


6.1 Life cycle costs

Euros per square metre
per year (€/m²/yr)

6.2 Value creation and risk exposure

Level 1 checklist



Level(s) indicator 1.1

Aim: Reporting and measuring the primary energy performance

Scope: Operational energy consumption

Level 1: Understanding Nearly-Zero Energy Buildings (NZEB) design principles; selection of tailored solutions for major renovation works.

Level 2: Estimates with building permitting assessment and EPB assessment sub types

Level 3: Measuring through construction quality testing, commissioning/functional performance testing and energy performance of buildings assessment sub types

Level 1



Objective: Understanding the energy needs & reduction pathways for primary energy use

Instructions:

- Level(s) building description
- Checklist of energy design concepts and Level 1 technical guide
- Review and identify options for the energy design concepts
- Record the energy design concepts

L1.5 Reporting format

To complete the reporting format for Level 1 you should answer yes or no for each of the design concepts that you have addressed and then provide brief descriptions of the measures or decisions taken for each one.

Energy design concept	Addressed? (yes/no)	How has it been incorporated into the building design concept? (provide a brief description)
1. Minimum energy performance requirements and Near Zero-Energy Building (NZEB) design		
2. Site specific design		
3. Renovation specific design		
4. High quality building fabric and services		
5. Smart monitoring and control systems		

Level 2

Objective: Estimation of energy needs/primary energy use

Instructions:

1. Identify type of energy performance assessment, calculation method and software tools
2. Complete reporting table
3. Gather input data
4. Obtain calculated values for on-site or off-site low carbon energy technologies
5. For renovation projects: provide necessary information about the existing building structure and fabric
6. Use the input data to calculate the energy needs of the building
7. Optional: estimate other occupier energy needs
8. Apply primary energy factors to the energy carriers
9. Continue with design iterations and improvements until the final design
10. Optional: For completed building performance, monitoring and metering strategy should be developed
11. Develop specifications and designs for the energy monitoring systems and metering
12. Complete supporting information table on energy needs
13. Complete the main reporting table

Level 3

Objective: Evaluation of energy needs and building related performance issues

Instructions:

Building fabric and technical services testing

1. Testing for air tightness and thermal integrity
2. Functional performance testing of the HVAC and energy systems
3. Review test reports for possible remedial actions

Monitoring and metering strategy

4. Complete the monitoring metering systems (calibration of meters)
5. Obtaining and compiling the data provided by the installed meters and systems
6. Data collection after completion of the building
7. For comparison with other buildings the performance should be adjusted to the conditions of use
8. Complete the supporting information table on energy needs
9. To obtain the total primary energy use
10. Complete the main reporting table
11. Optional step: Identify the reason for any significant deviations

Prior hand-over

In-use

Level 2 & 3 - Reporting

Necessary for the assessment:

Level 2

- calculation software tool
- input data for calculations
- occupier related energy needs

Level(s) building description

Level 3

- Results from air tightness, thermal integrity and functional performance
- Data from meters and sub-meters

Supporting information

Level 2 reporting item	Information to provide (select/delete as appropriate)
Type of assessment	<i>Building permit, as-built (calculated) EPC or tailored assessment</i>
	<i>Specify the Member State and the method used</i>
Calculation method	<i>The time step for the weather data used by the method e.g. monthly, daily, hourly</i>
Scope of energy needs assessed	<i>The energy needs included in the scope of the calculation method</i>
Unregulated energy needs assessed	<i>The unregulated energy needs assessed in addition to those included in the calculation method</i>

Supporting information

Level 3 reporting item	Information to provide (select/delete as appropriate)
Type of assessment	<i>Measured EPC or other type of corrected (measured) assessment</i>
Sampling period	<i>How long after completion of the building and for how many years</i>
Corrections applied	<i>Please detail any corrections applied to the data and according to which standard.</i>
Primary energy factors	<i>Please identify the calculation method from which the factors used are taken</i>



Level(s) indicator 1.2: Life cycle Global Warming Potential (GWP)



NOTE: This project has received funding from LIFE Programme under the Grant Agreement number LIFE 18 GIE/ES/000911 Life for LLL(s).

DISCLAIMER: The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Level(s) Key indicators

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



1.1 Use stage energy performance

kilowatt hours per
square metre per year
(kWh/m²/yr)

1.2 Life cycle Global Warming Potential

kg CO₂ equivalents per
square metre per year
(kg CO₂ eq./m²/yr)

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



2.1 Bill of quantities, materials and lifespans

Unit quantities, mass
and years

2.2 Construction & demolition waste and materials

kg of waste and
materials per m² total
useful floor area

2.3 Design for adaptability and renovation

Adaptability score

2.4 Design for deconstruction, reuse and recycling

Deconstruction score

Macro-objective 3: Efficient use of water resources



3.1 Use stage water consumption

m³/yr of water per
occupant

Macro-objective 4: healthy and comfortable spaces



4.1 Indoor air quality

Parameters for
ventilation, CO₂ and
humidity

Target list of pollutants:
TVOC, formaldehyde,
CMR VOC, LCI ratio,
mould, benzene,
particulates, radon

4.2 Time outside of thermal comfort range

% of the time out of
range during the heating
and cooling seasons

4.3 Lighting and visual comfort

Level 1 checklist

4.4 Acoustics and protection against noise

Level 1 checklist

Macro-objective 5: Adaptation and resilience to climate change



5.1 Protection of occupier health and thermal comfort

Projected % time out of
range in the years 2030
and 2050 (see also
indicator 4.2)

5.2 Increased risk of extreme weather events

Level 1 checklist (under
development)

5.3 Increased risk of flood events

Level 1 checklist (under
development)

Macro-objective 6: Optimised life cycle cost and value

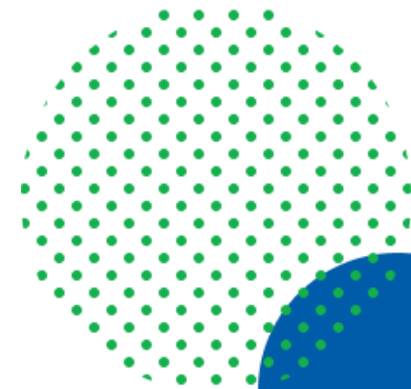


6.1 Life cycle costs

Euros per square metre
per year (€/m²/yr)

6.2 Value creation and risk exposure

Level 1 checklist



Level(s) indicator 1.2

Aim: Reporting and measuring the Global Warming Potential (GWP)

Scope: GWP of a building from “cradle to grave”

Minimum scope:

- Defined within the Level(s) building description: Shell (substructure and superstructure), core (fittings, furnishings and services), external works

Level 1: Understand GHG emissions ‘hot spots’ along buildings life cycle

Level 2: Estimation of greenhouse gas emissions associated with a building design; different design scenarios can be tested

Level 3: Measuring and data validation against as-built information

Level 1

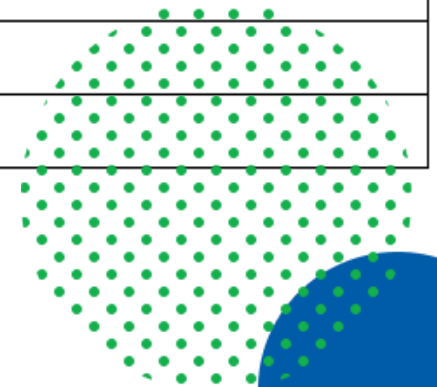


Objective: Understanding the lifecycle concepts for planning stage

Instructions:

1. Read the Part 1 introductory briefing on Whole Life Cycle thinking
2. Level(s) building description
3. Checklist of life cycle design concepts, Level 1 technical guidance
4. Optional: Review relevant LCA/whole life carbon studies
5. Optional: Interpret and identify 'hot spots' and recommendations
6. Review and identify options for using the life cycle design concepts
7. Record the life cycle design concepts

Life cycle design concept	Addressed? (yes/no)	How has it been incorporated into the building design concept? (provide a brief description)
1. Efficient building shape and form		
2. Optimised NZEB construction		
3. Optimised material utilisation and circular value		
4. Extending building and component service lives		
5. Design for adaptability		
6. Design for deconstruction		



Level 2 & 3



Objective: Calculation of life cycle GWP emissions of the building project

Instructions:

1. Level(s) building description
2. Life cycle software tool
3. Setup the model for the project
4. Determine the scope of the life cycle scenarios
5. Identify data sources from available databases
6. Make a classification of the data quality
7. Process the data with life cycle software tool
8. Compile the life cycle inventory and calculate the related impacts for the GWP
9. Additional: Calculate the impacts for the full set of environmental impact categories
10. Interpret the results
11. Options for addressing the hot spots identified
12. Improvements to the design until reaching a design freeze
13. Reporting format

EN 52000-1
EN ISO 13790
EN ISO 13790

Level 2 & 3 - Reporting

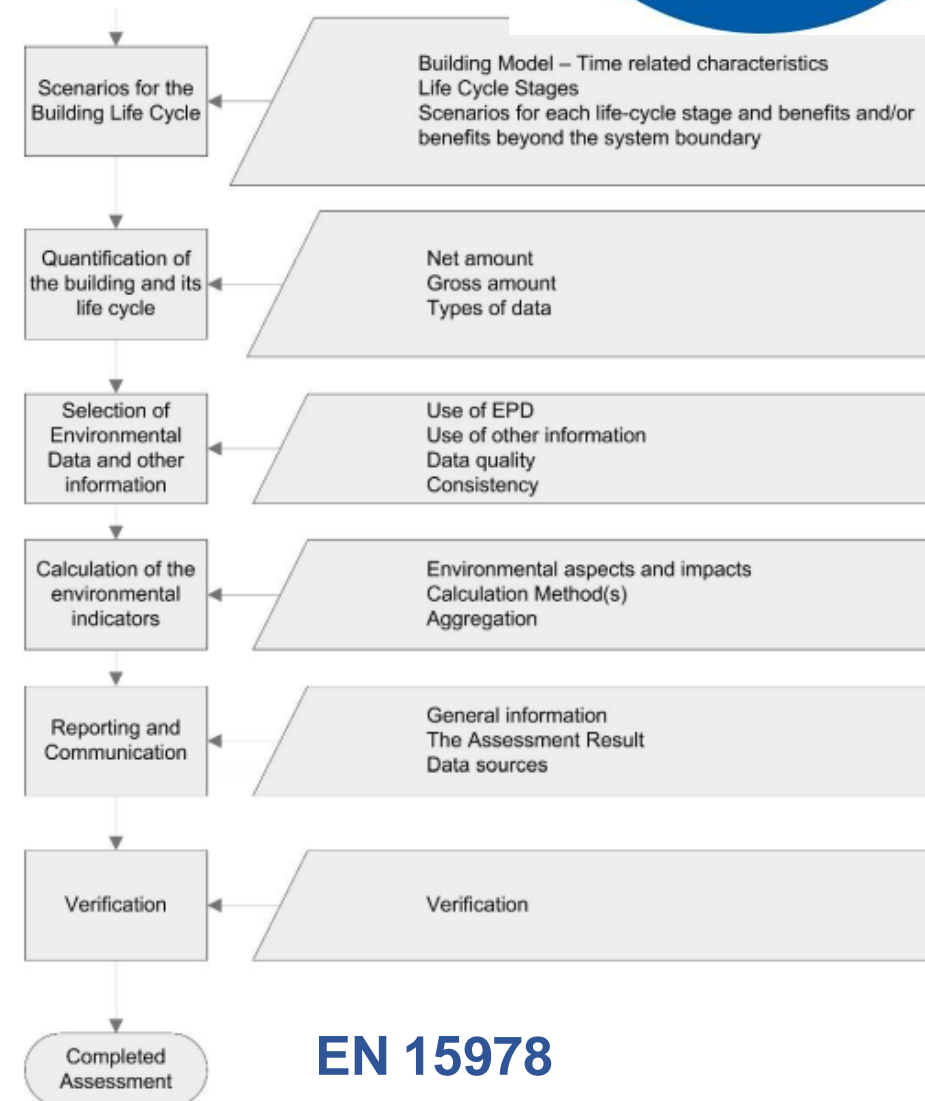


Necessary for the assessment:

