3.4.3 – Regional CESBA MED SNTs

BUILDING SCALE

Version 1.1

Date: March 2019

2.1: To raise capacity for better management of energy in public buildings at transnational level
Work package: WP3 TESTING
Activity: 3.4 Evaluation of test results
Deliverable: 3.4.3 – Regional CESBA MED SNTs

Responsible Partner: Andrea Moro, iiSBE Italia R&D

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REGIONAL TOOL

D.3.4.3 Regional Tool – TORINO

Version 1.1

Date: March 2019

2.1: To raise capacity for better management of energy in public buildings at transnational level
Work package: WP3 TESTING
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Responsible Partner: Andrea Moro, iiSBE Italia R&D

BUILDING SCALE ASSESSMENT

SBTool structure

B – ENERGY AND RESOURCES CONSUMPTION	
	Name of the Category
B1.1	*Primary energy demand **
B1.2	*Delivered thermal energy demand **
B1.3	*Delivered electric energy demand **
B1.5	*Energy from renewable sources in total thermal energy consumption **
B1.6	*Energy from renewable sources in total electrical energy consumption **
B1.11	*Embodied non renewable primary energy*

C- ENVIRONMENTAL LOADINGS	
C1	**Greenhouses gas emission**
C1.3	**Global warming potential**
C.3	Solid an liquid waste
C3.1	Construction and demolition waste
C3.2	Solid waste from building operations

D- INDOOR ENVIRONMENTAL QUALITY	
D1	Indoor air quality and ventilation
D1.3	Formalndeyde concentration
D1.4	TVOC concentration in indoor air
D1.5	CO2 concentration in indoor air
D2.1	Time outside of the thermal comfort rang
D2.2	Thermal comfort index

G- COST AND ECONOMIC ASPECTS	
G1	**Coat and economics**
G1.4	Use stage energy cost
G1.5	Use stage water cost

SBTool criteria selection rationale

B – ENERGY AND RESOURCES CONSUMPTION		
CRITERION		**REASON/MOTIVATION**
B1.1	***Primary energy demand***	*Relevant for the new development Plan of the city*
B1.2	*Delivered thermal energy demand*	*Relevant for the new development Plan of the cit*
B1.3	*Delivered electric energy demand*	*Relevant for the new development Plan of the city*
B1.5	*Energy from renewable sources in total thermal energy consumption*	*Relevant for the new development Plan of the city*
B1.6	*Energy from renewable sources in total electrical energy consumption*	*Relevant for the new development Plan of the cityy*

C- ENVIRONMENTAL LOADINGS	
CRITERION	**REASON/MOTIVATION**
C	
C3.1 Construction and demolition waste	*Relevant for the new development Plan of the city*
C3.2 Solid waste from building operations	*Relevant for the new development Plan of the city*

D- INDOOR ENVIRONMENTAL QUALITY	
CRITERION	**REASON/MOTIVATION**
D	
D1.3 Formaldehyde concentration	General Safety issue
D1.4 TVOC concentration in indoor air	*Important for occupants' safety*
D1.5 CO2 concentration in indoor air	*Important for occupants' air quality*
D2.1 Time outside of the thermal comfort rang	*Important for occupants' confort*
D2.2 Thermal comfort index	*Important for occupants' confort*

G- COST AND ECONOMIC ASPECTS		
	CRITERION	**REASON/MOTIVATION**
G1.4	*Use stage energy cost **	*KPI*
G1.5	*Use stage water cost **	*KPI*

SBTool weights rationale

ISSUE	WEIGHT (1 to 3)	MOTIVATION
B – ENERGY AND RESOURCES CONSUMPTION	**3**	**The Municipality considers Sustainable Urban Planning very relevant** ***Consistency with the draft revision of the general regulation plan (P.R.G.) of the City***
C- ENVIRONMENTAL LOADINGS	3	The Municipality considers Sustainable Urban Planning very relevant *Consistency with the draft revision of the general regulation plan (P.R.G.) of the City*
D- INDOOR ENVIRONMENTAL QUALITY	2	Relevant parameter linked with external air quality and health aspects
G- COST AND ECONOMIC ASPECTS	2	It is important to reduce the municipal budget

CATEGORIES	
B1- Total life cycle non renewable energy	45,0
B3- Use of materials	5,0
B4 – Use of water, stormwater and greywater	8,0
TOTAL	58
C1- Greenhouse gas emissions	15,0
C3- Solid and liquid waste	8,0
TOTAL	23,0
D1- Indoor air quality and ventilation	8,0
D2- Thermal comfort	3,0
TOTAL	11
G1- Cost	8,0
TOTAL	8,0

CRITERIA WEIGHTS

SBTool file A – WeightA-G

B - ENERGY AND RESOURCES CONSUMPTION							
B1 Energy							
CRITERION		**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
B1.1	*Primary energy demand*	*8*	*5*	*5*	*2*	*3*	*Give significant weight to energy issues*
B1.2	*Delivered thermal energy demand*	*8*	*5*	*5*	*2*	*3*	*Give significant weight to energy issues*
B1.3	*Delivered electric energy demand*	*5*	*5*	*5*	*2*	*3*	*Give significant weight to energy issues*
B1.5	*Energy from renewable sources in total thermal energy consumption*	*8*	*5*	*5*	*2*	*3*	*Give significant weight to energy issues*
B1.6	*Energy from renewable sources in total electrical energy consumption*	*8*	*5*	*5*	*2*	*3*	*Importance of renewable energy (covenant of Majors) for the Municipality*
B1.11	*Embodied energy*	*8*	*5*	*5*	*2*	*3*	*Important criterium, but limitate action in existing building*
B3 Use of Materials							
CRITERION		**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
B3.5	Recycled materials	*5*	*4*	*3*	*2*	*3*	*Important criterium, but limitate action in existing building*
B4 Use of potable water, stormwater and greywater							
CRITERION		**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
B4.5	*Water consumption for indoor uses*	*8*	*4*	*3*	*3*	*3*	*Importance of saving water*
TOTAL		**58**					

C- ENVIRONMENTAL LOADINGS							
C1 Greenhouse Gas Emissions							
CRITERION		**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
C1.3	*Greenhouse Gas Emissions from building's operations*	*15*	*5*	*5*	*3*	*3*	*Reduction of CO2 is strictly linked to energy use: important*
C3 Solid and Liquid Waste							
CRITERION		**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
C3.1	*Construction and demolition waste*	*4*	*4*	*3*	*2*	*3*	*Increase reuse of local material in refurbishment*
C3.2	*Solid waste from building operations*	*4*	*4*	*3*	*2*	*3*	*Increase reuse of local material in refurbishment*
TOTAL		**23**					

D- INDOOR ENVIRONMENTAL QUALITY

D1 Indoor Air Quality and Ventilation

CRITERION		Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
D1.4	*TVOC concentration in indoor air*	*4*	*1*	*3*	*3*	*2*	*Air quality is important for health issues*
D1.10	*Ventilation rate*	*4*	*1*	*3*	*3*	*2*	

D2 Air Temperature and Relative Humidity

CRITERION		Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
D2.2	*Thermal comfort index*	*3*	*1*	*3*	*3*	*2*	*Thermal comfort play significant role in energy saving*
TOTAL		11					

G- COST AND ECONOMIC ASPECTS

G1 Cost

CRITERION		Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
G1.4	*Use stage energy cost*	*4*	*2*	*3*	*3*	*2*	*Energy cost reduction can be used for other investments*
G1.5	*Use stage water cost*	*4*	*2*	*3*	*1*	*2*	*Water cost reduction can be used for other investments*
TOTAL		8					

a. SBTool benchmarks rationale

B- ENERGY AND RESOURCES CONSUMPTION				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
B.1.1	**Primary energy demand**	kWh/m2 y	*0: 80*	*Close to actual value/TABULA*
			5: 30	*Values from CasaClima ed ENEA*
B.1.2	Delivered thermal energy demand	*kWh/m2 y*	*0: 70*	*Values from CasaClima ed ENEA*
			5: 20	*Values from CasaClima ed ENEA*
B.1.3	**Delivered electric energy demand**	*kWh/m2 y*	*0: 30*	*Close to actual value*
			5: 20	*EURAC Study*
B.1.5	**Energy from renewable sources in total thermal energy consumption**	*%*	*0: 30*	*20% objectives 2020 from EU strategies*
			5: 100	*Excellent and ideal target*
B.1.6	**Energy from renewable sources in total electrical energy consumption**	*%*	*0: 40*	*20% objectives 2020 from EU strategies + increase for public building*
			5: 100	*Excellent and ideal target*
B.1.11	**Embodied energy**	*MJ/m2*	*0: 2500*	*Estimated actual value (IUAV, prof. Carbonari)*
			5: 1000	*Estimated reduction*
B.3.5	Recycled materials	*%*	*0: 15*	*Estimated actual value (from existing examples) CAM edilizia, DM 11/10/2017*
			5: 50	*Insert your comment here*
B.4.5	*Water consumption for indoor uses*	*m3/occupant/year*	*0: 40*	*From EURAC, ENEA (reduction for non residential)*
			5: 25	*<50% reduction from actual estimated from EURAC*

C- ENVIRONMENTAL LOADINGS				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
C 1.3	*Greenhouse Gas Emissions from building's operations*	*kgCO2eq/ m2 y*	*0: 30*	*technical evaluation*
			5: 0	*Ideal target*
C 3.1	*Construction and demolition waste*	*Kg/m2*	*0: 100*	*Usual practice*
			5: 20	*Reduction of waste in a renovation situation*
C 3.2	*Solid waste from building operations*	*%*	*0: 50*	*Actual analytical analisys*
			5: 80	*Target value*

D- INDOOR ENVIRONMENTAL QUALITY				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
D 1.4	*TVOC concentration in indoor air*	*µg/m3*	*0: 5000*	*Measured data operating buildingshttp://www.minerva.unito.it/Chimica&Industria/MonitoraggioAmbientale/A4/Confinati7.htm*
			5: 1000	*ECA report*
D 1.10	*Ventilation rate*	*l/s m2*	*0: 10*	*Standard UNI 10339*
			5: 20	*Technical evaluation*
D 2.2	*Thermal comfort index*	*%*	*0: 10*	*Literature value*
			5: 0	*Optimal value*

G- COST AND ECONOMIC ASPECTS				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
G1.4	*Use stage energy cost*	*€/m2 y*	*0: 20*	*Linked to energy target consumption*
			5: 10	*Linked to energy target consumption*
G1.5	*Use stage water cost*	*€/m2 y*	*0: 5*	*Linked to energy target consumption*
			5: 1	*Linked to energy target consumption*

b. SBTool Criteria Specifications

B- ENERGY AND RESOURCES CONSUMPTION			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
B1.1	*Primary energy demand **	*Information source*	*Calculated data - Estimations*
		Assessment method	Calculated on average values of similar buildings, Various EU project as reference and Covenant of majors
		Standard	*UNI11300*
B1.2	*Delivered thermal energy demand*	*Information source*	*Calculated data - Estimations*
		Assessment method	Calculated on average values of similar buildings, Various EU project as reference and Covenant of majors
		Standard	*UNI 11300*
B1.3	*Delivered electric energy demand **	*Information source*	*Calculated data - Estimations*
		Assessment method	Covenant of Majors; parametric calculation for specific values
		Standard	*No standards*
B1.5	*Energy from renewable sources in total thermal energy consumption*	*Information source*	*Calculated data - Estimations*
		Assessment method	*No Energy from RES*
		Standard	*UNI 11300*
B1.6	*Energy from renewable sources in total electrical energy consumption **	*Information source*	*Calculated data - Estimations*
		Assessment method	CESBA Tool
		Standard	*Directive 2009/28/EC (RES Directive)* *Decreto legislativo 28/2011, when usable.*

B1.11	*Embodied energy*	*Information source*	*Calculated data - Estimations*
		Assessment method	***Literature data***
		Standard	*EN 15978 "Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method".* *ISO 14040/44* *EN 15804 (Sustainability of construction works. Environmental product declarations. Core rules for the product category of construction products)* ***CAM Decreto***
B3.5	***Recycled materials***	*Information source*	*Calculated data - Estimations*
		Assessment method	*CESBAMED calculation steps*
		Standard	*EN ISO 14021 (Environmental labels and declarations - Self-declared environmental claims - Type II environmental labelling)* ***CAM Decreto***
B4.5	*Water consumption for indoor use*	*Information source*	*Metered data – Estimations* *CESBAMED calculation steps*
		Assessment method	*Calculation from SMAT (local water distribution) and Covenant of Majors*
		Standard	*Local Addendum for Building code (allegati Energetici al regolamento edilizio)*

C- ENVIRONMENTAL LOADINGS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
C1.3	*Greenhouse Gas Emissions from building's operations **	*Information source*	*Calculated data - Estimations*
		Assessment method	*CESBAMED calculation steps; D.M. 26/6/2015*
		Standard	*UNI 11300 and D.M. 26/6/2015*

C3.1	*Construction and demolition waste*	*Information source*	*Estimations, literature*
		Assessment method	*Estimated actual value (IUAV, prof. Carbonari)*
		Standard	*----- no standards*
C3.2	*Ratio of the number of collectable solid waste categories within a 100 m distance from the building's entrance to the reference solid waste categories **	*Information source*	*Metered data – Calculated data - Estimations*
		Assessment method	*CESBAMED calculation steps* *The seven reference categories of solid waste are: Paper, Plastic, Metal, Glass, Wet waste, Textiles, Special hazardous waste.* *Calculated from data collected by the Municipality and IREN*
		Standard	

D- INDOOR ENVIRONMENTAL QUALITY			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
D1.4	*TVOC concentration in indoor air*	*Information source*	*Metered data*
		Assessment method	Literature data
		Standard	*EU Commision Report n 19, 1997*
D1.10	*Ventilation rate **	*Information source*	*Metered data – Calculated data*
		Assessment method	*Estimated values for natural ventilation*
		Standard	*UNI 10339, (UNI EN 823), UNI 11300*
D2.2	*Predicted Percentage Dissatisfied (PPD) **	*Information source*	*Metered data – Calculated data - Estimations*
		Assessment method	Estimation, Fanger law
		Standard	

G- COST AND ECONOMIC ASPECTS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
G1.4	*Energy annual cost per usable floor area*	*Information source*	*Metered data – Estimations*
		Assessment method	Calculation based on actual energy cost and consumption from criteria B
		Standard	----
G1.5	*Water annual cost per usable floor area*	*Information source*	*Metered data – Estimations*
		Assessment method	Average consumption and usable surface (data from Municipal GIS data base)
		Standard	---

REGIONAL TOOL

D.3.4.3 Regional Tool – City of Udine

Version 1.1

Date: March 2019

2.1: To raise capacity for better management of energy in public buildings at transnational level
Work package: WP3 TESTING
Activity: 3.4 Evaluation of test results
Deliverable: 3.4.3 – Regional CESBA MED SNTs

Responsible Partner: Andrea Moro, iiSBE Italia R&D

BUILDING SCALE ASSESSMENT

SBTool structure

A - SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	
A1	**Site Regeneration and Development**
A1.8	*Use of native plant types*
A1.10	*Provision and quality of children's play area(s)*
A1.12	*Provision and quality of bicycle pathways and parking*
A2	**Urban Design**
A2.1	*Maximizing efficiency of land use through development density*
A3	**Project Infrastructure and Services**
A3.12	*Provision of on-site communal transportation system(s)*

B - ENERGY AND RESOURCES CONSUMPTION	
B1	**Total Life Cycle Non-Renewable Energy**
B1.1	*Primary energy demand*
B1.2	*Delivered thermal energy demand*
B1.3	*Delivered electric energy demand*
B1.5	*Energy from renewable sources in total thermal energy consumption*
B1.6	*Energy from renewable sources in total electric energy consumption*
B1.11	*Embodied non-renewable primary energy*
B2	**Embodied Energy**
B3	**Use of Materials**
B3.1	*Degree of re-use of suitable existing structure(s) where available*
B3.5	*Recycled materials*
B3.7	*Easy of disassembly, re-use or recycling*
B4	**Use of potable water, stormwater and greywater**
B4.3	*Use of water for irrigation purposes*
B4.5	*Potable water consumption for indoor uses*

C - ENVIRONMENTAL LOADINGS	
C1	**Greenhouse Gas Emissions**
C1.3	*Global Warming potential*
C3	**Solid and Liquid Wastes**
C3.1	*Construction and demolition waste.*
C3.2	*Solid waste from building operation.*
C4	**Impacts on Project Site**
C4.1	*Recharge of groundwater through permeable paving or landscaping.*
C5	**Other Local and Regional Impacts**
C5.7	*Contribution to Heat Island Effect from roofing, landscaping and paved areas.*

D - INDOOR ENVIRONMENTAL QUALITY	
D1	**Indoor Air Quality and Ventilation**
D1.4	*TVOC concentration in indoor air*

D1.10	*Ventilation rate*
D2	**Air Temperature and Relative Humidity**
D2.2	*Thermal comfort index*
D3	**Daylighting and Illumination**
D3.1	*Appropriate daylighting in primary occupancies areas*
D4	**Noise and Acoustics**
D4.1	*Noise attenuation through the exterior envelope*

E - SERVICE QUALITY	
E5	**Optimization and Maintenance of Operating Performance**
E5.5	*On-going monitoring and verification of performance-*

F - SOCIAL, CULTURAL AND PERCEPTUAL ASPECTS	
F1	**Social AspectsSocial Aspects**
F1.1	*Universal access on site and within the building*
F2	**Culture and Heritage**
F2.4	*Use of traditional local materials and techniques*

G - COST AND ECONOMIC ASPECTS	
G1	**Cost and Economics**
G1.4	*Use stage energy cost*
G1.5	*Use stage water cost*