- Level(s) building description,
- complete bill of quantities for design(s) that will be modelled
- a calculation software tool
- access to databases and EPDs

Global Warming Potential for each life cycle stage

Indicator	Unit	Product (A1-3)	Construction process (A4-5)	Use stage (B1-7)	End of life (C1-4)	Benefits and loads beyond the system boundary (D)
(1) GWP - fossil	kg CO ₂ eq					
(2) GWP - biogenic	kg CO ₂ eq					
GWP – GHGs (1+2)	kg CO ₂ eq					
(3) GWP – land use and land use change	kg CO ₂ eq					
GWP – overall (1+2+3)	kg CO ₂ eq					
Notes: Impacts referred to the use of 1 m ² of useful internal floor per year for a default reference study period of 50 years ¹ .						



EN 15978



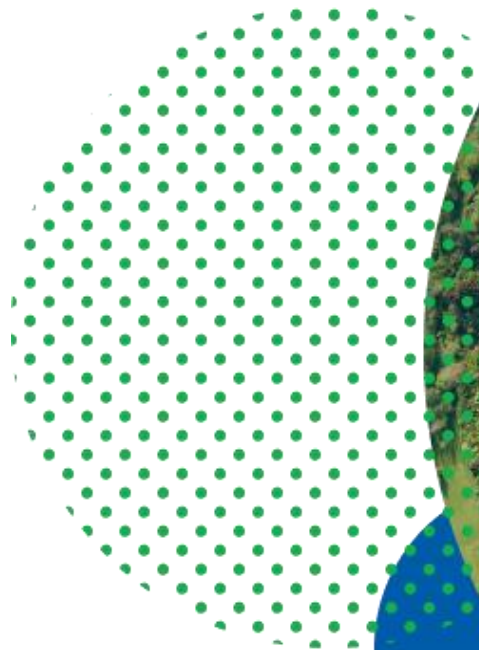
Level(s) indicator 2.1: Bill of Quantities, materials and lifespans



NOTE: This project has received funding from LIFE Programme under the Grant Agreement number LIFE 18 GIE/ES/000911 Life for LLL(s).



DISCLAIMER: The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Level(s) Key indicators



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



1.1 Use stage energy performance

kilowatt hours per
square metre per year
(kWh/m²/yr)

1.2 Life cycle Global Warming Potential

kg CO₂ equivalents per
square metre per year
(kg CO₂ eq./m²/yr)

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



2.1 Bill of quantities, materials and lifespans

Unit quantities, mass
and years

2.2 Construction & demolition waste and materials

kg of waste and
materials per m² total
useful floor area

2.3 Design for adaptability and renovation

Adaptability score

2.4 Design for deconstruction, reuse and recycling

Deconstruction score

Macro-objective 3: Efficient use of water resources



3.1 Use stage water consumption

m³/yr of water per
occupant

Macro-objective 4: healthy and comfortable spaces



4.1 Indoor air quality

Parameters for
ventilation, CO₂ and
humidity

Target list of pollutants:
TVOC, formaldehyde,
CMR VOC, LCI ratio,
mould, benzene,
particulates, radon

4.2 Time outside of thermal comfort range

% of the time out of
range during the heating
and cooling seasons

4.3 Lighting and visual comfort

Level 1 checklist

4.4 Acoustics and protection against noise

Level 1 checklist

Macro-objective 5: Adaptation and resilience to climate change



5.1 Protection of occupier health and thermal comfort

Projected % time out of
range in the years 2030
and 2050 (see also
indicator 4.2)

5.2 Increased risk of extreme weather events

Level 1 checklist (under
development)

5.3 Increased risk of flood events

Level 1 checklist (under
development)

Macro-objective 6: Optimised life cycle cost and value

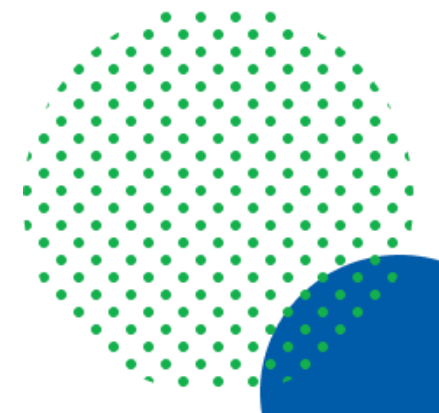


6.1 Life cycle costs

Euros per square metre
per year (€/m²/yr)

6.2 Value creation and risk exposure

Level 1 checklist



Level(s) indicator 2.1: Bill of Quantities, materials and lifespans

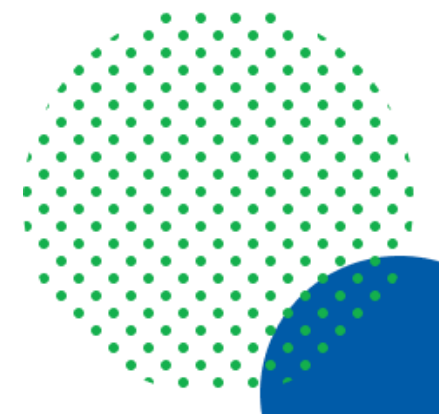
Aim: Reporting and measuring the mass of construction products and materials

Scope: All construction products and materials

Level 1: Decision making for choice of building structure and main materials to use in the shell and core

Level 2: Estimates of Bill of Quantities are compiled in Levels Excel template

Level 3: Measuring the material footprint of the as-built building



Level 1



Objective: Understanding the optimization of consumption of construction materials and products

Instructions:

1. Checklist and Level 1 technical guidance
2. Review and identify design concepts
3. Record design concepts

Checklist & Reporting

1. Consideration of building form on inherent material efficiency of the structure
2. Consideration for optimising material efficiency of structural design
3. Evaluate material efficient design options
4. Durable and repairable building components and systems
5. Optimum use of fit-out materials.
6. Incorporation of recycled materials

Level 2



Objective: Estimate of BoQ during the design stage

Instructions:

1. Define the technical specifications and layout for the building
2. load the Level(s) template for BoQ
3. Draft an outline BoQ for the building shell
4. Refine draft with specific information
5. Optional: Reporting estimated Construction Waste
6. Optional: With indicator 6.1 estimate the cost of construction products and materials
7. Optional: With indicator 1.2 for estimating the carbon and/or other life cycle impacts

Level 3



Objective: Estimate of BoQ during as-built stage

Instructions:

1. Gather quotations for the BoQ provided
2. Download the Level(s) template for BoQ
3. Optional: Fill out the “Quotations” worksheet in the BoQ Level(s) template
4. Insert chosen quotations to the “BoQ input” worksheet
5. Optional: With indicator 6.1 calculating the cost of construction products and materials
6. Optional: With indicator 1.2 calculating the carbon and/or other life cycle impacts

Level 2 & 3 – Reporting

Necessary for the assessment:

Level 2

- Level(s) building description.
- The excel-based Level(s) BoQ template
- Relevant building documentation and design calculations relating to materials and dimensions
- Optional: Assumptions about the split of construction products and materials into different material fractions, the unit cost and estimated service life

Level 3

- Records of quotations sent by suppliers and technical details of the construction product or material
- Purchase records and invoices for construction products and materials actually delivered to site
- The Level(s) BoQ template
- Optional: Access to carbon footprinting or LCA software.

Bill of Quantities/ Materials (for building life time)							
Breakdown by material type			Breakdown by building aspect				Building floor area (m2)
			Shell	Core	External	Total	2500
	Material total (t)	Material total (%)	Split by mass (t)				Totals check (should = 0)
Concrete, brick, tile, natural stone, ceramic	3472	88.7%	3839.6	75	0	3914.6	0
Wood	71.25	1.8%	Split by mass (%)				
Glass	128.04	3.3%	98.1%	1.9%	0.0%	100.0%	
Plastic	3.75	0.1%	Split by cost '000 €				
Bituminous mixtures	0	0.0%	669.825	120	0	789.825	
Metals	239.56	6.1%	Split by cost (%)				
Insulation materials	0	0.0%	84.8%	15.2%	0.0%	100.0%	
Gypsum	0	0.0%	Total cost €/m2		Total cost €/t		
Mixed	0	0.0%	315.9		201.8		
Electrical and Electronic Equipmnt	0	0.0%					
Combined total	3914.6	100.0%					



Level(s) indicator 2.2: Construction and Demolition waste materials



NOTE: This project has received funding from LIFE Programme under the Grant Agreement number LIFE 18 GIE/ES/000911 Life for LLL(s).



DISCLAIMER: The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Level(s) Key indicators

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



1.1 Use stage energy performance

kilowatt hours per
square metre per year
(kWh/m²/yr)

1.2 Life cycle Global Warming Potential

kg CO₂ equivalents per
square metre per year
(kg CO₂ eq./m²/yr)

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



2.1 Bill of quantities, materials and lifespans

Unit quantities, mass
and years

2.2 Construction & demolition waste and materials

kg of waste and
materials per m² total
useful floor area

2.3 Design for adaptability and renovation

Adaptability score

2.4 Design for deconstruction, reuse and recycling

Deconstruction score

Macro-objective 3: Efficient use of water resources



3.1 Use stage water consumption

m³/yr of water per
occupant

Macro-objective 4: healthy and comfortable spaces



4.1 Indoor air quality

Parameters for
ventilation, CO₂ and
humidity

Target list of pollutants:
TVOC, formaldehyde,
CMR VOC, LCI ratio,
mould, benzene,
particulates, radon

4.2 Time outside of thermal comfort range

% of the time out of
range during the heating
and cooling seasons

4.3 Lighting and visual comfort

Level 1 checklist

4.4 Acoustics and protection against noise

Level 1 checklist

Macro-objective 5: Adaptation and resilience to climate change



5.1 Protection of occupier health and thermal comfort

Projected % time out of
range in the years 2030
and 2050 (*see also*
indicator 4.2)

5.2 Increased risk of extreme weather events

*Level 1 checklist (under
development)*

5.3 Increased risk of flood events

*Level 1 checklist (under
development)*

Macro-objective 6: Optimised life cycle cost and value



6.1 Life cycle costs

Euros per square metre
per year (€/m²/yr)

6.2 Value creation and risk exposure

Level 1 checklist



Level(s) indicator 2.2: Construction and Demolition waste materials



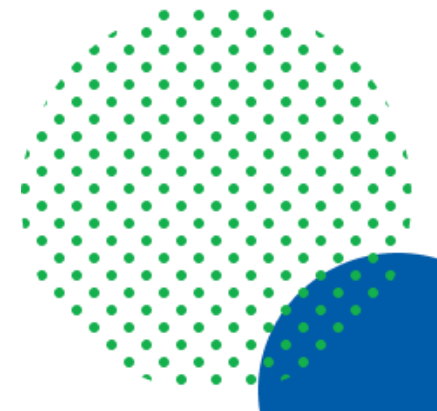
Aim: Systematically plan for the reuse, recycling or recovery

Scope: Include data for all building elements, materials and wastes

Level 1: Decision making for improving the outline Waste Management Plan and quantities of CDW generated

Level 2: Estimates of CDW are compiled in Levels Excel template

Level 3: Estimates of CDW during and after the construction/demolition



Level 1



Objective: Understanding for reducing CDW and optimizing its management

Instructions:

1. Checklist and Level 1 technical guidance
2. Review and identify design concepts
3. Record design concepts

Checklist & Reporting

1. Setting of relevant targets
2. Understand CDW generation and management
3. Pre-demolition auditing
4. Good construction practice
5. Outline Waste Management Plan
6. Consider “Buildings As Material Banks” (BAMB) principles

Level 2



Objective: Make reliable quantitative estimates of CDW

Instructions:

Demolition

1. Carry out a desk study
2. Conduct a field survey
3. Download the Level(s) template for DW estimates
4. Follow the instructions embedded in the Level(s) inventory template
5. Optional: Prepare a Waste Management Plan

Instructions:

Construction

1. Prepare an approximate Bill of materials
2. Download the Level(s) template for DW estimates
4. Insert BoM values into the Level(s) template
5. Select the nature of the waste material
6. Consider the best processes and systems
7. Prepare Waste management plan

Level 3



Objective: Estimating of BoQ during as-built stage

Instructions:

1. Download the Level(s) template for DW estimation
2. Download the Level(s) template for CW reporting and DW reporting
3. Develop a Waste Management Plan
4. Decide on tracking system to log site and logistical data
5. Add new entries to the inventory
6. Assess the total quantities

Level 2 & 3 – Reporting

Necessary for the assessment:

Level 2

- Level(s) building description
- For demolition activities, a desk study, field survey and completed Level(s) DW estimate inventory.
- For construction activities, the Level(s) CW estimate inventory

Level 3

- Level(s) building description
- Waste management plan
- Method of recording waste shipment data
- Tracking and tracing system

		Sum of material sub-chapters		
		Mass (kg)	Mass (kg/m2)	Fraction
Reuse of materials		4900	1.96	0.4%
Recycling of DW		640773	256	56.9%
Material recovery (backfill)		361000	144	32.0%
Energy recovery		0	0	0.0%
Disposal		22400	9	2.0%
of which:	Inert	0	0	
	Non-haz	0	0	
	Hazardous	22400	8.96	
Total (kg)		1126573	451	100.0%
Building GFA (m2)				2500
Normalised DW (kg/m2)				450.6



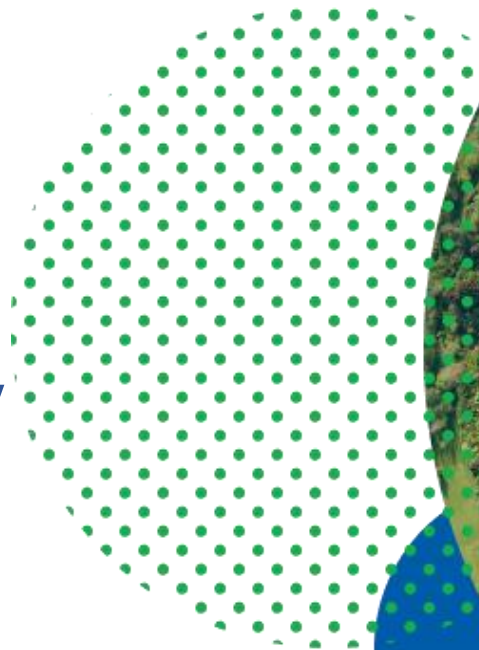
Level(s) indicator 2.3: Design for adaptability and renovation



NOTE: This project has received funding from LIFE Programme under the Grant Agreement number LIFE 18 GIE/ES/000911 Life for LLL(s).



DISCLAIMER: The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Level(s) Key indicators



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



1.1 Use stage energy performance

kilowatt hours per
square metre per year
(kWh/m²/yr)

1.2 Life cycle Global Warming Potential

kg CO₂ equivalents per
square metre per year
(kg CO₂ eq./m²/yr)

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



2.1 Bill of quantities, materials and lifespans

Unit quantities, mass
and years

2.2 Construction & demolition waste and materials

kg of waste and
materials per m² total
useful floor area

2.3 Design for adaptability and renovation

Adaptability score

2.4 Design for deconstruction, reuse and recycling

Deconstruction score

Macro-objective 3: Efficient use of water resources



3.1 Use stage water consumption

m³/yr of water per
occupant

Macro-objective 4: healthy and comfortable spaces



4.1 Indoor air quality

Parameters for
ventilation, CO₂ and
humidity

Target list of pollutants:
TVOC, formaldehyde,
CMR VOC, LCI ratio,
mould, benzene,
particulates, radon

4.2 Time outside of thermal comfort range

% of the time out of
range during the heating
and cooling seasons

4.3 Lighting and visual comfort

Level 1 checklist

4.4 Acoustics and protection against noise

Level 1 checklist

Macro-objective 5: Adaptation and resilience to climate change



5.1 Protection of occupier health and thermal comfort

Projected % time out of
range in the years 2030
and 2050 (see also
indicator 4.2)

5.2 Increased risk of extreme weather events

Level 1 checklist (under
development)

5.3 Increased risk of flood events

Level 1 checklist (under
development)

Macro-objective 6: Optimised life cycle cost and value



6.1 Life cycle costs

Euros per square metre
per year (€/m²/yr)

6.2 Value creation and risk exposure

Level 1 checklist



Level(s) indicator 2.3: Design for adaptability and renovation



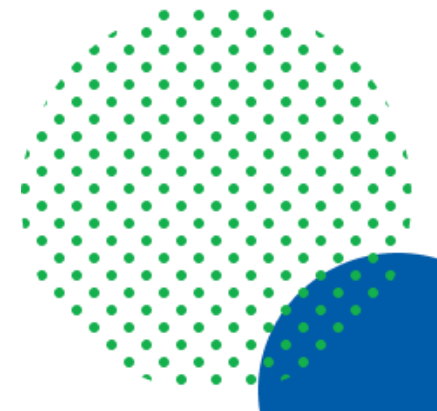
Aim: Adapt designs to facilitate future adaptation

Scope: Structural engineering + internal layouts + technical services

Level 1: Understand key design aspects for adaptability

Level 2: Design of spatial dimensions, structural design and servicing design

Level 3: Information gathering for potential future value



Level 1



Objective: Understand key design aspects for adaptability

Instructions:

1. Level(s) building description
2. Checklist of adaptability design concepts
3. Optional: Gather knowledge on local market needs
4. review and identify design concepts
5. record the design concepts

Checklist & Reporting

Office building

1. Changes to the internal space distribution
2. Changes to the buildings servicing
3. Changes to the buildings facade and structure

Residential building

1. Changes to the internal space distribution
2. Changes to the buildings servicing
3. Change to the use of units or floors
4. Changes in access requirements

Level 2 & 3 - Instructions

Level 2 objective: Compare design options for their relative adaptability

Instructions Level 2

1. Review planned design aspects
2. Optional: Gather knowledge on local market needs
3. For renovation: Identify design aspects inline with renovation needs
4. Develop the design options for appraisal
5. For residential housing with varying typologies: Make a representative selection of the designs
6. Scoring: Gather architectural and structural design drawings
7. Use the matrix of design aspects
8. obtain the adaptability score for the design

Level 3 objective: Compare the final as-built design

Instructions Level 3

1. Identify addressed design aspects
2. Check the as-built scoring: Gather as-built architectural and structural design drawings
3. Ensure that the same representative selection of house or apartment types as in Level 2
4. Obtain the adaptability score for a completed design
5. Optional: life cycle GWP assessment or LCA assessment

Level 2 & 3 – Reporting

Residential building checklist

Adaptability design concept	Specific design aspect to address	Weighted score
1. Changes to the internal space distribution	1.1 Wall systems that support layout changes	
	1.2 Greater ceiling heights for surface routes	
2. Changes to the buildings servicing	2.1 Ease of access to the building services	
	2.2 Ease of adaptation of the distribution networks and connectors	
3. Change to the use of units or floors	3.1 The potential for a segregated home working space	
	3.2 The potential for ground floor conversion to a contained unit	
4. Changes in access requirements	4.1 Ease of access to each residential unit	
	4.2 Access to and manoeuvrability within rooms	
Total weighted score		

Office building checklist

Adaptability design concept	Specific design aspect to address	Weighted score
1. Changes to the internal space distribution	1.1 Column grid spans	
	1.2 Façade pattern	
	1.3 Internal wall system	
	1.4 Unit size and access	
2. Changes to the buildings servicing	2.1 Ease of access to service ducts	
	2.2 Ease of access to plant rooms	
	2.3 Longitudinal ducts for service routes	
	2.4 Higher ceilings for service routes	
	2.5 Services to sub-divisions	
3. Changes to the buildings' façade and structure	3.1 Non-load bearing facades	
	3.2 Future-proofing of load bearing capacity	
	3.3 Structural design to support future expansion	
Total weighted score		

Level(s) indicator 2.4: Design for Deconstruction



NOTE: This project has received funding from LIFE Programme under the Grant Agreement number LIFE 18 GIE/ES/000911 Life for LLL(s).