SBTool criteria selection rationale

A – SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	
CRITERION	**REASON/MOTIVATION**
A1.8 – *Use of native plant types*	*Reduce water consumption using native plants*
A1.10 – *Provision and quality of children's play area(s)*	*Evaluate the quality of children's playing areas*
A1.12 – *Provision and quality of bicycle pathways and parking*	*Incentive use of bicycle*
A2.1 – *Maximizing efficiency of land use through development density*	*Reduce land consumption*
A3.12 – *Provision of on-site communal transportation system(s)*	*Evaluate the public transport service*

B – ENERGY AND RESOURCES CONSUMPTION	
CRITERION	**REASON/MOTIVATION**
B1.1 – *Primary energy demand*	*Criterion is mandatory*
B1.2 – *Delivered thermal energy demand*	*Criterion is mandatory*
B1.3 – *Delivered electric energy demand*	*Criterion is mandatory*
B1.5 – *Energy from renewable sources in total thermal energy consumption*	*Criterion is mandatory*

B1.6 – *Energy from renewable sources in total electric energy consumption*	*Criterion is mandatory*
B1.11 – *Embodied non-renewable primary energy*	*Not applicable*
B3.1 – *Degree of re-use of suitable existing structure(s) where available*	*Encourage the reuse of existing volumes*
B3.5 – *Recycled materials*	*Not applicable*
B3.7 – *Easy of disassembly, re-use or recycling*	*Evaluate the degree of ease of reuse*
B4.3 – *Use of water for irrigation purposes*	*Evaluate the consumption of irrigation water*
B4.5 – *Potable water consumption for indoor uses*	*Criterion is mandatory*

C – ENVIRONMENTAL LOADINGS

CRITERION	REASON/MOTIVATION
C1.3 – *Global Warming potential*	*Criterion is mandatory*
C3.1 – *Construction and demolition waste.*	*Not applicable*
C3.2 – *Solid waste from building operation.*	*Criterion is mandatory*
C3.3 - *Liquid effluents from building operations that are sent off the site.*	*To minimize the volume of waste water*
C4.1 - *Recharge of groundwater through permeable paving or landscaping.*	*To assess the extent to which natural groundwater in the site is recharged.*
C5.7 - *Contribution to Heat Island Effect from roofing, landscaping and paved areas.*	*Reduce the heat island effect*

D – INDOOR ENVIRONMENTAL QUALITY

CRITERION	REASON/MOTIVATION
D1.4 – T*VOC concentration in indoor air*	*Criterion is mandatory*
D2.2 – *Thermal comfort index*	*Criterion is mandatory*
D3.1 - *Appropriate daylighting in primary occupancies areas*	*To ensure an adequate level of daylighting in all primary occupied spaces.*
D4.1 - *Noise attenuation through the exterior envelope*	*Evaluate the quality with respect to noise sources*

E – SERVICE QUALITY

CRITERION	REASON/MOTIVATION
E3.1 - *Effectiveness of facility management control system*	*Evaluate the level of building control*
E5.5 - *On-going monitoring and verification of performance*	*Incentive monitoring of buildings*

F – SOCIAL, CULTURAL AND PERCEPTUAL ASPECTS

CRITERION	REASON/MOTIVATION
F1.1 - *Universal access on site and within the building*	*To assess the relative ease of access and use of facilities for persons with mobility or perceptual disabilities.*
F2.4 - *Use of traditional local materials and techniques*	*To assess the extent to which traditional local materials and construction techniques will used in the execution of the project.*

G – COST AND ECONOMIC ASPECTS	
CRITERION	**REASON/MOTIVATION**
G1.4 – *Use stage energy cost*	*Criterion is mandatory*
G1.5 – *Use stage water cost*	*Criterion is mandatory*

SBTool weights rationale

ISSUE	WEIGHT (1 to 3)	MOTIVATION
A – SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	**1**	Rigidity of the system
B – ENERGY AND RESOURCES CONSUMPTION	**3**	Political priority; PAC - PAES - EMAS
C – ENVIRONMENTAL LOADINGS	**3**	Political priority; PAC - PAES - EMAS
D – INDOOR ENVIRONMENTAL QUALITY	**2**	Reduced power of intervention - Reduced intervention domain
E – SERVICE QUALITY	**3**	Political priority; PAC - PAES - EMAS
F – SOCIAL CULTURAL AND PERCEPTUAL ASPECTS	**2**	Reduced power of intervention - Reduced intervention domain
G – COST AND ECONOMIC ASPECTS	**2**	Reduced power of intervention - Reduced intervention domain

CATEGORIES	WEIGHT (%)
B1 – In use energy consumptions	87
B3 – Use of materials	0
B4 – Use of water, stormwater and greywater	13
TOTAL	100
C1 – Greenhouse gas emissions	56
C3 – Solid and liquid waste	44
TOTAL	100
D1 – Indoor air quality and ventilation	0
D2 – Thermal comfort	100
TOTAL	100
G1 – Cost and economics	100
TOTAL	100

CRITERIA WEIGHTS

SBTool file A – WeightA-G

B - ENERGY AND RESOURCES CONSUMPTION						
B1 – In use energy consumptions						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
B1.1	*9,0*	*5*	*4*	*2*		*Criterion is mandatory*
B1.2	*9,0*	*5*	*4*	*2*		*Criterion is mandatory*
B1.3	*9,0*	*5*	*4*	*2*		*Criterion is mandatory*
B1.5	*9,0*	*5*	*4*	*2*		*Criterion is mandatory*
B1.6	*9,0*	*5*	*4*	*2*		*Criterion is mandatory*
B1.11	*11,3*	*5*	*5*	*2*	*0*	*Not applicable*
B3 – Use of materials						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
B3.5	*5,4*	*4*	*3*	*3*	*0*	*Not applicable*
B4 – Use of water, stormwater and greywater						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
B4.5	*8,1*	*4*	*3*	*3*		*Criterion is mandatory*

C - ENVIRONMENTAL LOADINGS						
C1 - Greenhouse gas emissions						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
C1.3	*13,5*	*5*	*4*	*3*		*Criterion is mandatory*
C3 - Solid and liquid waste						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
C3.1	*5,4*	*4*	*3*	*2*	*0*	*Not applicable*
C3.2	*5,4*	*4*	*3*	*2*		*Criterion is mandatory*

D - INDOOR ENVIRONMENTAL QUALITY						
D1 - Indoor air quality and ventilation						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
D1.4	*1,4*	*1*	*3*	*3*	*0*	*Not applicable*
D1.10	*1,4*	*1*	*3*	*3*	*0*	*Not applicable*
D2 – Thermal comfort						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
D2.2	*1,4*	*1*	*3*	*3*		*Criterion is mandatory*

G - COST AND ECONOMIC ASPECTS						
G1 - Cost and economics						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
G1.4	*0.9*	*2*	*3*	*1*		*Criterion is mandatory*
G1.5	*0.9*	*2*	*3*	*1*		*Criterion is mandatory*
TOTAL	**100**					

SBTool benchmarks rationale

A - SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
A1.8	*The extent of vegetated landscaped area that is planted with native plants.*	*%*	*0: 45*	*UNI PdR 13 ITACA*
			5: 70	*UNI PdR 13 ITACA*
A1.10	*The existence and type of facilities for children's play and the quality of service provided*	*-*	*0: 0*	*UNI PdR 13 ITACA*
			5: 5	*UNI PdR 13 ITACA*
A1.12	*Amount of sheltered and unsheltered bicycle parking, location of bicycle parking facilities relative to building entrances*	*-*	*0: 0*	*UNI PdR 13 ITACA*
			5: 5	*UNI PdR 13 ITACA*
A2.1	*Development density of the project, expressed as the ratio of gross floor area above grade of the Design relative to the maximum permitted gross floor area on the site.*	*%*	*0: 35*	*Current level*
			5: 100	*Maximum exploitation*
A3.12	*Existence and type of an on-site public or communal transportation system*	*-*	*0: 0*	*-*
			5: 5	*-*

B - ENERGY AND RESOURCES CONSUMPTION				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
B1.1	*Primary energy demand*	*kWh/m2/y*	*0: 140*	*-*
			5: 23	*Energy regulation*
B1.2	*Delivered thermal energy demand*	*kWh/m2/y*	*0: 80*	*-*
			5: 10	*Energy regulation*
B1.3	*Delivered electric energy demand*	*kWh/m2/y*	*0: 23*	*-*
			5: 5	*-*
B1.5	*Energy from renewable sources in total thermal energy consumption*	*%*	*0: 25*	*-*
			5: 50	*D.Leg. 28/11*
B1.6	*Energy from renewable sources in total electric energy consumption*	*%*	*0: 35*	*-*
			5: 75	*-*
B1.11	*Embodied non-renewable primary energy*	*kWh/m^2/yr*	*0: -*	*Non applicable*
			5: -	*Non applicable*
B3.1	*Degree of re-use of suitable existing structure(s) where available*	*%*	*0: 0*	*UNI PdR 13 ITACA*
			5: 100	*UNI PdR 13 ITACA*

B3.5	*Recycled materials*	*%*	*0: 15*	*UNI PdR 13 ITACA*
			5: 50	*UNI PdR 13 ITACA*
B3.7	*Easy of disassembly, re-use or recycling*	*-*	*0: 0*	*Scenario*
			5: 5	*Scenario*
B4.3	*Use of water for irrigation purposes*	*m^3/m^2 year*	*0: 0,20*	*UNI PdR 13 ITACA*
			5: 0,05	*-*
B4.5	*Water consumption for indoor uses*	*m^3/occupant/year*	*0: 47*	*UNI PdR 13 ITACA*
			5: 23	*-*

C - ENVIRONMENTAL LOADINGS

CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
C1.3	*Global Warming potential*	*kg CO2 eq./m^2/yr*	*0: 28*	*-*
			5: 5	*Energy regulation*
C3.1	*Construction and demolition waste.*	*kg/m^2/life cycle stage*	*0: -*	*Non applicable*
			5: -	*Non applicable*
C3.2	*Solid waste from building operation.*	*%*	*0: 14*	*At least one*
			5: 100	*All the services*
C3.3	*Liquid effluents from building operations that are sent off the site.*	*m3 / pp*yr*	*0: 0,13*	*UNI PdR 13 ITACA*
			5: 0	*UNI PdR 13 ITACA*
C4.1	*Recharge of groundwater through permeable paving or landscaping.*	*%*	*0: 40*	*UNI PdR 13 ITACA*
			5: 60	*UNI PdR 13 ITACA*
C5.7	*Contribution to Heat Island Effect from roofing, landscaping and paved areas.*	*%*	*0: 0*	*UNI PdR 13 ITACA*
			5: 100	*UNI PdR 13 ITACA*

D - INDOOR ENVIRONMENTAL QUALITY

CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
D1.4	*TVOC concentration in indoor air*	*µg per cube meter*	*0: 2000*	*UNI PdR 13 ITACA*
			5: 1000	*<1500 limit CAM = 3*
D1.10	*Ventilation rate*	l/s/m^2	*0: 0,35*	*UNI EN 15251 Table B.5 Cat III*
			5: 0,49	*UNI EN 15251 Table B.5 Cat I*
D2.2	*Thermal comfort index*	*-*	*0: 10*	*UNI EN ISO 7730 Class B*
			5: 6	*UNI EN ISO 7730 Class A*

D3.1	*Appropriate daylighting in primary occupancies areas*	*%*	*0: 100*	*Reference law*
			5: 125	*UNI PdR 13 ITACA*
D4.1	*Noise attenuation through the exterior envelope*	*STC-Rw*	*0: 37*	*Standard window*
			5: 45	*Best window*

E - SERVICE QUALITY				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
E3.1	*Effectiveness of facility management control system*	-	*0: 0*	*Scenario*
			5: 5	*Scenario*
E5.5	*On-going monitoring and verification of performance*	-	*0: 0*	*Scenario*
			5: 5	*Scenario*

F - SOCIAL CULTURAL AND PERCEPTUAL ASPECTS				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
F1.1	*Universal access on site and within the building*	-	*0: 0*	*Scenario*
			5: 5	*Scenario*
F2.4	*Use of traditional local materials and techniques*	*%*	*0: 30*	*UNI PdR 13 ITACA*
			5: 80	*UNI PdR 13 ITACA*

G - COST AND ECONOMIC ASPECTS				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
G1.4	*Use stage energy cost*	€/m2/yr	*0: 10,70*	-
			5: 1,75	*Energy regulation*
G1.5	*Use stage water cost*	*€/m2/yr*	*0: 1,55*	-
			5: 0,70	*Energy regulation*

SBTool Criteria Specifications

A - SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
A1.8	*The extent of vegetated landscaped*	*Information source*	*Assessment by landscape architect*

	area that is planted with native plants	*Assessment method*	*The percent of landscaped area (excuding paved areas) planted with native species*
		Standard	*UNI PdR 13 ITACA*
A1.10	*The existence and type of facilities for children's play and the quality of service provided*	*Information source*	*Assessment by landscape architect*
		Assessment method	*Evaluation scenario*
		Standard	*UNI PdR 13 ITACA*
A1.12	*Amount of sheltered and unsheltered bicycle parking, location of bicycle parking facilities relative to building entrances*	*Information source*	*Rilievo*
		Assessment method	*Evaluation scenario*
		Standard	*UNI PdR 13 ITACA*
A2.1	*Development density of the project, expressed as the ratio of gross floor area above grade of the Design relative to the maximum permitted gross floor area on the site.*	*Information source*	*PRGC*
		Assessment method	*The ratio of gross floor area above grade of the Design relative to the maximum permitted gross floor area on the site*
		Standard	*Current situation*
A3.12	*Existence and type of an on-site public or communal transportation system.*	*Information source*	*Hours of public service*
		Assessment method	*Evaluation scenario*
		Standard	*Scenario*

B - ENERGY AND RESOURCES CONSUMPTION			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
B1.1	*Primary energy demand per internal useful floor area per year*	*Information source*	*Consumption bills*
		Assessment method	*Calculated using the measured values*
		Standard	*Energy regulation*
B1.2	*Delivered thermal energy demand per internal useful floor area per year*	*Information source*	*Energy bills*
		Assessment method	*Calculated using the measured values*

B1.3	*Delivered electric energy demand per internal useful floor area per year*	*Standard*	*Energy regulation*
		Information source	*Energy bills*
		Assessment method	*Calculated using the measured values*
B1.5	*Share of renewable energy in final thermal energy consumptions*	*Standard*	*Reference of the law*
		Information source	*Monitoring of produced energy*
		Assessment method	*Calculated using the measured values*
B1.6	*Share of renewable energy in final electric energy consumption*	*Standard*	*Reference of the law*
		Information source	*Monitoring of produced energy*
		Assessment method	*Calculated using the measured values*
B1.11	*Embodied non-renewable primary energy*	*Standard*	*-*
		Information source	*Non applicable*
		Assessment method	*-*
B3.1	*Degree of re-use of suitable existing structure(s) where available*	*Standard*	*-*
		Information source	*Executive projects*
		Assessment method	*The percentage (by area) of existing sound structures that is planned to be re-used as part of the project*
B3.5	*Wight of recycled materials on total weight of materials.*	*Standard*	*UNI PdR 13 ITACA*
		Information source	*Non applicable*
		Assessment method	*-*
B3.7	*Easy of disassembly, re-use or recycling*	*Standard*	*UNI PdR 13 ITACA*
		Information source	*Executive projects*
		Assessment method	*Scenario*
B4.3	*Use of water for irrigation purposes*	*Standard*	*Scenario*
		Information source	*Consumption bills*
		Assessment method	*Volume of water on gross surface*
B4.5	*Potable water consumption per occupant per year*	*Standard*	*UNI PdR 13 ITACA*
		Information source	*Consumption bills*

		Assessment method	*Calculated using the measured values*
		Standard	*UNI PdR 13 ITACA*

C – ENVIRONMENTAL LOADINGS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
C1.3	*CO2 equivalent emissions per internal useful floor area per year*	*Information source*	*Energy bills*
		Assessment method	*Calculated using the estimate based on the measures*
		Standard	*Energy regulation*
C3.1	*Weight of waste and materials generated per 1 m2 of useful floor area demolished or constructed*	*Information source*	*Non applicable*
		Assessment method	*-*
		Standard	*UNI PdR 13 ITACA*
C3.2	*Ratio of the number of collectable solid waste categories within a 100 m distance from the building's entrance to the reference solid waste categories*	*Information source*	*Relief and georeferencing containers*
		Assessment method	*Calculated using the measured values*
		Standard	*-*
C3.3	*Liquid effluents from building operations that are sent off the site.*	*Information source*	*Bills*
		Assessment method	*The predicted volume of liquid waste per year to be sent off the site for treatment*
		Standard	*UNI PdR 13 ITACA*
C4.1	*Recharge of groundwater through permeable paving or landscaping.*	*Information source*	*Design documents and on-site surveys*
		Assessment method	*The predicted percentage of precipitation that is able to recharge groundwater through permeable paving or landscaping.*
		Standard	*UNI PdR 13 ITACA adapted*

C5.7	*Contribution to Heat Island Effect from roofing, landscaping and paved areas.*	*Information source*	*Design documents and on-site surveys*
		Assessment method	*Percentage of surface with a high reflection index*
		Standard	*UNI PdR 13 ITACA*

D – INDOOR ENVIRONMENTAL QUALITY			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
D1.4	*TVOC concentration in indoor air*	*Information source*	*Not applicable*
		Assessment method	-
		Standard	*UNI PdR 13 ITACA*
D1.10	*Ventilation rate normalized per useful floor area*	*Information source*	*Not applicable*
		Assessment method	
		Standard	*UNI EN 15251*
D2.2	*Predicted Percentage Dissatisfied (PPD)*	*Information source*	-
		Assessment method	-
		Standard	*UNI EN ISO 7730 Class B*
D3.1	Daylighting and Illumination	*Information source*	Design documents
		Assessment method	*Rapporto fra DF e DF lim*
		Standard	*UNI PdR 13 ITACA*
D4.1	Noise attenuation through the exterior envelope	*Information source*	Design documents
		Assessment method	*Ratio between DF and DF lim*
		Standard	*Standard window*

E – SERVICE QUALITY			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
E3.1	*Effectiveness of facility management control system*	*Information source*	*Design documents*
		Assessment method	*Scenario*
		Standard	*Scenario*
E5.5	*On-going monitoring and verification of performance*	*Information source*	*Contract documentation.*
		Assessment method	*Scenario*
		Standard	*Scenario*

F – SOCIAL CULTURAL AND PERCEPTUAL ASPECTS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
F1.1	*Universal access on site and within the building*	*Information source*	*Design documents*
		Assessment method	*Scenario*
		Standard	*Scenario*
F2.4	*Use of traditional local materials and techniques*	*Information source*	*Design documents*
		Assessment method	*The estimated percentage of traditional local materials*
		Standard	*UNI PdR 13 ITACA*

G – COST AND ECONOMIC ASPECTS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
G1.4	*Energy annual cost per usable floor area*	*Information source*	*Consumption bills*
		Assessment method	*Energy annual cost per usable floor area*
		Standard	*Energy regulation*

G1.5	*Water annual cost per usable floor area*	*Information source*	*Consumption bills*
		Assessment method	*Water annual cost per usable floor area*
		Standard	*Energy regulation*

REGIONAL TOOL

D.3.4.3 Regional Tool - EnvirobatBDM

Version 1.1

Date: March 2019

2.1: To raise capacity for better management of energy in public buildings at transnational level
Work package: WP3 TESTING
Activity: 3.4 Evaluation of test results
Deliverable: 3.4.3 – Regional CESBA MED SNTs

Responsible Partner: Andrea Moro, iiSBE Italia R&D

BUILDING SCALE ASSESSMENT

SBTool structure

A – SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	

B – ENERGY AND RESOURCES CONSUMPTION	
B1	**Total life cycle non-renewable energy**
B1.1	Primary energy demand
B.1.2	Delivered thermal energy demand
B.1.3	Delivered electric energy demand
B.1.5	Energy from renewable sources in total thermal energy consumption
B.1.6	Energy from renewable sources in total electric energy consumption
B.1.11	Embodied non-renewable primary energy
B3	**Use of Material**
B3.5	Recycled materials
B4	**Use of potable water, stormwater and greywater**
B4.5	Potable water consumption for indoor uses

C- ENVIRONMENTAL LOADINGS	
C1	**Greenhouse Gas Emissions**
C1.3	Global Warming potential
C3	**Solid and Liquid Wastes**
C3.1	Construction and demolition waste
C3.2	Solid waste from building operation

D- INDOOR ENVIRONMENTAL QUALITY	
D1	**Indoor Air Quality and Ventilation**
D1.4	TVOC concentration in indoor air
D1.10	Ventilation rate
D2	**Air Temperature and Relative humidity**
D.2.2	Thermal comfort index

E- SERVICE QUALITY	

F- SOCIAL, CULTURAL AND PERCEPTUAL ASPECTS

G- COST AND ECONOMIC ASPECTS	
G1	**Cost and Economics**
G.1.4	*Use stage energy cost*
G.1.5	Use stage water cost

SBTool criteria selection rationale

A - SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	
CRITERION	**REASON/MOTIVATION**

B – ENERGY AND RESOURCES CONSUMPTION	
CRITERION	**REASON/MOTIVATION**
B1.1 Primary energy demand	*KPI are mandatory; KPI were sufficient for local purposes. The motivation is to share with partners a Passport that will allow us to discuss issues related to sustainable building assessment – despite the different local approaches.*
B1.2 Delivered thermal energy demand	*KPI are mandatory; KPI were sufficient for local purposes. The motivation is to share with partners a Passport that will allow us to discuss issues related to sustainable building assessment – despite the different local approaches.*
B1.3 Delivered electric energy demand	*KPI are mandatory; KPI were sufficient for local purposes. The motivation is to share with partners a Passport that will allow us to discuss issues related to sustainable building assessment – despite the different local approaches.*
B1.5 Energy from renewable sources in total thermal energy consumption	*KPI are mandatory; KPI were sufficient for local purposes. The motivation is to share with partners a Passport that will allow us to discuss issues related to sustainable building assessment – despite the different local approaches.*
B1.6 Energy from renewable sources in total electric energy consumption	*KPI are mandatory; KPI were sufficient for local purposes. The motivation is to share with partners a Passport that will allow us to discuss issues related to sustainable building assessment – despite the different local approaches.*
B1.11 Embodied non-renewable primary energy	*KPI are mandatory; KPI were sufficient for local purposes. The motivation is to share with partners a Passport that will allow us to discuss issues related to sustainable building assessment –*

	despite the different local approaches.
B3.5 Recycled materials	*KPI are mandatory; KPI were sufficient for local purposes. The motivation is to share with partners a Passport that will allow us to discuss issues related to sustainable building assessment – despite the different local approaches.*
B4.5 Potable water consumption for indoor uses	*KPI are mandatory; KPI were sufficient for local purposes. The motivation is to share with partners a Passport that will allow us to discuss issues related to sustainable building assessment – despite the different local approaches.*

C- ENVIRONMENTAL LOADINGS

CRITERION	REASON/MOTIVATION
C1.3 Global Warming potential	*KPI are mandatory; KPI were sufficient for local purposes. The motivation is to share with partners a Passport that will allow us to discuss issues related to sustainable building assessment – despite the different local approaches.*
C3.1 Construction and demolition waste	*KPI are mandatory; KPI were sufficient for local purposes. The motivation is to share with partners a Passport that will allow us to discuss issues related to sustainable building assessment – despite the different local approaches.*
C3.2 Solid waste from building operation	*KPI are mandatory; KPI were sufficient for local purposes. The motivation is to share with partners a Passport that will allow us to discuss issues related to sustainable building assessment – despite the different local approaches.*

D- INDOOR ENVIRONMENTAL QUALITY

CRITERION	REASON/MOTIVATION
D1.4 TVOC concentration in indoor air	*KPI are mandatory; KPI were sufficient for local purposes. The motivation is to share with partners a Passport that will allow us to discuss issues related to sustainable building assessment – despite the different local approaches.*
D1.10 Ventilation rate	*KPI are mandatory; KPI were sufficient for local purposes. The motivation is to share with partners a Passport that will allow us to discuss issues related to sustainable building assessment – despite the different local approaches.*
D2.2 Thermal comfort index	*KPI are mandatory; KPI were sufficient for local purposes. The motivation is to share with partners a Passport that will allow us to discuss issues related to sustainable building assessment – despite the different local approaches.*

E- SERVICE QUALITY

CRITERION	REASON/MOTIVATION
I	

F- SOCIAL, CULTURAL AND PERCEPTUAL ASPECTS	
CRITERION	**REASON/MOTIVATION**
/	

G- COST AND ECONOMIC ASPECTS	
CRITERION	**REASON/MOTIVATION**
G1.4 Use stage energy cost	*KPI are mandatory; KPI were sufficient for local purposes. The motivation is to share with partners a Passport that will allow us to discuss issues related to sustainable building assessment – despite the different local approaches.*
G1.5 Use stage water cost	*KPI are mandatory; KPI were sufficient for local purposes. The motivation is to share with partners a Passport that will allow us to discuss issues related to sustainable building assessment – despite the different local approaches.*

SBTool weights rationale

ISSUE	WEIGHT (1 to 3)	MOTIVATION
A - SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	**1**	**Default values from CESBA MED PP were used**
B – ENERGY AND RESOURCES CONSUMPTION	3	Default values from CESBA MED PP were used
C- ENVIRONMENTAL LOADINGS	3	Default values from CESBA MED PP were used
D- INDOOR ENVIRONMENTAL QUALITY	2	Default values from CESBA MED PP were used
E- SERVICE QUALITY	1	Default values from CESBA MED PP were used
F- SOCIAL CULTURAL AND PERCEPTUAL ASPECTS	1	Default values from CESBA MED PP were used
G- COST AND ECONOMIC ASPECTS	2	Default values from CESBA MED PP were used

CATEGORIES	WEIGHT (%)
A1- Site regeneration and Development	0
A2- Urban design	0
A3- Project Infrastructure and Services	0
SUB TOTAL- SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	0
B1- Total life cycle non renewable energy	60
B2- Embodied energy	0
B3- Use of materials	5
B4 – Use of water, stormwater and greywater	7
SUB TOTAL ENERGY AND RESOURCES CONSUMPTION	72
C1- Greenhouse gas emissions	15
C2- Other atmospheric emissions	0
C3- Solid and liquid waste	10
C4- Impact on project site	0
C5- Other local and regional impacts	0
SUB TOTAL- ENVIRONMENTAL LOADINGS	25
D1- Indoor air quality and ventilation	1
D2- Thermal comfort	1
D3– Visual comfort	0
D4– Acoustic comfort	0
SUB TOTAL- INDOOR ENVIRONMENTAL QUALITY	2
E1- Safety and Security	0
E2- Functionality and efficiency	0
E3- Controllability	
E4– Flexibility and adaptability	0
E5- Optimization and maintenance of operating performance	
SUB TOTAL - SERVICE QUALITY	0
F1- Social aspects	0
F2- Culture and heritage	0
F3- Perceptual	0
SUB TOTAL - SOCIAL CULTURAL AND PERCEPTUAL ASPECTS	0
G1- Cost and economics	2
SUB TOTAL - COST AND ECONOMIC ASPECTS	2
TOTAL	100

CRITERIA WEIGHTS

sheet WeightsA: B= Intensity of the Potential Effect (1-3), C=Extent of potential effect (1-5), D=Duration of potential effect (1-5)

CESBA MED SNTool, sheet WeightsB: LF = Local Factor

B- ENERGY AND RESOURCES CONSUMPTION						
B1- Total life cycle non-renewable energy						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
B1.1 Primary energy demand	*10%*	*2*	*5*	*5*	*10%*	*Default values from CESBA MED PP were used*
B1.2 Delivered	*10%*	*2*	*5*	*5*	*10%*	*Default values from CESBA MED PP were used*

thermal energy demand						
B1.3 Delivered electric energy demand	*10%*	*2*	*5*	*5*	*10%*	*Default values from CESBA MED PP were used*
B1.5 Energy from renewable sources in total thermal energy consumption	*10%*	*2*	*5*	*5*	*10%*	*Default values from CESBA MED PP were used*
B1.6 Energy from renewable sources in total electric energy consumption	*10%*	*2*	*5*	*5*	*10%*	*Default values from CESBA MED PP were used*
B1.11 Embodied non-renewable primary energy	*10%*	*2*	*5*	*5*	*10%*	*Default values from CESBA MED PP were used*

B2- Electrical peak demand

B3- Use of Material

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
B3.5 Recycled materials	*5%*	*2*	*4*	*3*	*5%*	*Default values from CESBA MED PP were used*

B4- Use of potable water, stormwater and greywater

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
B4.5 Potable water consumption for indoor uses	7%	3	4	3		

C- ENVIRONMENTAL LOADINGS

C1- Greenhouse Gas Emissions

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
C1.3 Global Warming potential	*15%*	*3*	*5*	*5*	*15%*	*Default values from CESBA MED PP were used*

C3 - Solid and Liquid Wastes

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
C3.1 Construction and demolition waste	5%	2	4	3	5%	*Default values from CESBA MED PP were used*
C3.2 Solid waste from building operation	5%	2	4	3	5%	*Default values from CESBA MED PP were used*

D- INDOOR ENVIRONMENTAL QUALITY

D1- Indoor Air Quality and Ventilation

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
D1.4 TVOC concentration in indoor air	*0,5%*	3	*1*	*3*	*1%*	*Default values from CESBA MED PP were used*

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION

D1.10 Ventilation rate	*0,5%*	3	*3*	*3*	*1%*	*Default values from CESBA MED PP were used*

D2 - Air Temperature and Relative humidity						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
D2.2 Thermal comfort index	*1%*	3	*1*	*3*	*1%*	*Default values from CESBA MED PP were used*

G- COST AND ECONOMIC ASPECTS						
G1- Cost and Economics						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
G1.4 Use stage energy cost	1%	3	2	3	1%	*Default values from CESBA MED PP were used*
G1.5 Use stage water cost	*0.4%*	1	*2*	*3*	*0.4%*	*Default values from CESBA MED PP were used*

SBTool benchmarks rationale

B- ENERGY AND RESOURCES CONSUMPTION				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
B1.1 Primary energy demand	Primary energy demand per area per year	*kWh/m2/y*	*0: 48* *3: 15* 5 : 0	Building regulation (2020)
B1.2 Delivered thermal energy demand	*Delivered thermal energy demand per area per year*	*kWh/m2/y*	*0: 40* *3: 15* 5 : 0	consultant feedback
B1.3 Delivered electric energy demand	Delivered electric energy demand per area per year	*kWh/m2/y*	*0: 40* *3:15* *5 : 0*	consultant feedback
B1.5 Energy from renewable sources in total thermal energy consumption	Share of renewable energy in final thermal energy consumptions	*%*	*0: 25* *3: 80* 5 : 100	consultant feedback
B1.6 Energy from renewable sources in total electric energy	*Share of renewable energy in final electric energy consumption*	*%*	*0: 10* *3: 100*	consultant feedback

consumption			5 : 200	
B1.11 Embodied non-renewable primary energy	*Embodied primary non-renewable energy*	*MJ/m2*	*0: 180* *3: 108* 5 : 90	values A1 to A3 on future building regulation E+C- or calcul on Elodie. Other sources from HQE performance 2011 and the guide_bio_tech_l_energie_grise_des_materiaux_et_des_ouvrages
B3.5 Recycled materials	Weight of recycled materials on total weight of materials	*%*	*0: 5* *3: 45* 5 : 75	*Aura and Indi*
B4.5 Potable water consumption for indoor uses	*Water consumption per occupant per year*	*m3/occupant/year*	*0: 40* *3: 25* 5 : 20	Study Tribu/Ademe

C- ENVIRONMENTAL LOADINGS				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
C1.3 Global Warming potential	*CO2 equivalent emissions per area per year*	*kg CO2 eq./m2/yr*	*0: 20* *3: 10* *5: 5*	Regulatory labels
C3.1 Construction and demolition waste	Weight of waste and materials generated per 1 m2 of useful floor area demolished or constructed	*kg/m2/life cycle stage*	*0: 1400* 3: 1000 *5: 600*	Figures given in the CESBA protocol
C3.2 Solid waste from building operation	*Ratio of the number of collectable solid waste types within a 100 m distance from the building's entrance to the reference solid waste categories*	%	*0: 0,4* *3: 0,7* *5: 1*	Criteria based on local practices in dense urban areas

D- INDOOR ENVIRONMENTAL QUALITY				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS

D1.4 TVOC concentration in indoor air	TVOC concentration in indoor air	µg/ m_3	*0: 300* *3: >200* *5 : <200*	HQE Performance
D1.10 Ventilation rate	Ventilation rate normalized per useful floor area	*l/s.m2*	*0 : 0,5* *3 : 0,7* *5 : 0,9*	*Annex B of EN15251*
D2.2 Thermal comfort index	Predicted Percentage Dissatisfied	*%*	0: 10 3: 7 5 : 5	Annex A of ISO 7730

G- COST AND ECONOMIC ASPECTS				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
G1.4 Use stage energy cost	Energy annual cost per usable floor area	€/m_2.yr	*0: 15* *3: 7* *5: 5*	*consultant feedback*
G1.5 Use stage water cost	Water annual cost per usable floor area	€/m_2.yr	*0: 10* *3: 5* *5: 3*	*consultant feedback*