DISCLAIMER: The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Level(s) Key indicators



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



1.1 Use stage energy performance

kilowatt hours per
square metre per year
(kWh/m²/yr)

1.2 Life cycle Global Warming Potential

kg CO₂ equivalents per
square metre per year
(kg CO₂ eq./m²/yr)

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



2.1 Bill of quantities, materials and lifespans

Unit quantities, mass
and years

2.2 Construction & demolition waste and materials

kg of waste and
materials per m² total
useful floor area

2.3 Design for adaptability and renovation

Adaptability score

2.4 Design for deconstruction, reuse and recycling

Deconstruction score

Macro-objective 3: Efficient use of water resources



3.1 Use stage water consumption

m³/yr of water per
occupant

Macro-objective 4: healthy and comfortable spaces



4.1 Indoor air quality

Parameters for
ventilation, CO₂ and
humidity

Target list of pollutants:
TVOC, formaldehyde,
CMR VOC, LCI ratio,
mould, benzene,
particulates, radon

4.2 Time outside of thermal comfort range

% of the time out of
range during the heating
and cooling seasons

4.3 Lighting and visual comfort

Level 1 checklist

4.4 Acoustics and protection against noise

Level 1 checklist

Macro-objective 5: Adaptation and resilience to climate change



5.1 Protection of occupier health and thermal comfort

Projected % time out of
range in the years 2030
and 2050 (see also
indicator 4.2)

5.2 Increased risk of extreme weather events

Level 1 checklist (under
development)

5.3 Increased risk of flood events

Level 1 checklist (under
development)

Macro-objective 6: Optimised life cycle cost and value

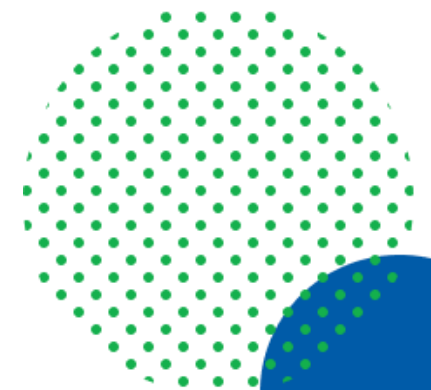


6.1 Life cycle costs

Euros per square metre
per year (€/m²/yr)

6.2 Value creation and risk exposure

Level 1 checklist



Level(s) indicator 2.4: Design for Deconstruction



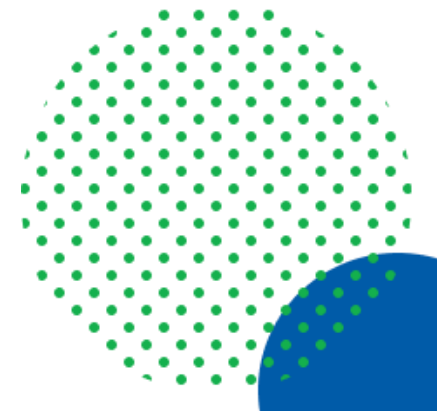
Aim: Adapt designs that facilitate the future recovery of materials

Scope: Building's bill of quantities and materials

Level 1: Understand key design aspects for deconstruction

Level 2: Assessment of the structure, façade and building design and of renovation building parts

Level 3: Information gathering for circular design features



Level 1



Objective: Understanding the design concepts for future deconstruction

Instructions:

1. Level(s) building description
2. Checklist of deconstruction design concepts
3. Optional: Gather knowledge on local market needs
4. Review and identify design concepts
5. Record the design concepts

Checklist & Reporting

1. Ease of recovery
2. Ease of reuse
3. Ease of recycling

Level 2 & 3 - Instructions

Level 2 objective: Compare design options for their deconstruction potential

Instructions Level 2

1. Review planned design aspects
2. Optional: Gather knowledge on local market needs
3. For renovation: Identify design aspects inline with renovation needs
4. Develop the design options for appraisal
5. For residential housing with varying typologies: Make a representative selection of the designs
6. Gather architectural and structural design drawings
7. Allocate a score for the ease of recovery
8. Record building parts for recovery
9. Optional: life cycle GWP assessment or LCA assessment

Level 3 objective: Compare the final as-built design

Instructions Level 3

1. Identify addressed design aspects
2. Gather architectural and structural design drawings
3. Ensure that the same representative selection of house or apartment types as in Level 2
4. Allocate a score for the ease of recovery
5. Record building parts for recovery
6. Optional: life cycle GWP assessment or LCA assessment

Level 2 & 3 – Reporting

Part 1 - Ease of recovery reporting

<i>Ease of recovery</i>	<i>Overall score obtained</i>
-------------------------	-------------------------------

<i>Building part</i>	<i>Design aspects checked/implemented</i>	
	<i>Ease of recovery aspect</i>	<i>Description of the design solution(s) used to facilitate recovery</i>
<i>Of the parts in table 3 list those that have been addressed</i>	<i>Aspect x</i>	

Part 2 - Ease of reuse and recycling reporting

<i>Ease of reuse and recycling</i>	<i>Overall score obtained</i>
------------------------------------	-------------------------------

<i>Building part</i>	<i>Design aspects checked/implemented</i>	
	<i>Ease of recycling/reuse aspect</i>	<i>Description of the design solution(s) used to facilitate recovery</i>
<i>Of the parts in table 3 list those that have been addressed</i>	<i>Aspect x</i>	

Necessary for the assessment:

- Building design with a bill of quantities, as well as structure and servicing plans
- For renovation projects: an agreed scope of building parts



Level(s) indicator 3.1: Use stage water consumption



NOTE: This project has received funding from LIFE Programme under the Grant Agreement number LIFE 18 GIE/ES/000911 Life for LLL(s).



DISCLAIMER: The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Level(s) Key indicators



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



1.1 Use stage energy performance

kilowatt hours per
square metre per year
(kWh/m²/yr)

1.2 Life cycle Global Warming Potential

kg CO₂ equivalents per
square metre per year
(kg CO₂ eq./m²/yr)

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



2.1 Bill of quantities, materials and lifespans

Unit quantities, mass
and years

2.2 Construction & demolition waste and materials

kg of waste and
materials per m² total
useful floor area

2.3 Design for adaptability and renovation

Adaptability score

2.4 Design for deconstruction, reuse and recycling

Deconstruction score

Macro-objective 3: Efficient use of water resources



3.1 Use stage water consumption

m³/yr of water per
occupant

Macro-objective 4: healthy and comfortable spaces



4.1 Indoor air quality

Parameters for
ventilation, CO₂ and
humidity

Target list of pollutants:
TVOC, formaldehyde,
CMR VOC, LCI ratio,
mould, benzene,
particulates, radon

4.2 Time outside of thermal comfort range

% of the time out of
range during the heating
and cooling seasons

4.3 Lighting and visual comfort

Level 1 checklist

4.4 Acoustics and protection against noise

Level 1 checklist

Macro-objective 5: Adaptation and resilience to climate change



5.1 Protection of occupier health and thermal comfort

Projected % time out of
range in the years 2030
and 2050 (*see also*
indicator 4.2)

5.2 Increased risk of extreme weather events

*Level 1 checklist (under
development)*

5.3 Increased risk of flood events

*Level 1 checklist (under
development)*

Macro-objective 6: Optimised life cycle cost and value

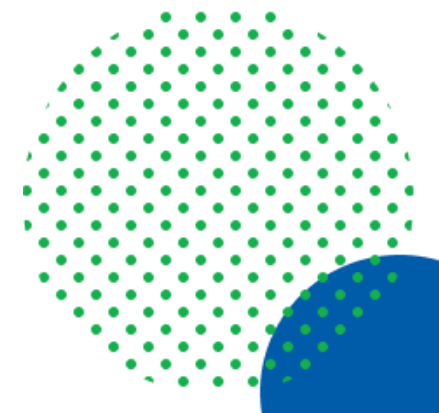


6.1 Life cycle costs

Euros per square metre
per year (€/m²/yr)

6.2 Value creation and risk exposure

Level 1 checklist



Level(s) indicator 3.1: Use stage water consumption

Aim: Understanding and measuring the water consumption of the building

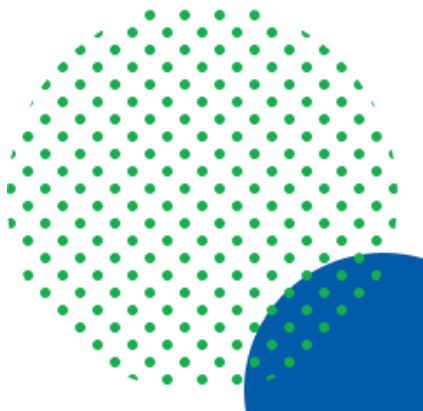
Scope:

	Residential buildings	Office buildings
Sanitary fittings	Toilets, bathroom taps, showers, bath-tubs and kitchen taps.	Toilets (incl. urinals), bathroom taps, showers and kitchenette taps.
Water using appliances	Dishwashers and washing machines	-
Other*	Irrigation	Irrigation, floor cleaning, window cleaning

Level 1: Decision making for improving consumption of water, especially potable water

Level 2: Estimates of design features are made using Excel-based Levels water calculator

Level 3: Measuring on-site water consumption data



Level 1



Objective: Understanding optimisation of use stage water consumption

Instructions:

1. Checklist and Level 1 technical guidance
2. Review and identify design concepts
3. Record design concepts

Checklist & Reporting

1. Specification of water efficient sanitary devices and fittings
2. The relevance of water scarcity as a driver for reducing water demand
3. Examine the potential to use non-potable water to substitute for potable water demand
4. Water efficient vegetated areas
5. Metering plan

Level 2 & 3 - Instructions

Level 2 objective: Estimate water consumption in the building

Instructions Level 2

1. Download the Level(s) water calculator
2. Generate the average summer WEI+ value (measure of water scarcity)
3. Generate estimates of the total water consumption
4. Enter Data for areas to be irrigated
5. Enter Data for harvested rainwater or reused greywater
6. Breakdown of results
7. Compare results to other design options for minimising potable water consumption

Level 3 objective: Measure actual water consumption

Instructions Level 3

1. Estimate the number of days that the building is occupied for normal use
2. Estimate the number of full time equivalent staff in the office
3. Consider if visitor numbers are significant compared to the office employees
4. Calculate the full time equivalent occupants
5. Enter the actual meter reading data
6. Optional: For turning Level 2 estimate into an estimated meter reading fill out the estimated occupancy rate