SBTool Criteria Specifications

B- ENERGY AND RESOURCES CONSUMPTION			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
B1.1 Primary energy demand	Primary energy demand per area per year	*Information source*	*Models and simulation*
		Assessment method	*The calculation methods for each sub-indicator are given by the CEN standards that support the implementation of the Directive on the Energy Performance of Buildings (EPBD) in the European Union. The CEN standards that form the basis of the calculation methods of most national regulations are: EN 15603 (Energy performance of buildings. Overall energy consumption and definition of energy assessments) and EN ISO 52000 (Energy performance of buildings - Calculation of energy requirements for space heating and*

			cooling). In fact, the national calculation methods used to produce the energy performance certificates can be used here. *Interior lighting is not always covered by national regulations. As a result, the evaluator must clearly mention in his report that the consumptions were discarded or detail the specific method used. The reference standard for the evaluation of lighting consumption must be EN 15193.* *References and standards* *Level (s)* *EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments).*
		Standard	*The reference standard for the evaluation of lighting consumption must be EN 15193.* *References and standards* *Level (s)* *EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments).* *EN 52016-1*
B1.2 Delivered thermal energy demand	Delivered thermal energy demand per year	*Information source*	*Models and simulation*
		Assessment method	*The calculation method for this indicator is given by the CEN standards that support the implementation of the Directive on the energy performance of buildings (EPBD) in the European Union.* *The CEN standards that form the basis of the calculation methods of most national regulations are: EN 52000 (Energy performance of buildings.* *Overall energy consumption and definition of energy assessments) and EN ISO 56001 (Energy performance of buildings - Calculation of energy requirements for space heating and cooling). In fact, the national calculation methods used to produce the energy performance certificates can be used here.*
		Standard	*Level (s)* *EN 52000 (Energy performance of buildings.* *Overall energy consumption and definition of energy assessments) and EN ISO 56001 (Energy performance of buildings - Calculation of energy requirements for space heating and cooling). In fact, the national calculation methods used to produce the energy performance certificates can be used here.*
B1.3 Delivered electric energy demand	Delivered electric energy demand per area per year	*Information source*	*Models and simulation*
		Assessment method	*The calculation method for this indicator is given by the CEN standards that support the implementation of the Directive on the energy performance of buildings (EPBD) in the European Union.* *The CEN standards which form the basis of the calculation methods of most national regulations are: EN 52000 (Energy performance of*

			buildings. Overall energy consumption and definition of energy assessments) and EN ISO 56001 (Energy performance of buildings - Calculation of energy requirements for space heating and cooling). In fact, the national calculation methods used to produce the energy performance certificates can be used here. In the case of existing buildings, the electrical energy delivered must be evaluated preferentially from the data collected.
		Standard	*EN 52000 (Energy performance of buildings. Overall energy consumption and definition of energy assessments) and EN ISO 56001 (Energy performance of buildings - Calculation of energy requirements for space heating and cooling)*
B1.5 Energy from renewable sources in total thermal energy consumption	Share of renewable energy in final thermal energy consumptions	*Information source*	*Models and simulation*
		Assessment method	*The calculation method for this indicator is given by the CEN standards which support the implementation of the Directive on the energy performance of buildings.*
		Standard	*EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments*
B1.6 Energy from renewable sources in total electric energy consumption	*Share of renewable energy in final electric energy consumption*	*Information source*	*Models and simulation*
		Assessment method	*The calculation method for this indicator is given by the CEN standards which support the implementation of the Directive on the energy performance of buildings. In the case of existing buildings, the share of renewable energy in total electricity consumption should be assessed from measurements. References and standards*
		Standard	*EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments*
B1.11 Embodied non-renewable primary energy	*Embodied primary non-renewable energy*	*Information source*	*Models and simulation*
		Assessment method	*The main reference standards for this indicator are ISO 14040/44, EN 15804 (Contribution of construction works to sustainable development - Environmental product declarations - Rules governing categories of construction products) and EN 1578 (Contribution of construction works to sustainable development - Evaluation of the environmental performance of buildings - Calculation method). The calculation of this indicator is based on the inventory of the different materials that make up the building (enkg), the nomenclature of material surveys. The document lists the quantities of different materials by type of constructive elements. The starting point is the DQE, estimated quantitative detail, which details the various elements of the project (foundations, columns ...). The*

			nomenclature of material records describes the different materials that make up the elements of the building. Once the material survey has been completed, the indicator can be calculated. The different stages of the calculation are the following: *-Compiling the masses of different materials; this compilation work must be at least 99% of the total mass of the building;* *-Identify the different elements of the buildings. A decomposition by material must be carried out. And the mass of each of the materials estimated:* *- Aggregate by material: the masses by type of elements must be added so as to obtain the total mass per material. Once the nomenclature of the material surveys carried out, it is possible to calculate the indicator by associating each material (in kg) with the corresponding gray energy factor (in MJ / kg).* *The total value of gray energy of non-renewable origin is then reported to the surface.*
		Standard	*EN 15978 (Contribution of construction works to sustainable development - Evaluation of the environmental performance of buildings - Calculation method)*
B3.5 Recycled materials	Weight of recycled materials on total weight of materials	*Information source*	*Models and simulation or material documents*
		Assessment method	*To calculate the value of the indicator it is necessary to compile a Bill of Materials (BoM) that is a mass-based inventory of the different materials (kg) that compose a building. The BoM is organised according to main elements that a building is composed of.* *The starting point is the Bill of Quantities (BoQ) that specifies the elements of a building (e.g. foundations, columns). The BoQ comprises different categories of elements, which can have different functional performance characteristics. A BoM differs from a BoQ in that it describes the different materials (e.g. wood, steel, aluminium) that are contained in the various building elements. Once the BoM has been compiled, it is possible to calculate the value of the indicator. The following steps should be followed in order to characterize the indicator:* *- Compile the Bill of Quantities: A BoQ is compiled which comprises the building elements accounting for at least 99% of the mass of the building.* *- Identify the basic composition of each building element. A breakdown of its constituent materials has to elaborated. The mass of each constituent material has to be estimated;* *- Aggregation by material: the mass of all constituent material should thereafter be aggregated to obtain the total mass of materials used in the building (A);* *- Identify the recycled content of each constituent material (in mass);* *- Aggregation by material: the recycled mass of*

			all constituent materials should thereafter be aggregated to obtain the total recycled mass of materials (B) used in the building; *- The indicator's value is calculated as B/A (total mass of recycled materials on the total mass of materials).*
		Standard	*/*
B4.5 Potable water consumption for indoor uses	*Water consumption per occupant per year*	*Information source*	*Models and simulation*
		Assessment method	*The evaluator should include sanitary equipment (ie toilets, taps and showers) that consume water (ie dishwashers, washing machines). The unit consumptions of the different devices are determined from the industrial data. The specific factors of use must be established, as well as the number of days of occupation per year.* *The principle of calculating the consumption per occupant for faucets and showers is as follows:* *Total consumption (L / n of day of occ.) =? Unit consumption (L / min) x utilization factor x (min / nb of day of occ.)* *The calculation is the same for the consumptions related to the use of the toilets (the flushes replace the minutes).* *For hygiene, the bases of calculation are as follows:* *Total consumption (L / year) = unit consumption (L / m²) area (m2) × annual washing number (year - 1)* *Total consumption (m3 / occupant. year) = total consumption (L / year) x 0.001 (m3 / L) + occupancy time (occupant) Non-potable water consumption must be specified (eg reclaimed water used for In the case of existing buildings, the indicator should be calculated from measured data. The measured consumption must be averaged over a period of 3 years.*
		Standard	Tool "Water calculator"

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C- ENVIRONMENTAL LOADINGS

CRITERION	INDICATOR	SPECIFICATIONS	
		Information source	*Models and simulation*
C1.3 Global Warming potential	*CO2 equivalent emissions per area per year*	*Assessment method*	*Calculation of CO2eq emissions. for each building can be realized thanks to this formula:* *E = [Σ (Qfuel, i x LHVi × Kem, i) + (Qel × Kem, el) + (Qdh × Kem, dh)] / SuQfuel, I = annual quantity of i-th fuel (m3 or kg)* *Qel = annual quantity of electricity from the grid (kWh)* *Qdh = annual amount of energy from the district heating or cooling network (kWh)* *LHVi = lower calorific value of i-th fuel (kWh / m3 or kWh / kg)* *Kem, i = CO2 emission factor eq. i-th fuel (kg CO2 / kWh)* *Kem, el = CO2 emission factor eq. electrical*

			energy from the grid (kg CO2 / kWh) *Kem, dh = CO2 emission factor eq. of the urban heat or cold network (kg CO2 / kWh)* *Su = total usable area of buildings*
		Standard	*EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments)*
C3.1 Construction and demolition waste	Weight of waste and materials generated per 1 m2 of useful floor area demolished or constructed	*Information source*	*Models and simulation*
		Assessment method	*1. Design phase (based on estimates): Estimates based on surveys of existing buildings that will undergo a major renovation or whose structure will be reused (life cycle stage B5). Estimates based on building deconstruction and demolition scenarios beyond the end of building use (life cycle stages C1 / 3, D).* *2. Construction (based on data collected on site): Data of deconstruction and demolition of a building to make room for a new construction (as part of the life cycle stages) .Data of partial deconstruction of a building for on-site reuse. On-site construction data for a new building and / or prefabrication / construction of some off-site elements (Life Cycle Steps A3 / 5)* *3. Completion (based on estimates supported by compliant plans): Estimates based on deconstruction and demolition scenarios of the building beyond the end of use of the building (life cycle stages C1 / 3, D)* *4 Post-delivery (based on commissioning and testing)* *5. Occupation (based on measured performance)* *6.End of life (based on the envisaged performance): Details the measures taken in the design phase to facilitate the construction, reuse and recycling (stages of the C1 / 3, D life cycle).*
		Standard	*/*
C3.2 Solid waste from building operation	*Ratio of the number of collectable solid waste types within a 100 m distance from the building's entrance to the reference solid waste categories*	*Information source*	*Plans of the area with the location of containers*
		Assessment method	*The seven solid waste reference categories are:* *-Paper* *-Plastic* *-Metal* *-Glass* *-Wet waste* *-Textiles* *-Dangerous* *Identify the availability and location of dedicated containers for each of the 7 categories of solid waste. Calculate the walking distance (m) of the main building door for each sorting equipment. Evaluate which of the 7 categories of solid waste can be collected within a 50m perimeter from the main entrance of the building (A) .The value of the indicator is given by the ratio: A / 7*

		Standard	/

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D- INDOOR ENVIRONMENTAL QUALITY			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
D1.4 TVOC concentration in indoor air	TVOC concentration in indoor air	*Information source*	*Measured data*
		Assessment method	*The value of the indicator must be given by measurements in situ in occupancy (and after delivery). Measurements must be carried out on at least 10% of the apartments. These must be representative of the different types of housing, configurations and materials used. The samples must be taken from the living room and the smallest room of each apartment. The measuring equipment must be placed in the center of the room so as not to be too much influenced by the doors and windows and the air inlets.* *The sampling method shall be in accordance with ISO 16000-6 (Indoor Air - Part 6: Determination of Volatile Organic Compounds in Indoor Air and Active Sampling Chambers on Tenax TA (R) Sorbent, Desorption thermal and gas chromatographic using MS or MS / FID) or equivalent.* *In the design phase, product testing can be used as a simplified data source. These emissions must be evaluated over a period of 28 days. They must be established in accordance with standard NF EN 16516 (Construction products - evaluation of the emission of dangerous substances - Determination of indoor air emissions).* *Test data is then required from the manufacturers and suppliers of the products concerned. All tests must be on compliant finished products.* *References and Standards EN 15251 (Indoor Environment Criteria for the Design and Evaluation of the Energy Performance of Buildings covering Indoor Air Quality, Thermal, Lighting and Acoustics)* *Resources:* *VOC and housing (up to 35 substances): "In the gas phase, the chemical compounds present are mainly Volatile Organic Compounds (VOCs) containing a multitude of substances of different chemical families, and are thus detected in the indoor environments in a more significant way than some aldehydes (including formaldehyde mainly and almost systematically), certain aromatic hydrocarbons including benzene, toluene, ethylbenzene and xylenes commonly called BTEX, but also VOCs belonging to the families of terpenes, ketones, alcohols, ethers of*

			Glycol ... "For information, the United States recommends a total VOC concentration of less than 200 µg / m3 as the comfort threshold and Germany recommends a target value of 300 µg / m3. measures of_19 "Air Atmo Alsace http: //www.atmo-alsace.net/medias/products/Campagne_de_measures_de_19.pdf
		Standard	*ISO 16000-6 (Indoor Air - Part 6: Determination of Volatile Organic Compounds in Indoor Air and Active Sampling Chambers on Tenax TA (R) Sorbent, Desorption thermal and gas chromatographic using MS or MS / FID) or equivalent.* *NF EN 16516 (Construction products - evaluation of the emission of dangerous substances - Determination of indoor air emissions).*
D1.10 Ventilation rate	Ventilation rate normalized per useful floor area	*Information source*	*Estimation or measured method*
		Assessment method	*Project stage: design* *A design simulation of the building's ventilation strategy in accordance with EN 16798-7 (Energy performance of buildings - Ventilation for buildings - Part 7: Calculation methods for the determination of air flow rates in buildings including infiltration) shall be used to calculate the ventilation rate. According to Directive 2010/31/EU for the Energy Performance of buildings, a ventilation system is part of the technical building system. The simulation shall therefore always form part of the performance assessment for the typical use of a building as a whole.* *The ventilation rate (l/s/m2) must be calculated in all the main rooms, excluding circulation spaces and service rooms (i.e. toilets).* *The indicator must be calculated as weighted sum all the calculated ventilation rates:* *Indicator= (∑▒ ⟦V_i×S_(u,i) ⟧)/(∑▒S_(u,i))* *Vi = Ventilation rate calculated in the i-th room (l/s/m2)* *Su,i = useful floor area of the i-th room (m2)* *Project stage: post completion* *The ventilation rate shall be tested as part of the commissioning process on site according to the methods described in Annex D of EN 12599.* *The average ventilation rate shall be reported.* *Measurements can be taken at a number of points in a system. The measurements shall be made for the related ducts and/or air terminals that supply air to the internal spaces as identified according to the guidance in section 2.1.2.2 of the reference standard.*

		Standard	*EN 16798-7 - Energy performance of buildings - Ventilation for buildings - Part 7: Calculation methods for the determination of air flow rates in buildings including infiltration.* *EN 12599 - Ventilation for buildings - Test procedures and measurement methods to hand over air conditioning and ventilation systems.*
D2.2 Thermal comfort index	Predicted Percentage Dissatisfied	*Information source*	*Models and simulation or measured method*
		Assessment method	*In the design phase, PPD estimation can be done using simulation software. In the operation phase, the PPD can be measured.* *The value of the PPD shall be calculated or measured in accordance with EN 7730 (Ergonomics of the thermal environment - Analytical determination and interpretation of thermal comfort by calculation of the PMV and PPD indices and by local thermal comfort criteria) for the seasonal and winter conditions. The PDP must be evaluated in all main living rooms and bedrooms. In the case of a collective dwelling, each configuration and orientation must be evaluated.* *The measuring point should be placed one meter from the center of the main window of each room. The following parameters must be used to characterize the value of the PDP:* *-clothing thermal resistance (clo) = 0.5-metabolic energy (met) = 1.2* *To evaluate the value of the PDP on a building as a whole, the PPD values estimated or measured in each room must be aggregated by a weighted average: PPDm = Sum PPDi x Au, i / Sum Au, where:* *PPDi = PPD for the coin-th* *Au, i = useful area of the i-th room*
		Standard	*EN 7730 (Ergonomics of the thermal environment - Analytical determination and interpretation of thermal comfort by calculation of the PMV and PPD indices and by local thermal comfort criteria*

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G- COST AND ECONOMIC ASPECTS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
		Information source	*Models and simulation*
G1.4 Use stage energy cost	Energy annual cost per usable floor area	*Assessment method*	*The calculation can be based on estimates in the design phase. It must be based on consumption monitoring during the exploitation phase. The indicator can be used by different actors for different purposes. In the design phase, it can be used to estimate future operating costs. In the operating phase, it can be used to compare the real performance of the building with the estimated estimates. For existing buildings, the total annual cost of*

			thermal and electrical consumption from energy bills must be realized over an average of 3 years.
		Standard	*/*
G1.5 Use stage water cost	Water annual cost per usable floor area	*Information source*	*Models and simulation*
		Assessment method	*The calculation can be based on estimates in the design phase. It must be based on consumption monitoring during the operation phase. The indicator can be used by different actors for different purposes. In the design phase, it can be used to estimate future operating costs. In the operation phase, it can be used to compare the real performance of the building with the estimated estimates.* *For existing buildings, the total annual cost of water consumption from the invoices must be realized over an average of 3 years.*
		Standard	*/*

REGIONAL TOOL

D.3.4.3 Regional Tool – AURA-EE

Version 1.1

Date: March 2019

2.1: To raise capacity for better management of energy in public buildings at transnational level
Work package: WP3 TESTING
Activity: 3.4 Evaluation of test results
Deliverable: 3.4.3 – Regional CESBA MED SNTs

Responsible Partner: Andrea Moro, iiSBE Italia R&D

BUILDING SCALE ASSESSMENT

SBTool structure

A – SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	
/	

B – ENERGY AND RESOURCES CONSUMPTION	
B1	**Total life cycle non-renewable energy**
B1.1	Primary energy demand
B.1.2	Delivered thermal energy demand
B.1.3	Delivered electric energy demand
B.1.5	Energy from renewable sources in total thermal energy consumption
B.1.6	Energy from renewable sources in total electric energy consumption
B.1.11	Embodied non-renewable primary energy
B3	**Use of Material**
B3.5	Recycled materials
B4	**Use of potable water, stormwater and greywater**
B4.5	**Potable water** consumption for indoor uses

C- ENVIRONMENTAL LOADINGS	
C1	**Greenhouse Gas Emissions**
C1.3	Global Warming potential
C3	**Solid and Liquid Wastes**
C3.1	Construction and demolition waste
C3.2	Solid waste from building operation

D- INDOOR ENVIRONMENTAL QUALITY	
D1	**Indoor Air Quality and Ventilation**
D1.4	TVOC concentration in indoor air
D2	**Air Temperature and Relative humidity**
D.2.2	Thermal comfort index

E- SERVICE QUALITY
/

F- SOCIAL, CULTURAL AND PERCEPTUAL ASPECTS
/

G- COST AND ECONOMIC ASPECTS	
G1	**Cost and Economics**
G.1.4	*Use stage energy cost*
G.1.5	Use stage water cost

SBTool criteria selection rationale

A - SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	
CRITERION	**REASON/MOTIVATION**
/	

B – ENERGY AND RESOURCES CONSUMPTION	
CRITERION	**REASON/MOTIVATION**
B1.1 Primary energy demand	*KPI are mandatory; KPI were sufficient for local purposes*
B1.2 Delivered thermal energy demand	KPI are mandatory; KPI were sufficient for local purposes
B1.3 Delivered electric energy demand	KPI are mandatory; KPI were sufficient for local purposes
B1.5 Energy from renewable sources in total thermal energy consumption	KPI are mandatory; KPI were sufficient for local purposes
B1.6 Energy from renewable sources in total electric energy consumption	KPI are mandatory; KPI were sufficient for local purposes
B1.11 Embodied non-renewable primary energy	KPI are mandatory; KPI were sufficient for local purposes
B3.5 Recycled materials	KPI are mandatory; KPI were sufficient for local purposes
B4.5 Potable water consumption for indoor uses	KPI are mandatory; KPI were sufficient for local purposes

C- ENVIRONMENTAL LOADINGS	
CRITERION	**REASON/MOTIVATION**
C1.3 Global Warming potential	KPI are mandatory; KPI were sufficient for local purposes
C3.1 Construction and demolition waste	KPI are mandatory; KPI were sufficient for local purposes

C3.2 Solid waste from building operation	KPI are mandatory; KPI were sufficient for local purposes

D- INDOOR ENVIRONMENTAL QUALITY	
CRITERION	**REASON/MOTIVATION**
D1.4 TVOC concentration in indoor air	KPI are mandatory; KPI were sufficient for local purposes
D2.2 Thermal comfort index	KPI are mandatory; KPI were sufficient for local purposes

E- SERVICE QUALITY	
CRITERION	**REASON/MOTIVATION**
/	

F- SOCIAL, CULTURAL AND PERCEPTUAL ASPECTS	
CRITERION	**REASON/MOTIVATION**
/	

G- COST AND ECONOMIC ASPECTS	
CRITERION	**REASON/MOTIVATION**
G1.4 Use stage energy cost	KPI are mandatory; KPI were sufficient for local purposes
G1.5 Use stage water cost	KPI are mandatory; KPI were sufficient for local purposes

SBTool weights rationale

ISSUE	WEIGHT (1 to 3)	MOTIVATION
A - SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	**1**	**Default values from CESBA MED PPs were relevant**
B – ENERGY AND RESOURCES CONSUMPTION	3	Default values from CESBA MED PPs were relevant
C- ENVIRONMENTAL LOADINGS	3	Default values from CESBA MED PPs were relevant
D- INDOOR ENVIRONMENTAL QUALITY	2	Default values from CESBA MED PPs were relevant
E- SERVICE QUALITY	1	Default values from CESBA MED PPs were relevant
F- SOCIAL CULTURAL AND PERCEPTUAL ASPECTS	1	Default values from CESBA MED PPs were relevant
G- COST AND ECONOMIC ASPECTS	2	Default values from CESBA MED PPs were relevant

CATEGORIES	WEIGHT (%)
A1- Site regeneration and Development	0
A2- Urban design	0
A3- Project Infrastructure and Services	0
SUB TOTAL	0
B1- Total life cycle non renewable energy	60
B2- Embodied energy	0
B3- Use of materials	5
B4 – Use of water, stormwater and greywater	7
SUB TOTAL	72
C1- Greenhouse gas emissions	15
C2- Other atmospheric emissions	0
C3- Solid and liquid waste	10
C4- Impact on project site	0
C5- Other local and regional impacts	0
SUB TOTAL	25
D1- Indoor air quality and ventilation	1
D2- Thermal comfort	1
D3– Visual comfort	0
D4– Acoustic comfort	0
SUB TOTAL	2
E1- Safety and Security	0
E2- Functionality and efficiency	0

E3- Controllability **E4– Flexibility and adaptability** **E5- Optimization and maintenance of operating performance**	0
SUB TOTAL	0
F1- Social aspects	0
F2- Culture and heritage	0
F3- Perceptual	0
SUB TOTAL	0
G1- Cost and economics	2
SUB TOTAL	2
TOTAL	100

CRITERIA WEIGHTS

sheet WeightsA: B= Intensity of the Potential Effect (1-3), C=Extent of potential effect (1-5), D=Duration of potential effect (1-5)

CESBA MED SNTool, sheet WeightsB: LF = Local Factor

B- ENERGY AND RESOURCES CONSUMPTION						
B1- Total life cycle non-renewable energy						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
B1.1 Primary energy demand	*10%*	*2*	*5*	*5*	*10%*	*Default values from CESBA MED PPs were relevant*
B1.2 Delivered thermal energy demand	*10%*	*2*	*5*	*5*	*10%*	*Default values from CESBA MED PPs were relevant*
B1.3 Delivered electric energy demand	*10%*	*2*	*5*	*5*	*10%*	*Default values from CESBA MED PPs were relevant*
B1.5 Energy from renewable sources in total thermal energy consumption	*10%*	*2*	*5*	*5*	*10%*	*Default values from CESBA MED PPs were relevant*
B1.6 Energy from renewable sources in total electric energy consumption	*10%*	*2*	*5*	*5*	*10%*	*Default values from CESBA MED PPs were relevant*
B1.11 Embodied non-renewable primary energy	*10%*	*2*	*5*	*5*	*10%*	*Default values from CESBA MED PPs were relevant*
B2- Electrical peak demand						
B3- Use of Material						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
B3.5 Recycled materials	*5%*	*2*	*4*	*3*	*5%*	*Default values from CESBA MED PPs were relevant*
B4- Use of potable water, stormwater and greywater						

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
B4.5 Potable water consumption for indoor uses	7%	3	4	3		

C- ENVIRONMENTAL LOADINGS

C1- Greenhouse Gas Emissions

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
C1.3 Global Warming potential	*15%*	*3*	*5*	*5*	*15%*	*Default values from CESBA MED PPs were relevant*

C3 - Solid and Liquid Wastes

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
C3.1 Construction and demolition waste	5%	2	4	3	5%	*Default values from CESBA MED PPs were relevant*
C3.2 Solid waste from building operation	5%	2	4	3	5%	*Default values from CESBA MED PPs were relevant*

D- INDOOR ENVIRONMENTAL QUALITY

D1- Indoor Air Quality and Ventilation

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
D1.4 TVOC concentration in indoor air	*1%*	3	*1*	*3*	*1%*	*Default values from CESBA MED PPs were relevant*

D2 - Air Temperature and Relative humidity

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
D2.2 Thermal comfort index	*1%*	3	*1*	*3*	*1%*	*Default values from CESBA MED PPs were relevant*

G- COST AND ECONOMIC ASPECTS

G1- Cost and Economics

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
G1.4 Use stage energy cost	1%	3	2	3	1%	*Default values from CESBA MED PPs were relevant*
G1.5 Use stage water cost	*0.4%*	1	*2*	*3*	*0.4%*	*Default values from CESBA MED PPs were relevant*

SBTool benchmarks rationale

B- ENERGY AND RESOURCES CONSUMPTION				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
B1.1 Primary energy demand	Primary energy demand per area per year	*kWh/m2/y*	*0: 140*	Result new collective dwellings RT2012
			3: 50	Mid value
			5 : 0	Result new collective dwellings RT2012
B1.2 Delivered thermal energy demand	*Delivered thermal energy demand per area per year*	*kWh/m2/y*	*0: 130*	Result new collective dwellings RT2012
			3: 45	Mid value
			5 : 30	Result new collective dwellings RT2012
B1.3 Delivered electric energy demand	Delivered electric energy demand per area per year	*kWh/m2/y*	*0: 140*	Result new collective dwellings RT2012
			3: 50	Mid value
			5 : 0	Result new collective dwellings RT2012
B1.4 Energy from renewable sources in total primary energy consumption	Primary energy demand of the building that is met by renewable sources on total primary energy demand	*%*	*0: 10*	*The minimum value given corresponds to the criteria given in the Greater Lyon Sustainable Habitat framework, which requires an active renewable energy production with a minimum*
			3: 80	high-performance building
			5 : 100	*Autonomous building*
B1.5 Energy from renewable sources in total thermal energy consumption	Share of renewable energy in final thermal energy consumptions	*%*	*0: 10*	The minimum value given corresponds to the criteria given in the Greater Lyon Sustainable Habitat framework, which requires an active renewable energy production with a minimum
			3: 80	High-performance building
			5 : 100	Autonomous building
B1.6 Energy from renewable sources in total electric energy consumption	*Share of renewable energy in final electric energy consumption*	*%*	*0: 10*	The minimum value given corresponds to the criteria given in the Greater Lyon Sustainable Habitat

				framework, which requires an active renewable energy production with a minimum
			3: 80	High-performance building
			5 : 100	Autonomous building for electricity
B1.11 Embodied non-renewable primary energy	*Embodied primary non-renewable energy*	*MJ/m2*	*0: 900*	Sources: CSTB report "Capitalization of the results of the HQE Performance experimentation, Statistical analysis, Action 22" of October 2013. 250kWhep/m²shon/an toute typologie confondue
			3: 630	*175 kWhep / m²shon / year any typology taken together*
			5 : 504	140 kWhep / m²shon / year any typology taken together
B3.5 Recycled materials	Weight of recycled materials on total weight of materials	*%*	*0: 5*	*Actual professional* practice
			3: 45	*objective of professional practice*
			5 : 75	objective of professional best practice
B4.5 Potable water consumption for indoor uses	*Water consumption per occupant per year*	*m3/occupant/year*	*0: 90*	Assumptions: for all dwellings, people present every day of the year, heavy use of all water uses, consumer equipment, over-occupancy - see Water Calculator tool - for 3121 m² SHAB, with 3 occupants per dwelling and 50 dwellings
			3: 30	*Water Calculator - 3121 m² SHAB, with 2.3 occupants per dwelling and 50 dwellings*
			5 : 20	Water Calculator - 3121 m² SHAB with 2.3 occupants per dwelling and 50 dwellings

C- ENVIRONMENTAL LOADINGS				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
C1.3 Global Warming potential	*CO2 equivalent emissions per area per year*	*kg CO2 eq./m2/yr*	*0: 80*	Emissions from the regulatory calculation
			3: 10	Emissions from the regulatory calculation

			5: 5	Emissions from the regulatory calculation
C3.1 Construction and demolition waste	Weight of waste and materials generated per 1 m2 of useful floor area demolished or constructed	*kg/m2/life cycle stage*	*0: 1700*	Figures given in the CESBA protocol
			3: 1200	Figures given in the CESBA protocol
			5: 600	Figures given in the CESBA protocol
C3.2 Solid waste from building operation	*Ratio of the number of collectable solid waste types within a 100 m distance from the building's entrance to the reference solid waste categories*	%	*0: 0,4*	Criteria based on local practices in dense urban areas
			3: 0,7	Criteria based on local practices in dense urban areas
			5: 1	Criteria based on local practices in dense urban areas

D- INDOOR ENVIRONMENTAL QUALITY

CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
D1.4 TVOC concentration in indoor air	TVOC concentration in indoor air	µg/ m3	*0: 300*	Recommendation of German Federal Agency
			3: 200	*Local value*
			5 : 100	*Local objective*
D2.2 Thermal comfort index	Predicted Percentage Dissatisfied	*%*	0: 10	CESBA Default value
			3: 5	Mid Value
			5 : 0	Good quality

G- COST AND ECONOMIC ASPECTS

CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
G1.4 Use stage energy cost	Energy annual cost per usable floor area	€/m2/yr	*0: 15*	*Hypothesis: Collective building, cep <96 kWhep / m².year, collective gas boiler*
			3: 7	*Hypothesis: Collective building with efficient thermal envelope, collective gas boiler*
			5: 5	*Hypothesis: Collective building with high performance thermal envelope, collective gas boiler*
G1.5 Use stage water cost	Water annual cost per usable floor area	€/m2/yr	*0: 13*	*Assumptions: for all dwellings, people present every day of the year, strong use of all*

			water uses, consumer equipment, - see Water Calculator tool - 90 m3 / occupant / year, for 3121 m² SHAB, with 3 occupants per dwelling and 50 dwellings
		3: 3,5	*Water Calculator - 30 m3 / occupant / year, for 3121 m² SHAB, with 2.3 occupants per dwelling and 50 dwellings*
		5: 2,3	*Water Calculator - 20 m3 / occupant / year, for 3121 m² SHAB, with 2.3 occupants per dwelling and 50 dwellings*

SBTool Criteria Specifications

B- ENERGY AND RESOURCES CONSUMPTION			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
B1.1 Primary energy demand	Primary energy demand per area per year	*Information source*	*Models and simulation*
		Assessment method	*The calculation methods for each sub-indicator are given by the CEN standards that support the implementation of the Directive on the Energy Performance of Buildings (EPBD) in the European Union. The CEN standards that form the basis of the calculation methods of most national regulations are: EN 15603 (Energy performance of buildings. Overall energy consumption and definition of energy assessments) and EN ISO 52000 (Energy performance of buildings - Calculation of energy requirements for space heating and cooling). In fact, the national calculation methods used to produce the energy performance certificates can be used here. Interior lighting is not always covered by national regulations. As a result, the evaluator must clearly mention in his report that the consumptions were discarded or detail the specific method used. The reference standard for the evaluation of lighting consumption must be EN 15193. References and standards Level (s) EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments).*
		Standard	*The reference standard for the evaluation of lighting consumption must be EN 15193. References and standards Level (s) EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments). EN 52016-1*

B1.2 Delivered thermal energy demand	Delivered thermal energy demand per year	*Information source*	*Models and simulation*
		Assessment method	*The calculation method for this indicator is given by the CEN standards that support the implementation of the Directive on the energy performance of buildings (EPBD) in the European Union.* *The CEN standards that form the basis of the calculation methods of most national regulations are: EN 52000 (Energy performance of buildings.* *Overall energy consumption and definition of energy assessments) and EN ISO 56001 (Energy performance of buildings - Calculation of energy requirements for space heating and cooling). In fact, the national calculation methods used to produce the energy performance certificates can be used here.*
		Standard	*Level (s)* *EN 52000 (Energy performance of buildings. Overall energy consumption and definition of energy assessments) and EN ISO 56001 (Energy performance of buildings - Calculation of energy requirements for space heating and cooling). In fact, the national calculation methods used to produce the energy performance certificates can be used here.*
B1.3 Delivered electric energy demand	Delivered electric energy demand per area per year	*Information source*	*Models and simulation*
		Assessment method	*The calculation method for this indicator is given by the CEN standards that support the implementation of the Directive on the energy performance of buildings (EPBD) in the European Union.* *The CEN standards which form the basis of the calculation methods of most national regulations are: EN 52000 (Energy performance of buildings. Overall energy consumption and definition of energy assessments) and EN ISO 56001 (Energy performance of buildings - Calculation of energy requirements for space heating and cooling). In fact, the national calculation methods used to produce the energy performance certificates can be used here.* *In the case of existing buildings, the electrical energy delivered must be evaluated preferentially from the data collected.*
		Standard	*EN 52000 (Energy performance of buildings. Overall energy consumption and definition of energy assessments) and EN ISO 56001 (Energy performance of buildings - Calculation of energy requirements for space heating and cooling)*
B1.4 Energy from renewable sources in total primary energy consumption	Primary energy demand of the building that is met by renewable sources on total primary energy	*Information source*	*Models and simulation*
		Assessment method	*The calculation method for this indicator is given by the CEN standards that support the implementation of the Directive on the Energy*

	demand		*Performance of Buildings (EPBD) in the European Union.* *The CEN standards which form the basis of the calculation methods of most national regulations are: EN 52000 (Energy performance of buildings.* *Overall energy consumption and definition of energy assessments) and EN ISO 56001 (Energy performance of buildings - Calculation of energy requirements for space heating and cooling).*
		Standard	*EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments)*
B1.5 Energy from renewable sources in total thermal energy consumption	Share of renewable energy in final thermal energy consumptions	*Information source*	*Models and simulation*
		Assessment method	*The calculation method for this indicator is given by the CEN standards which support the implementation of the Directive on the energy performance of buildings.*
		Standard	*EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments*
B1.6 Energy from renewable sources in total electric energy consumption	*Share of renewable energy in final electric energy consumption*	*Information source*	*Models and simulation*
		Assessment method	*The calculation method for this indicator is given by the CEN standards which support the implementation of the Directive on the energy performance of buildings.* *In the case of existing buildings, the share of renewable energy in total electricity consumption should be assessed from measurements.* *References and standards*
		Standard	*EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments*
B1.11 Embodied non-renewable primary energy	*Embodied primary non-renewable energy*	*Information source*	*Models and simulation*
		Assessment method	*The main reference standards for this indicator are ISO 14040/44, EN 15804 (Contribution of construction works to sustainable development - Environmental product declarations - Rules governing categories of construction products) and EN 1578 (Contribution of construction works to sustainable development - Evaluation of the environmental performance of buildings - Calculation method). The calculation of this indicator is based on the inventory of the different materials that make up the building (enkg), the nomenclature of material surveys. The document lists the quantities of different materials by type of constructive elements. The starting point is the DQE, estimated quantitative detail, which details the various elements of the project (foundations, columns ...). The nomenclature of material records describes the different materials that make up the elements of the building. Once the material survey has been*

			completed, the indicator can be calculated. The different stages of the calculation are the following: *-Compiling the masses of different materials; this compilation work must be at least 99% of the total mass of the building;* *-Identify the different elements of the buildings. A decomposition by material must be carried out. And the mass of each of the materials estimated:* *- Aggregate by material: the masses by type of elements must be added so as to obtain the total mass per material. Once the nomenclature of the material surveys carried out, it is possible to calculate the indicator by associating each material (in kg) with the corresponding gray energy factor (in MJ / kg).* *The total value of gray energy of non-renewable origin is then reported to the surface.*
		Standard	*EN 15978 (Contribution of construction works to sustainable development - Evaluation of the environmental performance of buildings - Calculation method)*
B3.5 Recycled materials	Weight of recycled materials on total weight of materials	*Information source*	*Models and simulation or material documents*
		Assessment method	*To calculate the value of the indicator it is necessary to compile a Bill of Materials (BoM) that is a mass-based inventory of the different materials (kg) that compose a building. The BoM is organised according to main elements that a building is composed of.* *The starting point is the Bill of Quantities (BoQ) that specifies the elements of a building (e.g. foundations, columns). The BoQ comprises different categories of elements, which can have different functional performance characteristics. A BoM differs from a BoQ in that it describes the different materials (e.g. wood, steel, aluminium) that are contained in the various building elements. Once the BoM has been compiled, it is possible to calculate the value of the indicator. The following steps should be followed in order to characterize the indicator:* *- Compile the Bill of Quantities: A BoQ is compiled which comprises the building elements accounting for at least 99% of the mass of the building.* *- Identify the basic composition of each building element. A breakdown of its constituent materials has to elaborated. The mass of each constituent material has to be estimated;* *- Aggregation by material: the mass of all constituent material should thereafter be aggregated to obtain the total mass of materials used in the building (A);* *- Identify the recycled content of each constituent material (in mass);* *- Aggregation by material: the recycled mass of all constituent materials should thereafter be aggregated to obtain the total recycled mass of materials (B) used in the building;*