Level 2 & 3 – Reporting

Necessary for the assessment:

Level 2

- Level(s) building description
- The excel-based Level(s) water calculator
- The design details that relate to water consuming devices, fittings and appliances
- Further details that influence water consumption, otherwise default values are suggested in the calculator

Level 3

- Level(s) building description
- Meter readings of potable water consumption, meter readings of supplied rainwater and/or greywater
- A calculation to estimate the occupancy rate of the building

Office Building

Summer WEI+ =	4.09	Total Water Consumption (m ³ /o/a)	Of which potable (m3/o/a)	Of which non-potable (m3/o/a)
Sanitary fittings and devices (e.g. toilets, taps, baths and showers).	Toilets & urinals	3.75	0.00	3.75
	Bathroom taps	1.88	1.88	0.00
	Showers	1.50	1.50	0.00
	Kitchenette taps	1.50	1.50	0.00
	Sub-Total	8.63	4.88	3.75
Cleaning	Floor cleaning	0.16	0.16	0.00
	Window cleaning	0.02	0.02	0.00
	Sub-Total	0.17	0.17	0.00
Irrigation	Irrigation	11.49	0.00	11.49
Other uses (e.g. fountains, swimming pools, HVAC etc.)	Other-1 (please spe	0.00	0.00	0.00
	Other-2 (please spe	0.00	0.00	0.00
	Other-3 (please spe	0.00	0.00	0.00
	Sub-Total	0.00	0.00	0.00
	TOTAL (m ³ /o/a)	20.29	5.05	15.24
	TOTAL (%)	100	24.9	75.1



Level(s) indicator 4.1: Indoor air quality



NOTE: This project has received funding from LIFE Programme under the Grant Agreement number LIFE 18 GIE/ES/000911 Life for LLL(s).

DISCLAIMER: The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Level(s) Key indicators

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



1.1 Use stage energy performance

kilowatt hours per
square metre per year
(kWh/m²/yr)

1.2 Life cycle Global Warming Potential

kg CO₂ equivalents per
square metre per year
(kg CO₂ eq./m²/yr)

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



2.1 Bill of quantities, materials and lifespans

Unit quantities, mass
and years

2.2 Construction & demolition waste and materials

kg of waste and
materials per m² total
useful floor area

2.3 Design for adaptability and renovation

Adaptability score

2.4 Design for deconstruction, reuse and recycling

Deconstruction score

Macro-objective 3: Efficient use of water resources



3.1 Use stage water consumption

m³/yr of water per
occupant

Macro-objective 4: healthy and comfortable spaces



4.1 Indoor air quality

Parameters for
ventilation, CO₂ and
humidity

Target list of pollutants:
TVOC, formaldehyde,
CMR VOC, LCI ratio,
mould, benzene,
particulates, radon

4.2 Time outside of thermal comfort range

% of the time out of
range during the heating
and cooling seasons

4.3 Lighting and visual comfort

Level 1 checklist

4.4 Acoustics and protection against noise

Level 1 checklist

Macro-objective 5: Adaptation and resilience to climate change



5.1 Protection of occupier health and thermal comfort

Projected % time out of
range in the years 2030
and 2050 (see also
indicator 4.2)

5.2 Increased risk of extreme weather events

Level 1 checklist (under
development)

5.3 Increased risk of flood events

Level 1 checklist (under
development)

Macro-objective 6: Optimised life cycle cost and value

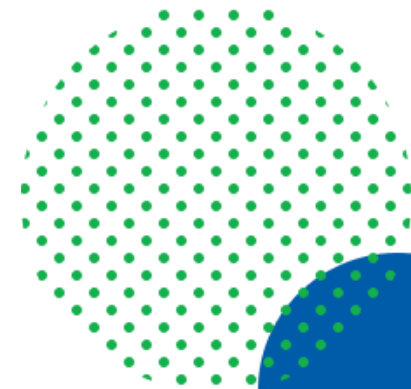


6.1 Life cycle costs

Euros per square metre
per year (€/m²/yr)

6.2 Value creation and risk exposure

Level 1 checklist



Level(s) indicator 4.1

Aim: Ensuring suitable Indoor Air Quality (IAQ)

Scope: “Air quality conditions” and “target pollutants”

Level 1: Design of the building fabric and ventilation systems, identification of renovation needs, design solutions, selection of construction products/materials

Level 2: Verification of as-built and installed building fabric and services

Level 3: As built and in-use performance measurement

Minimum scope

4.1.1 Indoor air quality conditions		4.1.2 Target pollutants			
		Mainly from indoor sources ⁴		Mainly from outdoor sources	
Parameter	Unit	Parameter	Unit	Parameter	Unit
Ventilation rate (air flow)	L/s/m ²	Total VOCs	µg/m ³	Benzene	µg/m ³
CO ₂	ppm	CMR VOCs*	µg/m ³	Radon	Bq/m ³
Relative humidity	%	R value	Decimal ratio	Particulate matter <2,5 µm	µg/m ³
Occupant survey	Not defined	Formaldehyde	µg/m ³	Particulate matter <10 µm	µg/m ³

Level 1

Objective: Understanding factors that influence IAQ and optimising the ventilation strategy

Instructions:

- Checklist for IAQ, Level 1 technical guidance
- Review and identify IAQ and ventilation design concepts
- Reporting format

Checklist & Reporting

1. Consider how the building will be used and the expectations level of the future occupants
2. Basic understanding of the main pollutants in indoor air
3. Preferred ventilation strategy
4. Localised ventilation strategies to control point sources in parts of the building
5. The importance of on-site monitoring

EN 13779, EN 16516
EN 15251 and EN 16798
ISO 10551 and ISO 28802

Level 2



Objective: Detailed design of ventilation systems and specification of indoor fit-out materials

Instructions:

1. Decide on EN 16798-1 method
2. Define an occupation schedule
3. Define the material specifications for insulation and fit-out materials
4. Define the outdoor air quality (ODA)
5. Design calculations to derive the target supply air quality (SUP)
6. Optional: Design simulations for supply air quality
7. Renovation projects: Mould risk assessment
8. Design documentation

Design indoor air quality conditions - general building level information							
Floor area (m2)	Method applied	Outdoor air quality (particulates)	Outdoor air quality (gaseous pollutants)	Supply air quality	Filter specification		
					1st	2nd	3rd
2500	Method 3 - predefined airflow rates	ODA (P) 2 - high contamination (<50% above limits)	ODA (G) 1 - clean (below limits)	SUP 2 - rooms for permanent occupation	ePM10: 85%		

Target indoor air pollutants - specific construction products and materials						
Construction product/material	Product type or application	Total VOCs (µg/m³)	R value	Formaldehyde (µg/m³)	Certified by labelling scheme? If so, which one?	Other relevant information? (e.g. specific limits/results for other VOCs etc.)
Ceiling tiles	All					
Paints and varnishes	walls and ceiling					
	floors and stairs					
	doors and windows					
Floor coverings	textile coverings					
	laminate and flexible coverings					
	wooden coverings					
	associated adhesives and sealants					
Renovation products	Internal insulation					
	interior surface treatments (e.g. to resist damp)					
Other (please specify)	Other (please specify)					

Level 3



Objective: Assess the IAQ

Instructions:

On-site monitoring

1. Agree on which parameters are to be monitored
2. Identify the relevant testing standards
3. Time plan for monitoring and sampling
4. Determine who will conduct the sampling and monitoring
5. Obtain necessary equipment
6. Decide on monitoring and sampling strategy
7. Collect samples and analyse them

Post-occupancy surveys

1. Decide upon the questions focus
2. Send out the survey to all building occupants
3. Gather results and compile into a report

Level 3 - 4.1.1 IAQ conditions								
Representative area tested and time/date of test	Floor area (m2)	Method applied	Ventilation performance category	Ventilation rate	Units	Occupation rate (person/m2)	CO2 (ppm above outdoor air concentration)	Control range of relative humidity (%)
Level 3 - 4.1.2 Target indoor air pollutants		Representative area tested			Representative area tested			
Nature of IAQ parameter	IAQ parameter	Design stage	Post completion (prior to occupation)	During occupation	Design stage	Post completion (prior to occupation)	During occupation	
Pollutants predominantly from outdoor sources	Radon (Bq/m ³)							
	PM _{2.5} (µg/m ³)							
	PM ₁₀ (µg/m ³)							
	Ozone (µg/m ³)							
	Benzene (µg/m ³)							
Air quality aspects (from outdoor & indoor sources)	Relative humidity (%)							
	CO2 (ppm indoors)							
	CO2 (ppm outdoors)							
Pollutants predominantly from indoor sources	Total VOC (µg/m ³)	n/a			n/a			
	Total CMR VOCs (µg/m ³)	n/a			n/a			
	R-value	n/a			n/a			
	Formaldehyde (µg/m ³)	n/a			n/a			



Level(s) indicator 4.2: Time outside of thermal comfort range



NOTE: This project has received funding from LIFE Programme under the Grant Agreement number LIFE 18 GIE/ES/000911 Life for LLL(s).



DISCLAIMER: The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Level(s) Key indicators

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



1.1 Use stage energy performance

kilowatt hours per
square metre per year
(kWh/m²/yr)

1.2 Life cycle Global Warming Potential

kg CO₂ equivalents per
square metre per year
(kg CO₂ eq./m²/yr)

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



2.1 Bill of quantities, materials and lifespans

Unit quantities, mass
and years

2.2 Construction & demolition waste and materials

kg of waste and
materials per m² total
useful floor area

2.3 Design for adaptability and renovation

Adaptability score

2.4 Design for deconstruction, reuse and recycling

Deconstruction score

Macro-objective 3: Efficient use of water resources



3.1 Use stage water consumption

m³/yr of water per
occupant

Macro-objective 4: healthy and comfortable spaces



4.1 Indoor air quality

Parameters for
ventilation, CO₂ and
humidity

Target list of pollutants:
TVOC, formaldehyde,
CMR VOC, LCI ratio,
mould, benzene,
particulates, radon

4.2 Time outside of thermal comfort range

% of the time out of
range during the heating
and cooling seasons

4.3 Lighting and visual comfort

Level 1 checklist

4.4 Acoustics and protection against noise

Level 1 checklist

Macro-objective 5: Adaptation and resilience to climate change



5.1 Protection of occupier health and thermal comfort

Projected % time out of
range in the years 2030
and 2050 (see also
indicator 4.2)

5.2 Increased risk of extreme weather events

Level 1 checklist (under
development)

5.3 Increased risk of flood events

Level 1 checklist (under
development)

Macro-objective 6: Optimised life cycle cost and value



6.1 Life cycle costs

Euros per square metre
per year (€/m²/yr)