			- The indicator's value is calculated as B/A (total mass of recycled materials on the total mass of materials).
		Standard	*/*
B4.5 Potable water consumption for indoor uses	*Water consumption per occupant per year*	*Information source*	*Models and simulation*
		Assessment method	*The evaluator should include sanitary equipment (ie toilets, taps and showers) that consume water (ie dishwashers, washing machines). The unit consumptions of the different devices are determined from the industrial data. The specific factors of use must be established, as well as the number of days of occupation per year.* *The principle of calculating the consumption per occupant for faucets and showers is as follows: Total consumption (L / n of day of occ.) =? Unit consumption (L / min) x utilization factor x (min / nb of day of occ.)* *The calculation is the same for the consumptions related to the use of the toilets (the flushes replace the minutes).* *For hygiene, the bases of calculation are as follows:* *Total consumption (L / year) = unit consumption (L / m²) area (m2) × annual washing number (year - 1)* *Total consumption (m3 / occupant. year) = total consumption (L / year) x 0.001 (m3 / L) + occupancy time (occupant) Non-potable water consumption must be specified (eg reclaimed water used for In the case of existing buildings, the indicator should be calculated from measured data. The measured consumption must be averaged over a period of 3 years.*
		Standard	Tool "Water calculator"

C- ENVIRONMENTAL LOADINGS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
C1.3 Global Warming potential	*CO2 equivalent emissions per area per year*	*Information source*	*Models and simulation*
		Assessment method	*Calculation of CO2eq emissions. for each building can be realized thanks to this formula:* *E = [Σ (Qfuel, i x LHVi × Kem, i) + (Qel × Kem, el) + (Qdh × Kem, dh)] / SuQfuel, I = annual quantity of i-th fuel (m3 or kg)* *Qel = annual quantity of electricity from the grid (kWh)* *Qdh = annual amount of energy from the district heating or cooling network (kWh)* *LHVi = lower calorific value of i-th fuel (kWh / m3 or kWh / kg)* *Kem, i = CO2 emission factor eq. i-th fuel (kg CO2 / kWh)* *Kem, el = CO2 emission factor eq. electrical energy from the grid (kg CO2 / kWh)* *Kem, dh = CO2 emission factor eq. of the urban*

			heat or cold network (kg CO2 / kWh) *Su = total usable area of buildings*
		Standard	*EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments)*
C3.1 Construction and demolition waste	Weight of waste and materials generated per 1 m2 of useful floor area demolished or constructed	*Information source*	*Models and simulation*
		Assessment method	*1. Design phase (based on estimates): Estimates based on surveys of existing buildings that will undergo a major renovation or whose structure will be reused (life cycle stage B5). Estimates based on building deconstruction and demolition scenarios beyond the end of building use (life cycle stages C1 / 3, D).* *2. Construction (based on data collected on site): Data of deconstruction and demolition of a building to make room for a new construction (as part of the life cycle stages) .Data of partial deconstruction of a building for on-site reuse. On-site construction data for a new building and / or prefabrication / construction of some off-site elements (Life Cycle Steps A3 / 5)* *3. Completion (based on estimates supported by compliant plans): Estimates based on deconstruction and demolition scenarios of the building beyond the end of use of the building (life cycle stages C1 / 3, D)* *4 Post-delivery (based on commissioning and testing)* *5. Occupation (based on measured performance)* *6.End of life (based on the envisaged performance): Details the measures taken in the design phase to facilitate the construction, reuse and recycling (stages of the C1 / 3, D life cycle).*
		Standard	*/*
C3.2 Solid waste from building operation	*Ratio of the number of collectable solid waste types within a 100 m distance from the building's entrance to the reference solid waste categories*	*Information source*	*Plans of the area with the location of containers*
		Assessment method	*The seven solid waste reference categories are:* *-Paper* *-Plastic* *-Metal* *-Glass* *-Wet waste* *-Textiles* *-Dangerous* *Identify the availability and location of dedicated containers for each of the 7 categories of solid waste. Calculate the walking distance (m) of the main building door for each sorting equipment. Evaluate which of the 7 categories of solid waste can be collected within a 50m perimeter from the main entrance of the building (A) .The value of the indicator is given by the ratio: A / 7*
		Standard	*/*

D- INDOOR ENVIRONMENTAL QUALITY			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
D1.4 TVOC concentration in indoor air	TVOC concentration in indoor air	*Information source*	*Measured data*
		Assessment method	*The value of the indicator must be given by measurements in situ in occupancy (and after delivery). Measurements must be carried out on at least 10% of the apartments. These must be representative of the different types of housing, configurations and materials used. The samples must be taken from the living room and the smallest room of each apartment. The measuring equipment must be placed in the center of the room so as not to be too much influenced by the doors and windows and the air inlets.* *The sampling method shall be in accordance with ISO 16000-6 (Indoor Air - Part 6: Determination of Volatile Organic Compounds in Indoor Air and Active Sampling Chambers on Tenax TA (R) Sorbent, Desorption thermal and gas chromatographic using MS or MS / FID) or equivalent.* *In the design phase, product testing can be used as a simplified data source. These emissions must be evaluated over a period of 28 days. They must be established in accordance with standard NF EN 16516 (Construction products - evaluation of the emission of dangerous substances - Determination of indoor air emissions).* *Test data is then required from the manufacturers and suppliers of the products concerned. All tests must be on compliant finished products.* *References and Standards EN 15251 (Indoor Environment Criteria for the Design and Evaluation of the Energy Performance of Buildings covering Indoor Air Quality, Thermal, Lighting and Acoustics)* *Resources:* *VOC and housing (up to 35 substances): "In the gas phase, the chemical compounds present are mainly Volatile Organic Compounds (VOCs) containing a multitude of substances of different chemical families, and are thus detected in the indoor environments in a more significant way than some aldehydes (including formaldehyde mainly and almost systematically), certain aromatic hydrocarbons including benzene, toluene, ethylbenzene and xylenes commonly called BTEX, but also VOCs belonging to the families of terpenes, ketones, alcohols, ethers of Glycol ... "For information, the United States recommends a total VOC concentration of less than 200 µg / m3 as the comfort threshold and*

			Germany recommends a target value of 300 µg / m3. measures of_19 "Air Atmo Alsacehttp: //www.atmo-alsace.net/medias/products/Campagne_de_measures_de_19.pdf
		Standard	*ISO 16000-6 (Indoor Air - Part 6: Determination of Volatile Organic Compounds in Indoor Air and Active Sampling Chambers on Tenax TA (R) Sorbent, Desorption thermal and gas chromatographic using MS or MS / FID) or equivalent.* *NF EN 16516 (Construction products - evaluation of the emission of dangerous substances - Determination of indoor air emissions).*
D2.2 Thermal comfort index	Predicted Percentage Dissatisfied	*Information source*	*Models and simulation or measured method*
		Assessment method	*In the design phase, PPD estimation can be done using simulation software. In the operation phase, the PPD can be measured.* *The value of the PPD shall be calculated or measured in accordance with EN 7730 (Ergonomics of the thermal environment - Analytical determination and interpretation of thermal comfort by calculation of the PMV and PPD indices and by local thermal comfort criteria) for the seasonal and winter conditions. The PDP must be evaluated in all main living rooms and bedrooms. In the case of a collective dwelling, each configuration and orientation must be evaluated.* *The measuring point should be placed one meter from the center of the main window of each room. The following parameters must be used to characterize the value of the PDP: -clothing thermal resistance (clo) = 0.5-metabolic energy (met) = 1.2* *To evaluate the value of the PDP on a building as a whole, the PPD values estimated or measured in each room must be aggregated by a weighted average: PPDm = Sum PPDi x Au, i / Sum Au, where:* *PPDi = PPD for the coin-th* *Au, i = useful area of the i-th room*
		Standard	*EN 7730 (Ergonomics of the thermal environment - Analytical determination and interpretation of thermal comfort by calculation of the PMV and PPD indices and by local thermal comfort criteria*

G- COST AND ECONOMIC ASPECTS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
G1.4 Use stage energy cost	Energy annual cost per usable floor area	*Information source*	*Models and simulation*
		Assessment	*The calculation can be based on estimates in*

		method	*the design phase. It must be based on consumption monitoring during the exploitation phase. The indicator can be used by different actors for different purposes. In the design phase, it can be used to estimate future operating costs. In the operating phase, it can be used to compare the real performance of the building with the estimated estimates. For existing buildings, the total annual cost of thermal and electrical consumption from energy bills must be realized over an average of 3 years.*
		Standard	*/*
G1.5 Use stage water cost	Water annual cost per usable floor area	*Information source*	*Models and simulation*
		Assessment method	*The calculation can be based on estimates in the design phase. It must be based on consumption monitoring during the operation phase. The indicator can be used by different actors for different purposes. In the design phase, it can be used to estimate future operating costs. In the operation phase, it can be used to compare the real performance of the building with the estimated estimates.* *For existing buildings, the total annual cost of water consumption from the invoices must be realized over an average of 3 years.*
		Standard	*/*

REGIONAL TOOL

D.3.4.3 Regional Tool - GENCAT

Version 1.1

Date: March 2019

Generalitat de Catalunya
Departament de Territori i Sostenibilitat

2.1: To raise capacity for better management of energy in public buildings at transnational level
Work package: WP3 TESTING
Activity: 3.4 Evaluation of test results
Deliverable: 3.4.3 – Regional CESBA MED SNTs

Responsible Partner: Andrea Moro, iiSBE Italia R&D

BUILDING SCALE ASSESSMENT

SBTool structure

A – SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	
A1	**Site regeneration and development**
A1.12	Provision and quality of bicycle pathways and parking
A2	**Urban Design**
A2.3	Impact of orientation on the passive solar potential of building(s)
A3	**Project Infrastructure and Services**
A3.6	Provision of solid waste collection and sorting services
A3.13	Provision of on-site parking facilities for private vehicles

B – ENERGY AND RESOURCES CONSUMPTION	
B1	**Total life cycle non-renewable energy**
B1.1	Primary energy demand
B1.2	Delivered energy demand
B1.3	Delivered electric demand
B1.4	Energy from renewable sources in total primary energy consumption
B1.5	Energy from renewable sources in total thermal energy consumption
B1.6	Energy from renewable sources in total electrical energy consumption
B1.7	Consumption of renewable energy for all building operations
B1.11	Embodied non-renewable primary energy – Not applicable
B2	**Electrical peak demand**
B2.1	Electrical peak demand for building operations
B2.2	Scheduling of building operations to reduce peak loads on generating facilities.
B3	**Use of Material**
B3.5	Recycled materials – Not applicable
B4	**Use of potable water, stormwater and greywater**
B4.5	Potable water consumption for indoor uses.

C- ENVIRONMENTAL LOADINGS	
C1	**Greenhouse Gas Emissions**
C1.3	Global Warming Potential
C3	**Solid and Liquid Wastes**

C3.1	Construction and demolition waste – Not applicable
C3.2	Solid waste from building operations
C5	**Other Local and Regional Impacts**
C5.8	Degree of atmospheric light pollution caused by project exterior lighting systems

D- INDOOR ENVIRONMENTAL QUALITY	
D1	**Indoor Air Quality and Ventilation**
D1.4	TVOC concentration in indoor air – Not applicable
D1.5	CO2 concentration in indoor air
D1.10	Ventilation rate
D2	**Air Temperature and Relative humidity**
D2.1	Time outside of the thermal comfort range
D2.2	Thermal comfort index

E- SERVICE QUALITY	
E1	**Safety and Security**
E1.3	Risk to occupants and facilities from flooding
E1.6	Maintenance of core building functions during power outages
E2	**Functionality and Efficiency**
E2.5	Service quality and efficiency of vertical or horizontal transportation systems in building.
E3	**Controllability**
E3.1	Effectiveness of facility management control system
E3.2	Capability for partial operation of facility technical systems
E3.3	Degree of local control of lighting systems
E3.4	Degree of personal control of techinical systems by occupants
E4	**Flexibility and Adaptability**
E4.5	Adaptability to future changes in type of energy supply
E5	**Optimization and Maintenance of Operating Performance**
E5.1	Operating functionality and efficiency of key facility systems
E5.6	Retention of as-built documentation

F- SOCIAL, CULTURAL AND PERCEPTUAL ASPECTS	
F1	**Social Aspects**
F1.1	Universal access on site and within the building

G- COST AND ECONOMIC ASPECTS	
G1	**Cost and Economics**
G1.4	Use stage energy cost
G1.5	Use stage water cost – Only for Residential occ.

SBTool criteria selection rationale

A - SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE		
CRITERION		**REASON/MOTIVATION**
A1.12	Provision and quality of bicycle pathways and parking	*Assess the quality of bicycle pathways*
A2.3	Impact of orientation on the passive solar potential of building(s)	*Assess the passive solar solutions potential*
A3.6	Provision of solid waste collection and sorting services	*Assess the capacity of recycled*
A3.13	Provision of on-site parking facilities for private vehicles	*Assess the use of private vehicle in the workers*

B – ENERGY AND RESOURCES CONSUMPTION		
CRITERION		REASON/MOTIVATION
B1.1	Primary energy demand	*Assess the energy consumption*
B1.2	Delivered energy demand	*Assess the energy consumption*
B1.3	Delivered electric demand	*Assess the energy consumption*
B1.4	Energy from renewable sources in total primary energy consumption	*Assess the potential of the implementation renewable energy*
B1.5	Energy from renewable sources in total thermal energy consumption	*Assess the potential of the implementation renewable energy*
B1.6	Energy from renewable sources in total electrical energy consumption	*Assess the potential of the implementation renewable energy*
B1.7	Consumption of renewable energy for all building operations	*Assess the potential of the implementation renewable energy*
B2.1	Electrical peak demand for building operations	*Assess the required power for building operations*
B2.2	Scheduling of building operations to reduce peak loads on generating facilities.	*Assess the reduce the energy power*
B4.5	Potable water consumption for indoor uses.	*Assess the water consumption for the building operations*

C- ENVIRONMENTAL LOADINGS		
	CRITERION	**REASON/MOTIVATION**
C1.3	Global Warming Potential	*Assess the GHG emissions to reduce*
C3.2	Solid waste from building operations	*Assess the capacity of recycled*
C5.8	Degree of atmospheric light pollution caused by project exterior lighting systems	*Assess the lighting polution*

D- INDOOR ENVIRONMENTAL QUALITY		
	CRITERION	**REASON/MOTIVATION**
D1.5	CO_2 concentration in indoor air	*Assess the quality of interior air*
D1.10	Ventilation rate	*Assess the quality of interior air*
D2.1	Time outside of the thermal comfort range	*Assess the thermal comfort*
D2.2	Thermal comfort index	*Assess the thermal comfort*

E- SERVICE QUALITY		
	CRITERION	**REASON/MOTIVATION**
E1.3	Risk to occupants and facilities from flooding	*Assess the risk of flooding*
E1.6	Maintenance of core building functions during power outages	*Assess the auto-energy-capacity of the building*
E2.5	Service quality and efficiency of vertical or horizontal transportation systems in building.	*Assess the work properly of the lift*
E3.1	Effectiveness of facility management control system	*Assess the management system of facilities*
E3.2	Capability for partial operation of facility technical systems	*Assess the management system of facilites*
E3.3	Degree of local control of lighting systems	*Assess the management system of facilites*
E3.4	Degree of personal control of techinical systems by occupants	*Assess the management system of facilites*
E4.5	Adaptability to future changes in type of energy supply	*Assess the management system of facilites*
E5.1	Operating functionality and efficiency of key facility systems	*Assess the management system of facilites*
E5.6	Retention of as-built documentation	*Assess the management*

F- SOCIAL, CULTURAL AND PERCEPTUAL ASPECTS		
	CRITERION	**REASON/MOTIVATION**
F1.1 Universal access on site and within the building		*Assess the universal access of the building*

G- COST AND ECONOMIC ASPECTS		
	CRITERION	**REASON/MOTIVATION**
G1.4 Use stage energy cost		*Assess the cost of the energy*