6.2 Value creation and risk exposure

Level 1 checklist



Level(s) indicator 4.2

Aim: Understanding and measuring the building occupiers comfort

Scope: Internal operating temperature + comfort condition of the occupiers

Level 1: Thermal comfort risk assessment and selection of tailored solutions for major renovation works

Level 2: Calculated building permitting assessment, Consideration of different aspects of thermal comfort

Level 3: Measured EPB assessment sub types, functional performance testing, Evaluation of satisfaction levels

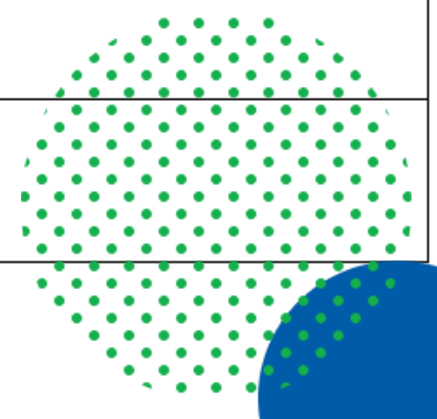
Level 1

Objective: Assessing risks of occupier thermal discomfort and understanding potential measures for improvements

Instructions:

- Determine the required level of thermal comfort
- Checklist of thermal comfort design concepts , Level 1 technical guidance
- Review and identify thermal comfort design concepts
- Reporting format

Thermal comfort design concept	Addressed? <i>(yes/no)</i>	How has it been incorporated into the building design concept? <i>(provide a brief description)</i>
1. Identify and assess risk factors		
2. Design for comfortable thermal conditions		
3. Take into account the site specific conditions		
4. Take into account renovation specific conditions		



Level 2



Objective: Quantitative assessment of the indoor thermal conditions

Instructions:

1. Determine the required level of thermal comfort
2. Check national/regional the calculation method whether or not it is dynamic
3. If yes, this may be used to calculate the time out of range. If not, a dynamic simulation method will be needed to be selected
4. Complete the reporting table
5. Optional: Decide if post-occupancy evaluation of occupant satisfaction is necessary
6. If yes, indicate in the reporting table
7. For residential developments with varying typologies, make a representative selection of the designs to be modelled
8. Determine whether default values for the building occupancy and conditions of use patterns
9. Gather input data that will be required to make the calculations
10. Setup the dynamic simulation
11. Going a step further: If there is access to historical data
12. Identify the output that can be used to interrogate the internal temperature per hour
13. Establish models, one with mechanical heating/cooling systems and one without
14. Obtain the internal temperatures per hour for a year
15. Obtain data to calculate the time out of range
16. Complete the main reporting table

Level 3



Objective: Assess the Indoor air quality

Instructions:

Monitoring and metering strategy

1. Office buildings set up temperature sensors long term, residential buildings require a monitoring period
2. For office buildings assign responsibility for obtaining and compiling the data

Data collection and reporting

3. Data shall be collected after the minimum period of occupation
4. Performance shall be corrected in relation to the conditions of use and the test reference year
5. Obtain data for upper and lower temperature bands
6. Complete the main reporting table
7. Optional : Identify the reason for deviations from the calculated figures reported at Level 2

Level 2 & 3 - Reporting

Necessary for the assessment: Level 2

- Calculation software tool
- Building design with the input data required to make the calculations
- Optional: Appropriate input data and assumptions to improve the assessment and building performance

Level 3

- A monitoring strategy for hourly thermal probes

Performance assessment results

Performance aspect	Heating season	Cooling season
Operative temperature range (°C)	<i>Lower/upper limits</i>	<i>Lower/upper limits</i>
Time out of range (%) - without mechanical heating/cooling	<i>Proportion of time</i>	<i>Proportion of time</i>
Time out of range (%) - with mechanical heating/cooling	<i>Proportion of time</i>	<i>Proportion of time</i>

Optional reporting for comparison with post-occupancy assessment results ⁴

Performance aspect	Heating season	Cooling season
Thermal environment categories - without mechanical cooling	<i>EN 15251, Annex F comfort category</i>	<i>EN 15251, Annex F comfort category</i>
Time out of range (%) - with mechanical cooling	<i>EN 15251, Annex F comfort category</i>	<i>EN 15251, Annex F comfort category</i>



Level(s) indicator 4.3: Lighting and Visual Comfort



NOTE: This project has received funding from LIFE Programme under the Grant Agreement number LIFE 18 GIE/ES/000911 Life for LLL(s).

DISCLAIMER: The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Level(s) Key indicators

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



1.1 Use stage energy performance

kilowatt hours per
square metre per year
(kWh/m²/yr)

1.2 Life cycle Global Warming Potential

kg CO₂ equivalents per
square metre per year
(kg CO₂ eq./m²/yr)

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



2.1 Bill of quantities, materials and lifespans

Unit quantities, mass
and years

2.2 Construction & demolition waste and materials

kg of waste and
materials per m² total
useful floor area

2.3 Design for adaptability and renovation

Adaptability score

2.4 Design for deconstruction, reuse and recycling

Deconstruction score

Macro-objective 3: Efficient use of water resources



3.1 Use stage water consumption

m³/yr of water per
occupant

Macro-objective 4: healthy and comfortable spaces



4.1 Indoor air quality

Parameters for
ventilation, CO₂ and
humidity

Target list of pollutants:
TVOC, formaldehyde,
CMR VOC, LCI ratio,
mould, benzene,
particulates, radon

4.2 Time outside of thermal comfort range

% of the time out of
range during the heating
and cooling seasons

4.3 Lighting and visual comfort

Level 1 checklist

4.4 Acoustics and protection against noise

Level 1 checklist

Macro-objective 5: Adaptation and resilience to climate change



5.1 Protection of occupier health and thermal comfort

Projected % time out of
range in the years 2030
and 2050 (see also
indicator 4.2)

5.2 Increased risk of extreme weather events

Level 1 checklist (under
development)

5.3 Increased risk of flood events

Level 1 checklist (under
development)

Macro-objective 6: Optimised life cycle cost and value



6.1 Life cycle costs

Euros per square metre
per year (€/m²/yr)

6.2 Value creation and risk exposure

Level 1 checklist



Level(s) indicator 4.3: Lighting and Visual Comfort

Aim: Improve and optimise lighting and visual comfort conditions

Scope: All architectural aspects with an influence on natural light penetration and all design specifications for lighting systems

Level 1: Design concepts for illumination considering influence of building form and orientation on the daylighting performance as well as the supplementary electric lighting systems

Level 2: Calculations will be made and verified by simulations, more accurate lighting plans as well as sequences of operations for lighting controls can be made

Level 3: On-site measurements to identify and address any performance gaps and to ensure that the commissioned luminaires and systems meet the design criteria

Level 1

Objective: Understanding concepts to improve lighting and visual comfort

Instructions:

- Checklist of lighting and visual comfort design concepts, Level 1 technical guidance
- Review and identify thermal comfort design concepts
- Reporting format

Checklist & Reporting

1. Daylight - Maximise the useful contribution of daylight and minimise negative impacts on visual comfort
2. Light levels and distribution for visual comfort
3. Automated and personalised control for visual comfort
4. Light source quality (for electric light sources)



Level(s) indicator 4.4: Acoustics and protection against noise



NOTE: This project has received funding from LIFE Programme under the Grant Agreement number LIFE 18 GIE/ES/000911 Life for LLL(s).

DISCLAIMER: The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Level(s) Key indicators

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



1.1 Use stage energy performance

kilowatt hours per
square metre per year
(kWh/m²/yr)

1.2 Life cycle Global Warming Potential

kg CO₂ equivalents per
square metre per year
(kg CO₂ eq./m²/yr)

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



2.1 Bill of quantities, materials and lifespans

Unit quantities, mass
and years

2.2 Construction & demolition waste and materials

kg of waste and
materials per m² total
useful floor area

2.3 Design for adaptability and renovation

Adaptability score

2.4 Design for deconstruction, reuse and recycling

Deconstruction score

Macro-objective 3: Efficient use of water resources



3.1 Use stage water consumption

m³/yr of water per
occupant

Macro-objective 4: healthy and comfortable spaces



4.1 Indoor air quality

Parameters for
ventilation, CO₂ and
humidity

Target list of pollutants:
TVOC, formaldehyde,
CMR VOC, LCI ratio,
mould, benzene,
particulates, radon

4.2 Time outside of thermal comfort range

% of the time out of
range during the heating
and cooling seasons

4.3 Lighting and visual comfort

Level 1 checklist

4.4 Acoustics and protection against noise

Level 1 checklist

Macro-objective 5: Adaptation and resilience to climate change



5.1 Protection of occupier health and thermal comfort

Projected % time out of
range in the years 2030
and 2050 (see also
indicator 4.2)

5.2 Increased risk of extreme weather events

Level 1 checklist (under
development)

5.3 Increased risk of flood events

Level 1 checklist (under
development)

Macro-objective 6: Optimised life cycle cost and value



6.1 Life cycle costs

Euros per square metre
per year (€/m²/yr)

6.2 Value creation and risk exposure

Level 1 checklist



Level(s) indicator 4.4

Aim: Improve acoustic quality and reduce noise

Scope: Architectural elements that can affect acoustic performance

Level 1: Improving acoustic quality and controlling noise by assessing the potential risks based on the building uses, the location and potential configuration of spaces within the building

Level 2: Acoustic performance can be calculated to guide material selection and detailing required to achieve a specific level of technical performance

Level 3: carry out field surveys and measurements in order to determine the as-built performance

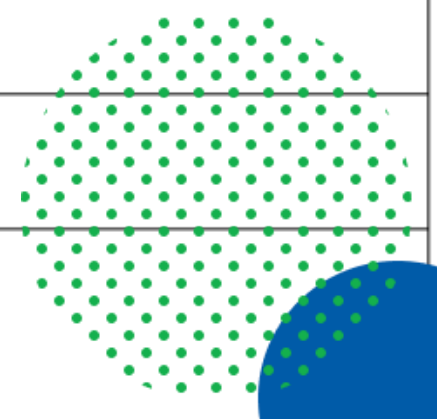
Level 1

Objective: Understand acoustic quality design concepts

Instructions:

- 1. Checklist for acoustics and noise protection design aspects
- 2. Review and identify best design concepts
- 3. Reporting format

Acoustic and noise protection design aspect	Has it been addressed? <i>(yes/no)</i>	How has it been addressed during the building design process? <i>(provide a brief description)</i>
1. Façade sound insulation		
2. Airborne sound insulation		
3. Impact sound insulation		
4. Service equipment noise		
5. Sound absorption in rooms and enclosed spaces		





Level(s) indicator 5.1: Protection of occupier health and thermal comfort



NOTE: This project has received funding from LIFE Programme under the Grant Agreement number LIFE 18 GIE/ES/000911 Life for LLL(s).