SBTool weights rationale

ISSUE	WEIGHT (1 to 3)	MOTIVATION
A - SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	1	This is an existing building and therefore there is not much scope of action to influence in its design. Consultation with Local Committee Members
B – ENERGY AND RESOURCES CONSUMPTION	3	This is a strategic axis with greater opportunity for action and improvement of results and directly linked to CO_2 emissions to reduce in the Climate and energy framework 2030. It is considered top priority. Consultation with Local Committee Members
C- ENVIRONMENTAL LOADINGS	3	This is a strategic axis with greater opportunity for action and improvement of results and directly linked to CO_2 emissions to reduce in the Climate and energy framework 2030. It is considered top priority. Consultation with Local Committee Members
D- INDOOR ENVIRONMENTAL QUALITY	2	It is very important due to directly affect the health of people. Consultation with Local Committee Members
E- SERVICE QUALITY	2	It is not considered priority, although it is important because it takes into consideration the relationship of people with that studied building. Consultation with Local Committee Members
F- SOCIAL CULTURAL AND PERCEPTUAL ASPECTS	3	It is considered top priority due to directly affect the quality of the workers. Consultation with Local Committee Members
G- COST AND ECONOMIC ASPECTS	2	This is a strategic axis with greater opportunity for action and improvement of results and directly linked to CO_2 emissions to reduce in the Climate and energy framework 2030. Consultation with Local Committee Members

CATEGORIES	WEIGHT (%)
A1- Site regeneration and Development	25,00
A2- Urban design	25,00
A3- Project Infrastructure and Services	50,00
TOTAL	**100**
B1- In use energy consumptions	77,78
B2- Embodied energy	11,11
B3- Use of materials	0,00
B4 – Use of water, stormwater and greywater	11,11
TOTAL	**100**
C1- Greenhouse gas emissions	33,33
C2- Other atmospheric emissions	0,00

C3- Solid and liquid waste	33,33
C4- Impact on project site	0,00
C5- Other local and regional impacts	33,33
TOTAL	**100**
D1- Indoor air quality and ventilation	50,00
D2- Thermal comfort	50,00
D3– Visual comfort	0,00
D4– Acoustic comfort	0,00
TOTAL	**100**
E1- Safety and Security	20,00
E2- Functionality and efficiency	10,00
E3- Controllability	40,00
E4– Flexibility and adaptability	10,00
E5- Optimization and maintenance of operating performance	20,00
TOTAL	**100**
F1- Social aspects	100
F2- Culture and heritage	0
F3- Perceptual	0
TOTAL	**100**
G1- Cost and economics	100
TOTAL	**100**

CRITERIA WEIGHTS

SBTool file A – WeightA-G

A- SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE						
A1- Site Regeneration and Development						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
A1.12	*0,84*	*2*	*3*	*2*	*1*	*Confirmed*
A2- Urban Design						
A2.3	*2,11*	*1*	*5*	*3*	*1*	*Confirmed*
A3- Project Infrastructure and Services						
A3.6	*0,28*	*2*	*3*	*2*	*1*	*Confirmed*
A3.13	*1,69*	*2*	*2*	*3*		*Confirmed*
TOTAL	**4.92%**					

B- ENERGY AND RESOURCES CONSUMPTION						
B1-Total Life Cycle Non-Renewable Energy						
CRITERION	**Weight(%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
B1.1	*7,02*	*5*	*5*	*2*	*1*	*Confirmed*
B1.2	*7,02*	*5*	*5*	*2*	*1*	*Confirmed*
B1.3	*7,02*	*5*	*5*	*2*		*Confirmed*
B1.4	*7,02*	*5*	*5*	*2*		*Confirmed*
B1.5	*7,02*	*5*	*5*	*2*		*Confirmed*
B1.6	*7,02*	*5*	*5*	*2*		*Confirmed*

B1.7	*10,53*	*5*	*5*	*3*		*Confirmed*
B2-Electrical Peak Demand						
B2.1	*6,32*	*5*	*5*	*3*	*1*	*Confirmed*
B4-Use of potable water, stormwater and greywater						
B1.1	*3,79*	*4*	*3*	*3*	*1*	*Confirmed*
TOTAL	**62,78%**					

C- ENVIRONMENTAL LOADINGS						
C1-Greenhouse Gas Emissions						
CRITERION	**Weight(%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
C1.3	*13,2*	*5*	*5*	*3*	*1*	*Confirmed*
C3-Solid and Liquid Wastes						
C3.2	*2,53*	*4*	*3*	*2*	*1*	*Confirmed*
C5-Other Local and Regional Impacts						
C5.8	*3,37*	*4*	*3*	*2*	*1*	*Confirmed*
TOTAL	**19,07%**					

D- INDOOR ENVIRONMENTAL QUALITY						
D1-Indoor Air Quality and Ventilation						
CRITERION	**Weight(%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
D1.5	*0,63*	*1*	*3*	*3*	*1*	*Confirmed*
D1.10	*0,21*	*1*	*3*	*2*	*1*	*Confirmed*
D2-Air Temperature and Relative Humidity						
D2.1	*0,63*	*1*	*3*	*3*	*1*	*Confirmed*
D2.2	*0,63*	*1*	*3*	*3*	*1*	*Confirmed*
TOTAL	**2,11%**					

E- Service Quality						
E1-Safety and Security						
CRITERION	**Weight(%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
D1.3	*2,53*	*2*	*4*	*3*		*Confirmed*
D1.6	*1,90*	*2*	*3*	*3*		*Confirmed*
E2-Functionality and efficiency						
D2.15	*0,63*	*1*	*3*	*3*		*Confirmed*
E3-Controllability						
E3.1	*0,14*	*1*	*2*	*2*		*Confirmed*
E3.2	*0,14*	*1*	*2*	*2*		*Confirmed*
E3.3	*0,14*	*1*	*2*	*2*		*Confirmed*
E3.4	*0,28*	*1*	*2*	*2*		*Confirmed*
E4-Flexibility and Adaptability						
E3.1	*1,26*	*1*	*3*	*3*		*Confirmed*
E5-Optimization and Manteinance of Operating Performance						
E5.1	*0,21*	*1*	*2*	*3*		*Confirmed*
E5.6	*0,11*	*1*	*1*	*3*		*Confirmed*
TOTAL	**7,97%**					

F- SOCIAL, CULTURAL AND PERCEPTUAL ASPECTS						
F1-Social Aspects						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
F1.1	*1,90*	*2*	*3*	*3*		*Confirmed*
TOTAL	**1,9%**					

G- COST AND ECONOMIC ASPECTS						
G1-Cost and Economics						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
G.1.4	*0,63*	*2*	*3*	*3*		*Confirmed*
G1.5	*0,21*	*2*	*3*	*1*		*Confirmed*
TOTAL	**0,84%**					

SBTool benchmarks rationale

A- URBAN STRUCTURE AND FORM				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	RATIONALE
A1.12	Provision and quality of bicycle pathways and parking	--	*0: 0*	*Confirmed by CLC members*
			5: 5	*Confirmed by CLC members*
A2.3	Impact of orientation on the passive solar potential of building(s)	--	*0: 0*	*Confirmed by CLC members*
			5: 5	*Confirmed by CLC members*
A3.6	Provision of solid waste collection and sorting services	--	*0: 0*	*Confirmed by CLC members*
			5: 5	*Confirmed by CLC members*
A3.13	Provision of on-site parking facilities for private vehicles	Spaces / 100m^2	*0: 1,50*	*Confirmed by CLC members*
			5: 0,50	*Confirmed by CLC members*

B- ENERGY AND RESOURCES CONSUMPTION				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	RATIONALE
B1.1	Primary energy demand	kWh/m^2/y	*0: 225*	*Confirmed by CLC members*
			5: 70	*Confirmed by CLC members*
B1.2	Delivered energy demand	kWh/m^2/y	*0: 22*	*Confirmed by CLC members*
			5: 12	*Confirmed by CLC members*
B1.3	Delivered electric demand	kWh/m^2/y	*0: 75*	*Confirmed by CLC members*
			5: 20	*Confirmed by CLC members*

B1.4	Energy from renewable sources in total primary energy consumption	%	*0: 25*	*Confirmed by CLC members*
			5: 90	*Confirmed by CLC members*
B1.5	Energy from renewable sources in total thermal energy consumption	%	*0: 30*	*Confirmed by CLC members*
			5: 100	*Confirmed by CLC members*
B1.6	Energy from renewable sources in total electrical energy consumption	%	*0: 40*	*Confirmed by CLC members*
			5: 100	*Confirmed by CLC members*
B1.7	Consumption of renewable energy for all building operations	kWh/m^2/y	*0: 2*	*Confirmed by CLC members*
			5: 5	*Confirmed by CLC members*
B2.1	Electrical peak demand for building operations	W/m^2	*0: 100*	*Confirmed by CLC members*
			5: 20	*Confirmed by CLC members*
B4.5	Water consumption for indoor uses (in use stage)	m^3/per/y	*0: 100*	*Confirmed by CLC members*
			5: 20	*Confirmed by CLC members*

C- ENVIRONMENTAL LOADINGS				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
C.1.3.	Global Warming potential - GHG emissions from primary energy	kgCO_2eq/ m2/y	*0: 30*	*Confirmed by CLC members*
			5: 10	*Confirmed by CLC members*
C.3.2.	Solid waste from building operations	%	*0: 15*	*Confirmed by CLC members*
			5: 100	*Confirmed by CLC members*
C.5.8	Degree of atmospheric light pollution caused by project exterior lighting systems	%	*0: 25*	*Confirmed by CLC members*
			5: 0	*Confirmed by CLC members*

D- INDOOR ENVIRONMENTAL QUALITY				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
D.1.5	CO_2 concentrations in indoor air	ppm	*0: 600*	*Confirmed by CLC members*
			5: 500	*Confirmed by CLC members*
D.1.10	Ventilation rate	l/s/m^2	*0: 6*	*Confirmed by CLC members*

			5: 12	*Confirmed by CLC members*
D.2.1.	Time outside of thermal comfort range	%	*0: 30*	*Confirmed by CLC members*
			5: 10	*Confirmed by CLC members*
D.2.2.	Thermal comfort index - PMV/PPD	%	*0: 25*	*Confirmed by CLC members*
			5: 5	*Confirmed by CLC members*

E- SERVICE QUALITY

CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
E1.3	Risk to occupants and facilities from flooding	--	*0: 0*	*Confirmed by CLC members*
			5: 5	*Confirmed by CLC members*
E1.6	Maintenance of core building functions during power outages	Days	*0: 1*	*Confirmed by CLC members*
			5: 5	*Confirmed by CLC members*
E2.5	Service quality and efficiency of vertical or horizontal transportation systems in building.	Minutes	*0: 0*	*Confirmed by CLC members*
			5: 5	*Confirmed by CLC members*
E3.1	Effectiveness of facility management control system	--	*0: 0*	*Confirmed by CLC members*
			5: 5	*Confirmed by CLC members*
E3.2	Capability for partial operation of facility technical systems	--	*0: 0*	*Confirmed by CLC members*
			5: 5	*Confirmed by CLC members*
E3.3	Degree of local control of lighting systems	m^2	*0: 25*	*Confirmed by CLC members*
			5: 10	*Confirmed by CLC members*
E3.4	Degree of personal control of techinical systems by occupants	--	*0: 0*	*Confirmed by CLC members*
			5:5	*Confirmed by CLC members*
E4.5	Adaptability to future changes in type of energy supply	--	*0: 0*	*Confirmed by CLC members*
			5: 5	*Confirmed by CLC members*
E5.1	Operating functionality and efficiency of key facility systems	--	*0: 0*	*Confirmed by CLC members*
			5: 5	*Confirmed by CLC members*
E5.6	Retention of as-built documentation	--	*0: 0*	*Confirmed by CLC members*
			5:5	*Confirmed by CLC members*

F- SOCIAL CULTURAL AND PERCEPTUAL ASPECTS

CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
F1.1	Universal access on site and within the building.	--	*0: 0*	*Insert your comment here*
			5: 5	*Insert your comment here*

G- COST AND ECONOMIC ASPECTS				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
G.1.4.	Use stage energy cost	€/m^2/y	*0: 60*	*Insert your comment here*
			5: 40	*Insert your comment here*

SBTool Criteria Specifications

A- SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
A1.12	Provision and quality of bicycle pathways and parking	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
A2.3	Impact of orientation on the passive solar potential of building(s)	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
A3.6	Provision of solid waste collection and sorting services	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
A3.13	Provision of on-site parking facilities for private vehicles	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*

B- ENERGY AND RESOURCES CONSUMPTION			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
B1.1	Primary energy demand	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
B1.2	Delivered energy demand	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*

B1.3	Delivered electric demand	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
B1.4	Energy from renewable sources in total primary energy consumption	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
B1.5	Energy from renewable sources in total thermal energy consumption	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
B1.6	Energy from renewable sources in total electrical energy consumption	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
B1.7	Consumption of renewable energy for all building operations	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
B2.1	Electrical peak demand for building operations	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
B4.5	Water consumption for indoor uses (in use stage)	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*

C- ENVIRONMENTAL LOADINGS

CRITERION	INDICATOR	SPECIFICATIONS	
C.1.3.	Global Warming potential - GHG emissions from primary energy	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
C.3.2.	Solid waste from building operations	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*

C.5.8	Degree of atmospheric light pollution caused by project exterior lighting systems	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*

D- INDOOR ENVIRONMENTAL QUALITY			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
D.1.5	CO_2 concentrations in indoor air	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
D.1.10	Ventilation rate	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
D.2.1.	Time outside of thermal comfort range	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
D.2.1.	Time outside of thermal comfort range	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*

E- SERVICE QUALITY			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
E1.3	Risk to occupants and facilities from flooding	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
E1.6	Maintenance of core building functions during power outages	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
E2.5	Service quality and efficiency of vertical or horizontal transportation systems in building.	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*

E3.1	Effectiveness of facility management control system	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
E3.2	Capability for partial operation of facility technical systems	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
E3.3	Degree of local control of lighting systems	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
E4.5	Adaptability to future changes in type of energy supply	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
E5.1	Operating functionality and efficiency of key facility systems	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*
E5.6	Retention of as-built documentation	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*

F- SOCIAL CULTURAL AND PERCEPTUAL ASPECTS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
F1.1	Universal access on site and within the building.	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*

G- COST AND ECONOMIC ASPECTS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
1.4	Use stage energy cost	*Information source*	*Maintenance staff*
		Assessment method	*According its factsheet in the SB-Tool*
		Standard	*NA*

REGIONAL TOOL

D.3.4.3 Regional Tool – SANT CUGAT

Version 1.1

Date: March 2019

2.1: To raise capacity for better management of energy in public buildings at transnational level
Work package: WP3 TESTING
Activity: 3.4 Evaluation of test results
Deliverable: 3.4.3 – Regional CESBA MED SNTs

Responsible Partner: Andrea Moro, iiSBE Italia R&D

BUILDING SCALE ASSESSMENT

SBTool structure

A – SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	
A1	**Site regeneration and development**
A1.8	*Use of native plant types*
A1.10	*Provision and quality of children's play area(s)*
A1.12	*Provision and quality of bicycle pathways and parking*
A2	**Urban Design**
A2.2	*Reducing need for commuting transport through provision of mixed uses*
A2.3	*Impact of orientation on the passive solar potential of building(s)*
A3	**Project Infrastructure and Services**
A3.6	*Provision of solid waste collection and sorting services*
A3.8	*Provision of split grey / potable water services*
A3.10	*On-site treatment of rainwater, stormwater and greywater*
A3.14	*Connectivity of roadways*
A3.15	*Provision of access roads and facilities for freight or delivery*

B – ENERGY AND RESOURCES CONSUMPTION	
B1	**Total life cycle non-renewable energy**
B1.1	*Primary energy demand*
B1.2	*Delivered energy demand*
B1.3	*Delivered electric demand*
B1.4	*Energy from renewable sources in total primary energy consumption*
B1.5	*Energy from renewable sources in total thermal energy consumption*
B1.6	*Energy from renewable sources in total electric energy consumption*
B1.11	*Embodied energy (Not for Use phase) **
B2	**Electrical peak demand**
B2.2	*Electrical peak demand for building operations*
B3	**Use of materials**
B3.5	***Recycled materials (Not for Use phase) ****
B4	**Use of potable water, stormwater and greywater**
B4.2	*Water consumption for indoor uses*
B4.3	*Use of water for irrigation purposes*

C- ENVIRONMENTAL LOADINGS	
C1	**Greenhouse Gas Emissions**
C1.3	*Global Warming Potential*
C3	**Solid and Liquid Wasters**
C3.1	*Construction and demolition waste (Not for Use phase) **
C3.2	*Solid waste from building operations*
C4	**Impacts on Project Site**
C4.1	*Recharge of groundwater through permeable paving or landscaping*

D- INDOOR ENVIRONMENTAL QUALITY	
D1	**Indoor Air Quality and Ventilation**

D1.4	*TVOC concentration in indoor air (Not for Use phase) **
D1.5	*CO2 concentration in indoor air*
D2	**Air Temperature and Relative humidity**
D2.1	*Time outside of the thermal comfort range*
D2.2	*Thermal comfort index * (Not calculated)*

E- SERVICE QUALITY	
E1	**Safety and Security**
E1.2	*Risk to occupants and facilities from fire*
E1.3	*Risk to occupants and facilities from flooding*
E1.6	*Maintenance of core building functions during power outages*
E2	**Functionality and Efficiency**
E2.6	*Spatial efficiency*
E3	**Controllability**
E3.1	*Effectiveness of facility management control system*
E3.2	*Capability for partial operation of facility technical systems*
E4	**Flexibility and Adaptability**
E4.5	*Adaptability to future changes in type of energy supply*
E5	**Optimization and Maintenance of Operating Performance**
E5.6	*Retention of as-built documentation*

F- SOCIAL, CULTURAL AND PERCEPTUAL ASPECTS	
F1	**Social Aspects**
F1.1	*Universal access on site and within the building*
F2	**Culture and Heritage**
F2.3	*Impact of the design on existing streetscapes*
F3	**Perceptual**
F3.7	*Access to exterior views from interior*