DISCLAIMER: The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Level(s) Key indicators

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



1.1 Use stage energy performance

kilowatt hours per
square metre per year
(kWh/m²/yr)

1.2 Life cycle Global Warming Potential

kg CO₂ equivalents per
square metre per year
(kg CO₂ eq./m²/yr)

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



2.1 Bill of quantities, materials and lifespans

Unit quantities, mass
and years

2.2 Construction & demolition waste and materials

kg of waste and
materials per m² total
useful floor area

2.3 Design for adaptability and renovation

Adaptability score

2.4 Design for deconstruction, reuse and recycling

Deconstruction score

Macro-objective 3: Efficient use of water resources



3.1 Use stage water consumption

m³/yr of water per
occupant

Macro-objective 4: healthy and comfortable spaces



4.1 Indoor air quality

Parameters for
ventilation, CO₂ and
humidity

Target list of pollutants:
TVOC, formaldehyde,
CMR VOC, LCI ratio,
mould, benzene,
particulates, radon

4.2 Time outside of thermal comfort range

% of the time out of
range during the heating
and cooling seasons

4.3 Lighting and visual comfort

Level 1 checklist

4.4 Acoustics and protection against noise

Level 1 checklist

Macro-objective 5: Adaptation and resilience to climate change



5.1 Protection of occupier health and thermal comfort

Projected % time out of
range in the years 2030
and 2050 (*see also*
indicator 4.2)

5.2 Increased risk of extreme weather events

*Level 1 checklist (under
development)*

5.3 Increased risk of flood events

*Level 1 checklist (under
development)*

Macro-objective 6: Optimised life cycle cost and value

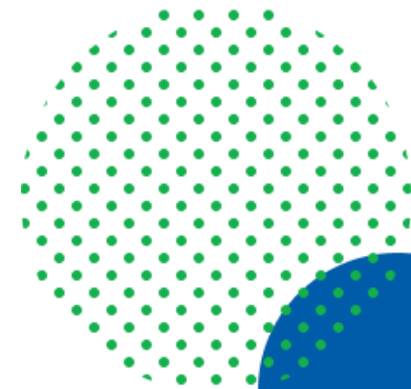


6.1 Life cycle costs

Euros per square metre
per year (€/m²/yr)

6.2 Value creation and risk exposure

Level 1 checklist



Level(s) indicator 5.1: Protection of occupier health and thermal comfort

Aim: Adapting to future conditions for the thermal comfort and resilience

Scope: Internal operating temperature + comfort conditions of the occupiers

Level 1: Thermal comfort risk assessment and tailored solutions for major renovation works

Level 2: Building permitting assessment, considering thermal comfort with localised discomfort effects

Level 3: Measured EPB assessment sub types (climate corrected, use corrected or standard), functional performance testing, comparison of estimated satisfaction levels with those obtained from occupier surveys

Level 1

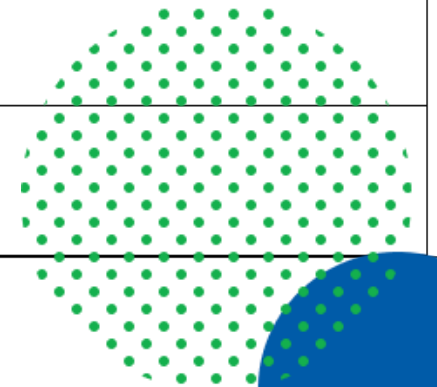


Objective: Understanding concepts of thermal comfort

Instructions:

- Determine the required level of thermal comfort
- Checklist of thermal comfort design concepts, Level 1 technical guidance
- Review literature for local area /region in respect to projected future climate change
- Review how the design concepts can be introduced into the design process
- Reporting format

Thermal comfort design concept	Addressed? (yes/no)	How has it been incorporated into the building design concept? (provide a brief description)
1. Identify and assess risk factors		
2. Design for comfortable thermal conditions		
3. Take into account the site specific conditions		
4. Take into account renovation specific conditions		



Level 2



Objective: Quantitative assessment of the indoor thermal conditions

Instructions (adapted from indicator 4.2):

1. Determine the required level of thermal comfort
2. Check national/regional the calculation method whether or not it is dynamic
3. If yes, this may be used to calculate the time out of range. If not, a dynamic simulation method will be needed to be selected
4. Complete the reporting table
5. Optional: Decide if post-occupancy evaluation of occupant satisfaction is necessary
6. If yes, indicate in the reporting table
7. For residential developments with varying typologies, make a representative selection of the designs to be modelled
8. Determine whether default values for the building occupancy and conditions of use patterns
9. Gather input data that will be required to make the calculations
10. Setup the dynamic simulation
11. Going a step further: If there is access to historical data
12. Identify the output that can be used to interrogate the internal temperature per hour
13. Establish models, one with mechanical heating/cooling systems and one without
14. Obtain the internal temperatures per hour for a year
15. Obtain data to calculate the time out of range
16. Complete the main reporting table

Level 2 - Reporting

Part 1 - Climate change projections used

Basis for simulation	Climate change projection of or design summer year
Weather file source	
Climate change scenarios modelled	e.g. IPCC E1, A1B

Part 2 - Performance assessment results

Performance aspect	2030 scenario		2050 scenario	
	2°C trajectory	High emissions trajectory	2°C scenario	High emissions trajectory
Time out of range (%) - without mechanical cooling				
Time out of range (%) - with mechanical cooling				

Necessary for the assessment:

- Calculation software tool
- A building design providing the input data
- Access to an authoritative set of weather data with climate change projections for the years 2030 and 2050
- Optional: Make a dynamic simulation



Level(s) indicator 5.2: Increased risk of extreme weather events



NOTE: This project has received funding from LIFE Programme under the Grant Agreement number LIFE 18 GIE/ES/000911 Life for LLL(s).

DISCLAIMER: The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Level(s) Key indicators

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



1.1 Use stage energy performance

kilowatt hours per
square metre per year
(kWh/m²/yr)

1.2 Life cycle Global Warming Potential

kg CO₂ equivalents per
square metre per year
(kg CO₂ eq./m²/yr)

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



2.1 Bill of quantities, materials and lifespans

Unit quantities, mass
and years

2.2 Construction & demolition waste and materials

kg of waste and
materials per m² total
useful floor area

2.3 Design for adaptability and renovation

Adaptability score

2.4 Design for deconstruction, reuse and recycling

Deconstruction score

Macro-objective 3: Efficient use of water resources



3.1 Use stage water consumption

m³/yr of water per
occupant

Macro-objective 4: healthy and comfortable spaces



4.1 Indoor air quality

Parameters for
ventilation, CO₂ and
humidity

Target list of pollutants:
TVOC, formaldehyde,
CMR VOC, LCI ratio,
mould, benzene,
particulates, radon

4.2 Time outside of thermal comfort range

% of the time out of
range during the heating
and cooling seasons

4.3 Lighting and visual comfort

Level 1 checklist

4.4 Acoustics and protection against noise

Level 1 checklist

Macro-objective 5: Adaptation and resilience to climate change



5.1 Protection of occupier health and thermal comfort

Projected % time out of
range in the years 2030
and 2050 (see also
indicator 4.2)

5.2 Increased risk of extreme weather events

Level 1 checklist (under
development)

5.3 Increased risk of flood events

Level 1 checklist (under
development)

Macro-objective 6: Optimised life cycle cost and value



6.1 Life cycle costs

Euros per square metre
per year (€/m²/yr)

6.2 Value creation and risk exposure

Level 1 checklist



Level(s) indicator 5.2

Aim: Improve resilience of buildings to extreme weather events

Scope: Building envelope and surroundings

Level 1: Understanding designs that will directly or indirectly influence the resilience of the building to extreme weather events

Level 2: The design criteria, actions, design situations and relevant limit states from applicable Eurocodes shall be defined

Level 3: The actual building structure and envelope that is constructed shall be compared to the design structure and envelope

Level 1

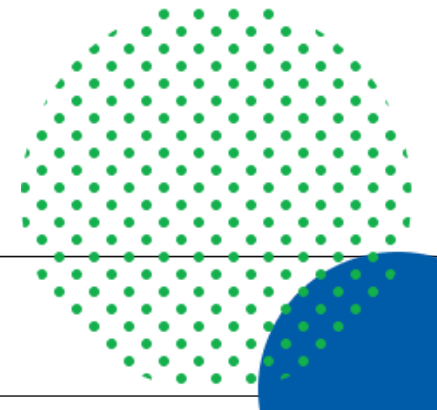


Objective: Understand adaption to extreme weather events

Instructions:

1. Prepare the ground for adaptation (dialogue with planning authorities)
2. Consult the checklist of adaptability features for extreme weather events
3. Review and identify best design concepts
4. Reporting format

Risk of extreme weather event design concept	Addressed? (yes/no)	How has it been incorporated into the building project? (provide a brief description)
1. Preparing the ground for adaptation and resistance to extreme weather events.		
2. Assess the main risks of and vulnerabilities to extreme weather events at the building location (both now and in the future).		
3. Identify potential adaptation actions.		
3. Assess the costs and benefits of adaptation actions.		



Level(s) indicator 5.3: Increased risk of flood events



NOTE: This project has received funding from LIFE Programme under the Grant Agreement number LIFE 18 GIE/ES/000911 Life for LLL(s).



DISCLAIMER: The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Level(s) Key indicators

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



1.1 Use stage energy performance

kilowatt hours per
square metre per year
(kWh/m²/yr)

1.2 Life cycle Global Warming Potential

kg CO₂ equivalents per
square metre per year
(kg CO₂ eq./m²/yr)

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



2.1 Bill of quantities, materials and lifespans

Unit quantities, mass
and years

2.2 Construction & demolition waste and materials

kg of waste and
materials per m² total
useful floor area

2.3 Design for adaptability and renovation

Adaptability score

2.4 Design for deconstruction, reuse and recycling

Deconstruction score

Macro-objective 3: Efficient use of water resources



3.1 Use stage water consumption

m³/yr of water per
occupant

Macro-objective 4: healthy and comfortable spaces



4.1 Indoor air quality

Parameters for
ventilation, CO₂ and
humidity

Target list of pollutants:
TVOC, formaldehyde,
CMR VOC, LCI ratio,
mould, benzene,
particulates, radon

4.2 Time outside of thermal comfort range

% of the time out of
range during the heating
and cooling seasons

4.3 Lighting and visual comfort

Level 1 checklist

4.4 Acoustics and protection against noise

Level 1 checklist

Macro-objective 5: Adaptation and resilience to climate change



5.1 Protection of occupier health and thermal comfort

Projected % time out of
range in the years 2030
and 2050 (*see also*
indicator 4.2)

5.2 Increased risk of extreme weather events

*Level 1 checklist (under
development)*

5.3 Increased risk of flood events

*Level 1 checklist (under
development)*

Macro-objective 6: Optimised life cycle cost and value



6.1 Life cycle costs

Euros per square metre
per year (€/m²/yr)

6.2 Value creation and risk exposure

Level 1 checklist



Level(s) indicator 5.3

Aim: Reduce the chances of pluvial flood events

Scope: Building surroundings

Level 1: Understanding designs that will influence pluvial flood risk directly at the site and that will indirectly influence fluvial flood risk downstream; Check performance requirements of the drainage system.

Level 2: The performance of the system shall be modelled against relevant design storms to estimate performance and adapted to requirements.

Level 3: The actual performance of the drainage system will be monitored.

Level 1



Objective: Understand adaption to extreme weather events

Instructions:

1. Understand the concept of sustainable drainage
2. Consult relevant authorities responsible for flood risk
3. Gather information from local authorities and utilities about the existing drainage network
4. Discuss potential performance metrics for the drainage system with the local authority
5. Consider other objectives that could be linked to the sustainable drainage system
6. Define the outline design and layout of the sustainable drainage system, retention capacities, discharge points and maintenance

Checklist

1. Familiarise with the concept of sustainable drainage and the components
2. Assess the potential flood risk at the site.
3. Consult relevant professionals and organisations at the beginning of the design process.
4. Define the outline design and layout of the sustainable drainage system.
5. Assess the costs and benefits of sustainable drainage system.



Level(s) indicator 6.1: Life cycle costs



NOTE: This project has received funding from LIFE Programme under the Grant Agreement number LIFE 18 GIE/ES/000911 Life for LLL(s).

DISCLAIMER: The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Level(s) Key indicators

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



1.1 Use stage energy performance

kilowatt hours per
square metre per year
(kWh/m²/yr)

1.2 Life cycle Global Warming Potential

kg CO₂ equivalents per
square metre per year
(kg CO₂ eq./m²/yr)

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



2.1 Bill of quantities, materials and lifespans

Unit quantities, mass
and years

2.2 Construction & demolition waste and materials

kg of waste and
materials per m² total
useful floor area

2.3 Design for adaptability and renovation

Adaptability score

2.4 Design for deconstruction, reuse and recycling

Deconstruction score

Macro-objective 3: Efficient use of water resources



3.1 Use stage water consumption

m³/yr of water per
occupant

Macro-objective 4: healthy and comfortable spaces



4.1 Indoor air quality

Parameters for
ventilation, CO₂ and
humidity

Target list of pollutants:
TVOC, formaldehyde,
CMR VOC, LCI ratio,
mould, benzene,
particulates, radon

4.2 Time outside of thermal comfort range

% of the time out of
range during the heating
and cooling seasons

4.3 Lighting and visual comfort

Level 1 checklist

4.4 Acoustics and protection against noise

Level 1 checklist

Macro-objective 5: Adaptation and resilience to climate change



5.1 Protection of occupier health and thermal comfort

Projected % time out of
range in the years 2030
and 2050 (*see also*
indicator 4.2)

5.2 Increased risk of extreme weather events

*Level 1 checklist (under
development)*

5.3 Increased risk of flood events

*Level 1 checklist (under
development)*

Macro-objective 6: Optimised life cycle cost and value



6.1 Life cycle costs

Euros per square metre
per year (€/m²/yr)

6.2 Value creation and risk exposure

Level 1 checklist



Level(s) indicator 6.1: Life cycle costs

Aim: Understanding and implementing comparative cost assessments

Scope: Initial capital costs + future operational cost + asset replacement cost

LCC for all stages, **minimum scope:**

- Use stage energy and water costs
- Construction and long-term maintenance, repair and replacement costs

Level 1: Life cycle thinking for a longer-term perspective on design decisions

Level 2: Cost estimates and modelling based on the client's requirements and detailed designs

Level 3: Verification of as-built costs, metered utility costs, monitoring of maintenance and replacement costs

EN 15459
ISO 15686-5
EN 16627
ISO 15686-8

Level 1



Objective: long-term perspective on design decisions

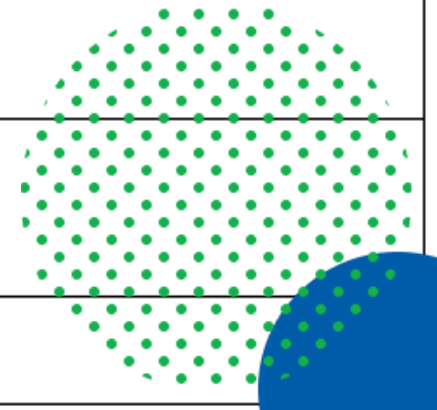
Instructions:

- Level(s) building description
- Checklist of LCC design concepts
- Optional: Review of relevant LCC studies of similar building types
- Optional: Interpret and identify recommendations for how to optimise LCC from the studies reviewed
- Review and identify options for using the life cycle design concepts
- Record the LCC design concepts

L1.5 Reporting format

To complete the reporting format for Level 1 you should answer yes or no for each of the design concepts that you have addressed and provide brief descriptions of the measures or decisions taken for each one.

Life cycle cost design concept	Addressed? (yes/no)	How has it been incorporated into the building design concept? (provide a brief description)
1. Take a longer-term perspective on costs and decisions		
2. Quality and representativeness of cost data		
3. Schedule and estimate future costs, risks and liabilities		
4. Make the link between life cycle cost and environmental performance		
5. Empowering building owners and occupiers		



Level 2 & 3

Level 2 objective:
calculating/modelling LCC of
the building project

Level 3 objective:
measuring LCC based on the as-
built initial costs

Instructions Level 2

1. Setting up the cost model
2. Data collection
3. Calculate/analyse LCC



Instructions Level 3

Level 3 follows
same steps (with in-use data)

OR

With completed Level 2:
Revise the cost model
+
Recalculate and analyse
LCC

Assessment format + Data transparency report

Level 2 & 3 – Reporting & Transparency



Necessary for the assessment:

- Level(s) building description
- bill of quantities (from indicator 2.1)
- the cost model for the project
- optional: an LCC calculation software tool
- access to cost databases and reference project costs

Type of cost	Normalised cost by life cycle stage (€/m²/yr)			
	A Product and construction stages	B Use stage		C End of life stage
Initial costs	Construction	Refurbishment and adaption		Deconstruction and demolition
Annual costs	-	Energy	Water	-
	-	Maintenance, repair and replacement		-
Periodic costs	-	Maintenance, repair and replacement		-
Global costs by life cycle stage	Sum of stage A costs	Sum of stage B costs		Sum of stage C costs

Building elements	Types of data source used for the identified life cycle stages *			
	A Product and construction stages	Basis for future assumptions		
		B2 Maintenance	B3 Repair	B4 Replacement
Foundations				
Load bearing structural frame				
Non-load bearing elements				
Facades				
Roof				
Parking facilities				
Fixed lighting system				
Energy system				
Ventilation system				
Sanitary systems				
Miscellaneous systems				



Level(s) indicator 6.2: Value creation and risk exposure



NOTE: This project has received funding from LIFE Programme under the Grant Agreement number LIFE 18 GIE/ES/000911 Life for LLL(s).



DISCLAIMER: The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Level(s) Key indicators

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



1.1 Use stage energy performance

kilowatt hours per
square metre per year
(kWh/m²/yr)

1.2 Life cycle Global Warming Potential

kg CO₂ equivalents per
square metre per year
(kg CO₂ eq./m²/yr)

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



2.1 Bill of quantities, materials and lifespans

Unit quantities, mass
and years

2.2 Construction & demolition waste and materials

kg of waste and
materials per m² total
useful floor area

2.3 Design for adaptability and renovation

Adaptability score

2.4 Design for deconstruction, reuse and recycling

Deconstruction score

Macro-objective 3: Efficient use of water resources



3.1 Use stage water consumption

m³/yr of water per
occupant

Macro-objective 4: healthy and comfortable spaces



4.1 Indoor air quality

Parameters for
ventilation, CO₂ and
humidity

Target list of pollutants:
TVOC, formaldehyde,
CMR VOC, LCI ratio,
mould, benzene,
particulates, radon

4.2 Time outside of thermal comfort range

% of the time out of
range during the heating
and cooling seasons

4.3 Lighting and visual comfort

Level 1 checklist

4.4 Acoustics and protection against noise

Level 1 checklist

Macro-objective 5: Adaptation and resilience to climate change



5.1 Protection of occupier health and thermal comfort

Projected % time out of
range in the years 2030
and 2050 (see also
indicator 4.2)

5.2 Increased risk of extreme weather events

Level 1 checklist (under
development)

5.3 Increased risk of flood events

Level 1 checklist (under
development)

Macro-objective 6: Optimised life cycle cost and value



6.1 Life cycle costs

Euros per square metre
per year (€/m²/yr)

6.2 Value creation and risk exposure

Level 1 checklist



Level(s) indicator 6.2

Aim: Understand and integrate long term value appraisal and risk exposure

Scope: All project related indicators

Level 1: Identification of potential design influences on the appraisal of value and risk

Level 2: Detailed design decisions, Financial approvals and due diligence, Cost control on site

Level 3: Management and monitoring of ongoing maintenance/replacement cycles and costs

Level 1

Objective: long-term perspective on design decisions

Instructions:

1. Consult the checklist of potential influences on value and risk appraisals
2. Review and identify likelihood of potential sustainability influences and the effect on the long-term property valuation
3. Record the potential financial value and risk influences of the final design

Level(s) core indicators	Has the potential influence been taken into account in discussion with the client and their property market valuers?		
	1. Increased revenues from more stable investments	2. Reduced operational overheads	3. Reduced exposure to future risk
1.1 Use stage energy consumption			
1.2 Life cycle Global Warming Potential			
<i>Cradle to grave Life Cycle Assessment (LCA)</i>			
2.1 Bill of quantities, materials and life spans			
2.2 Construction & demolition waste and materials			
2.3 Design for adaptability and refurbishment			
2.4 Design for deconstruction, reuse and recyclability			
3.1 Use stage water consumption			
4.1 Indoor air quality			
4.2 Time out of thermal comfort range			
4.3 Lighting and visual comfort			
4.4 Acoustics and protection against noise			
5.1 Protection of occupier health and thermal comfort			
5.2 Increased risk of extreme weather events			
5.3 Increased risk of flood events			
6.1 Life cycle costs			