G- COST AND ECONOMIC ASPECTS	
G1	**Cost and Economics**
G1.1	*Construction cost*
G1.2	*Operating and maintenance cost*
G1.4	*Use stage energy cost*
G1.5	*Use stage water cost*

SBTool criteria selection rationale

A - SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	
CRITERION	**REASON/MOTIVATION**
A1 Site regeneration and development **A1.1 Use of native plant types**	*The city has a Green areas plan, which also apply to new buildings and refurbishment to minimize the effect of heat island.*
A.1.10 Provision and quality of children's play area(s) **A.1.11.Provision and quality of bicycle pathways and parking**	*The city plan has different targets to achieve more bicycle pathways and improve the quality of children`s play areas.*

A2 Urban Design	
A2.1 Reducing need for commuting transport through Provisions of mixed uses	*The aim is to encourage the designs that promote public and private electric and bicycle transportation, as they provide a direct saving of energy demand for transportation and an environmental improvement based on triple reduction: avoiding oil extraction, associated GHG emissions in use and noise pollution in cities.*
A2.2 Impact of orientation on the passive solar Potential of building(s)	Passive strategies for all new buildings

B – ENERGY AND RESOURCES CONSUMPTION

CRITERION	REASON/MOTIVATION
B1 Total life cycle non-renewable energy	
B1.1 Primary energy demand	
B1.2 Delivered energy demand	*The aim of B1 criteria is to promote and reward the reduction of the energy consumption necessary for the heating of buildings (heating and cooling) and generation of hot water. Fossil fuels are currently the main energy resource on a global scale and are the causes, with their associated emissions, of a serious problem from the greenhouse effect.*
B1.3 Delivered electric demand	
B1.4 Energy from renewable sources in total primary energy consumption	
B1.5 Energy from renewable sources in total thermal energy consumption	
B1.6 Energy from renewable sources in total electric energy consumption	
B2 Electric peak demand	
B2.2 *Electrical peak demand for building operations*	
B4 Use of potable water, stormwater and greywater	
B4.2 Water consumption for indoor uses	
B4.3 Use of water for irrigation purposes	*Sant Cugat city council has a water saving local ordinance to reduce the water consumption in all new and refurbished buildings since year 2002. The main reduction of tap water consumption in buildings comes through grey water reuse to indoor WC discharge and rain water tanks with also water from swimming pools to use outdoors for irrigation purposes.*

C- ENVIRONMENTAL LOADINGS

CRITERION	REASON/MOTIVATION
C1 Greenhouse Gas Emissions	*Calculation of GEH greenhouse gas emissions in buildings for Covenant of mayors SEAP template and Agenda 2030 in order to achieve the 40% reduction.*
C1.3 Global Warming Potential	
C3 Solid and Liquid Wasters	*The city has a segregating waste priority plan in order to increase the rate of separate collection and recycle of solid waste from building operation.*
C3.2 Solid waste from building operations	
C4 Impacts on Project Site	*2018 new local water saving ordinance has a specific rule to improve the recharge of*
C4.1 Recharge of groundwater through permeable	

paving or landscaping	*groundwater through permeable paving or landscaping in free areas of the plot.*

D- INDOOR ENVIRONMENTAL QUALITY

CRITERION	REASON/MOTIVATION
D1 Indoor Air Quality and Ventilation **D1.5 CO2 concentration in indoor air** **D2 Air Temperature and Relative humidity** **D2.1 Time outside of the thermal comfort range** **D2.2 Thermal comfort index**	*The selection of materials with low polluting emissions, the good illumination and ventilation of the interior spaces and an adequate purge process of the building before its occupation significantly reduce the risks to the health of its occupants.*

E- SERVICE QUALITY

CRITERION	REASON/MOTIVATION
E1 Safety and Security **E1.2 Risk to occupants and facilities from fire** **E1.3 Risk to occupants and facilities from flooding** **E1.6 Maintenance of core building functions during power outages**	*To reduce to acceptable limits the risk that people involved in an emergency will suffer damages. Mainly in buildings of public concurrence. The regulations determine de security requirements corresponding to the security of people, the protection of the environment and the property.*
E2 Functionality and Efficiency **E2.6 Spatial efficiency**	*To improve the building quality of new buildings.*
E3 Controllability **E3.1 Effectiveness of facility management control system** **E3.2 Capability for partial operation of facility technical systems.** **E4 Flexibility and Adaptability** **E4.5 Adaptability to future changes in type of energy supply**	*To manage, metering and control the building operations in public buildings and also in new private ones. The aim is to obtained good quality data by sectorization for efficient consumption. To identify those buildings that can adapt quicker and cheaper to any future change of renewable energy systems.*
E5 Optimization and Maintenance of Operating Performance **E5.6 Retention of as-built documentation**	*To improve the quality of public buildings information by digitalising as-built documentation*

F- SOCIAL, CULTURAL AND PERCEPTUAL ASPECTS

CRITERION	REASON/MOTIVATION
F1 Social Aspects **F1.1 Universal access on site and within the building** **F2 Culture and Heritage** **F2.3 Impact of the design on existing streetscapes**	*It is important for the city to control the impact of existing, refurbished and new buildings in the city landscape.*

F3 Perceptual
F3.7 Access to exterior views from interior

G- COST AND ECONOMIC ASPECTS	
CRITERION	**REASON/MOTIVATION**
G1 Cost and Economics **G1.1 Construction cost** **G1.2 Operating and maintenance cost** **G1.4 Use stage energy cost** **G1.5 Use stage water cost**	*To rate the construction cost of public buildings according to the degree of sustainability.* *To rate the operation cost on energy and water of all buildings according to their use and typology.*

SBTool weights rationale

ISSUE	WEIGHT (1 to 3)	MOTIVATION
A - SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	**1**	**The priority was given by CLC as a principal effort in urban planning.**
B – ENERGY AND RESOURCES CONSUMPTION	3	Political priority; 2030 Agenda, SECAP, EMAS and PAM municipal activity plan.
C- ENVIRONMENTAL LOADINGS	3	Political priority; 2030 Agenda, SECAP, EMAS and PAM municipal activity plan.
D- INDOOR ENVIRONMENTAL QUALITY	2	Lower chances of intervention in buildings
E- SERVICE QUALITY	3	Political priority; 2030 Agenda, SECAP, EMAS and PAM municipal activity plan.
F- SOCIAL CULTURAL AND PERCEPTUAL ASPECTS	2	The priority was given by CLC
G- COST AND ECONOMIC ASPECTS	2	The priority was given by CLC

CATEGORIES	WEIGHT (%)
A1- Site regeneration and Development	3,0
A2- Urban design	4,6
A3- Project Infrastructure and Services	4,0
TOTAL A- Site regeneration and development, urban design and infrastructure	**11,6**
B1- In use energy consumptions	42,0
B2- Embodied energy	6,3
B4 – Use of water, stormwater and greywater	6,3
TOTAL B- Energy and resources consumption	**54,9**
C1- Greenhouse gas emissions	13,2
C3- Solid and liquid wastes	2,5

C4- Impact on project site	1,3
C5- Other local and regional impacts	3,4
TOTAL C- Environmental loadings	**20,4**
D1- Indoor air quality and ventilation	0,6
D2- Thermal comfort	0,6
D4– Acoustic comfort	0,2
TOTAL D- Indoor Environmental Quality	**1,50**
E1- Safety and Security	6,3
E2- Functionality and efficiency	0,2
E3- Controllability	0,3
E4– Flexibility and adaptability	1,3
TOTAL E- Service Quality	**8,1**
F1- Social aspects	1,9
F2- Culture and heritage	0,8
TOTAL F- Social Cultural and perceptual aspects	2,7
G1- Cost and economics	**0,8**
TOTAL G- Cost and economic aspects	0,8
TOTAL	**100**

CRITERIA WEIGHTS

SBTool file A – Weight A-G

A - SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE

A1 - Site Regeneration and Development

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
A1.8	*1.27*	*2*	*3*	*2*	*1*	*Default value*
A1.10	*0.84*	*2*	*3*	*2*	*1*	*Default value*
A1.12	*0.84*	*2*	*3*	*2*	*1*	*Default value*

A2 - Urban Design

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
A2.2	*2.53*	*3*	*3*	*2*	*1*	*Default value*
A2.3	*2.11*	*1*	*5*	*3*	*1*	*Default value*

A3 - Project Infrastructure and Services

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
A3.6	*0.28*	*2*	*2*	*2*	*1*	*Default value*
A3.8	*1.90*	*2*	*3*	*3*	*1*	*Default value*
A3.10	*1.27*	*2*	*3*	*2*	*1*	*Default value*
A3.14	*0.28*	*2*	*2*	*2*	*1*	*Default value*
A3.15	*0.28*	*2*	*2*	*2*	*1*	*Default value*
TOTAL	11,6					

B - ENERGY AND RESOURCES CONSUMPTION

B1 - Total Life Cycle Non-Renewable Energy

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
B1.1	*7.03*	5	*5*	*2*	*4*	*Default value*
B1.2	*7.03*	5	*5*	*2*	*4*	*Default value*
B1.3	*7.03*	5	*5*	*2*	*4*	*Default value*
B1.4	*7.03*	5	*5*	*2*	*1*	*Default value*
B1.5	*7.03*	5	*5*	*2*	*1*	*Default value*
B1.6	*7.03*	5	*5*	*2*	*5*	*Default value*

B2 - Electrical peak demand

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
B2.2	*6.33*	5	*3*	*3*	*1*	*Default value*

B4 - Use of potable water, stormwater and greywater

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
B4.2	*3.80*	4	*3*	*3*	*1*	*Default value*
B4.3	*2.53*	4	*3*	*2*	*1*	*Default value*
TOTAL	54,9					

C - ENVIRONMENTAL LOADINGS

C1- Greenhouse Gas Emissions

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
C1.3	*13.19*	5	*5*	*3*	*1*	*Default value*

C3 – Solid and liquid wastes

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
C3.2	*2.53*	4	*3*	*2*	*1*	*Default value*

C4 – Impacts on project site

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
C4.1	*1.27*	2	*3*	*2*	*1*	*Default value*

C5 – Other local and regional impacts

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
C5.8	*3.38*	4	*3*	*2*	*1*	*Default value*
TOTAL	20,4					

D - INDOOR ENVIRONMENTAL QUALITY

D1 – Indoor air quality and ventilation

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
D1.5	*0.63*	*1*	*3*	*3*	*1*	*Default value*

D2 - Thermal comfort

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
D2.1	*0.63*	*1*	*3*	*3*	*1*	*Default value*

D4 – Noise and illumination

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
D4.1	*0.21*	*1*	*3*	*1*	*1*	*Default value*

TOTAL	1,50

E- SERVICE QUALITY

E1 – Safety and security

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
E1.2	*1.90*	*2*	*3*	*3*	*1*	*Default value*
E1.3	*2.53*	*2*	*4*	*3*	*1*	*Default value*
E1.6	*1.90*	*2*	*3*	*3*	*1*	*Default value*

E2 – Functionality and efficiency

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
E2.6	*0.21*	*1*	*3*	*2*	*1*	*Default value*

E3 – Controllability

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
E3.1	*0.14*	*1*	*2*	*2*	*1*	*Default value*
E3.2	*0.14*	*1*	*2*	*2*	*1*	*Default value*

E4 – Flexibility and adaptability

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
E4.5	*1.27*	*1*	*3*	*3*	*1*	*Default value*

E5 – optimization and maintenance of operating performance

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
E5.6	*0.11*	*1*	*1*	*3*	*1*	*Default value*

TOTAL	8,1

F- Social, cultural and perceptual aspects

F1 – Social aspects

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
F1.1	*1.90*	*2*	*3*	*3*	*1*	*Default value*

F2 – Culture and heritage

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
F2.3	*0.84*	*2*	*3*	*2*	*1*	*Default value*

TOTAL	2,7

G- COST AND ECONOMIC ASPECTS

G1 – Cost and economics

CRITERION	Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
G1.4	*0.63*	*2*	*3*	*3*	*1*	*Default value*
G1.5	*0.21*	*2*	*3*	*1*	*1*	*Default value*
TOTAL	0,8					

SBTool benchmarks rationale

A- SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
A1.8	*Use of native plant types*	%	*0: 50*	*Compliance of local water saving ordinance*
			5: 100	*Compliance of local water saving ordinance*
A1.10	*Provision and quality of children's play area(s)*	*text*	*0: 0*	*Specific local city plan for children's play areas*
			5: 5	*Specific local city plan for children's play areas*
A1.12	*Provision and quality of bicycle pathways and parking*	*text*	*0: 0*	*Specific local city plan for mobility and parking areas*
			5: 5	*Specific local city plan for mobility and parking areas*
A2.2	*Reducing need for commuting transport through provision mixed*	text	*0: 0*	*Only one occupancy type*
			5 : 5	*The project contents 3 or + occupancy types*
A2.3	*Impact of orientation on the passive solar potential of building (s)*	e-w angle degree	*0: 28*	*Current level, up to 30º.*
			5 : 5	*Long axis of the building is oriented within 5º of east-west*
A3.6	Provision of solid waste collection and sorting services	text	*0: 0*	*1 or + organic solid waste*
			5 :5	*4-5 organic and non-organic communal solid waste are located in the project*
A3.8	*Provision of split grey / potable water services*	%	*0: 0*	*Local water saving ordinance: No grey water systems are implemented in buildings generating less than 400 m3 of grey water a year.*
			5 : 100	*Local water saving ordinance compliance when a building generates more than 400 m3 of grey water/year.*
A3.10	*On-site treatment of rainwater, stormwater and greywater*	%	*0:25*	*Local water saving ordinance*
			5 : 100	*Local water saving ordinance*
A3.14	*Connectivity of roadways*	m	*0: 200*	*Mean distance between intersections. CESBA MED reference*

A3.15	*Provision of access roads and facilities for freight or delivery*	text	*5 : 60* *0: 0* *5 : 5*	*Current results* Acceptable level of access for freight or delivery Convenient and direct access

B- ENERGY AND RESOURCES CONSUMPTION

CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
B1.1 Primary energy demand	*Primary energy demand per area per year*	*kWh/m^2/y*	*0: 292*	CTE energy certificate regulation in buildings in Spain (for office buildings) G level (worst scenario)
			5 : 58	CTE energy certificate regulation in buildings in Spain (for office buildings) A level (BEST scenario)
B1.2 Delivered thermal energy demand	*Delivered thermal energy demand per area per year*	*kWh/m^2/y*	*0: 75*	CESBA MED references and energy certification in tertiary buildings
			5 : 20	CESBA MED references and energy certification in tertiary buildings
B1.3 Delivered electric energy demand	*Delivered electric energy demand per area per year*	*kWh/m^2/y*	*0:70*	CESBA MED references and energy certification in tertiary buildings
			5 : 30	CESBA MED references and energy certification in tertiary buildings
B1.4 Energy from renewable sources in total primary energy consumption	*Primary energy demand of the building that is met by renewable sources on total primary energy demand*	*%*	*0: 30*	*The minimum value given corresponds to the criteria given in local ordinance which requires an active renewable energy production with a minimum* High-performance building
			5 :90	*Autonomous building nZEB*
B1.5 Energy from renewable sources in total thermal energy consumption	*Share of renewable energy in final thermal energy consumptions*	*%*	*0: 30*	*The minimum value given corresponds to the criteria given in local ordinance which requires an active renewable energy production with a minimum*
			5 : 100	Autonomous building nZEB

B1.6 Energy from renewable sources in total electric energy consumption	*Share of renewable energy in final electric energy consumption*	*%*	*0: 40*	The minimum value given corresponds to the criteria given in local ordinance which requires an active renewable energy production with a minimum
			5 : 100	Autonomous building nZEB
B2.2. Electrical peak demand for BO	*Electrical peak demand for building operations*	*W/m²*	*0: 40*	*CESBA assessment criteria for offices*
			5 : 10	*objective of professional best practice for nZEB buildings*
B3.5 Recycled materials	*Weight of recycled materials on total weight of materials (Not for Use phase) **	*%*	*0: 15*	*Actual professional practice based on discussions with national local committee in Catalunya.*
			5 : 50	*objective of professional best practice*
B4.2 Potable water consumption for indoor uses	*Water consumption per occupant per year*	*m³/m²year*	*0: 11*	*From values for offices*
			5 : 5	*Consumption can be reduce a 75%*
B4.3 Use of water for irrigation purposes	*Water consumption per green area per year*	*m³/m²/ year*	*0: 0,20*	CESBA assessment criteria
			5 : 0,05	CESBA assessment criteria

C- ENVIRONMENTAL LOADINGS

CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
C1.3 Global Warming potential	*CO2 equivalent emissions per area per year*	*kg CO2 eq./m²/yr*	*0: 96,31*	Emissions from Spanish *energy certification G level in tertiary buildings*
			5: 19,26	*Emissions from Spanish energy certification in A level tertiary buildings*
C3.2 Construction and demolition waste	*Weight of waste and materials generated per 1 m2 of useful floor area demolished or constructed (not*	*kg/m²/life cycle stage*	*0: 1700*	Figures given in the CESBA protocol

	calculated)			
			5: 600	Figures given in the CESBA protocol
C4.1 Recharge groundwater	*Recharge of groundwater through permeable paving or landscaping.*	*% m^2 permeable area / m^2 total area*	*0: 50*	Figures given in the CESBA protocol
			5: 90	Figures given in the CESBA protocol
C5.8 Atmospheric light	*Degree of atmospheric light pollution caused by project exterior lighting systems. (not calculated)*	%	0: 25	Figures given in the CESBA protocol
			5: 0	Figures given in the CESBA protocol

D- INDOOR ENVIRONMENTAL QUALITY

CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
D1.4 TVOC concentration in indoor air	*TVOC concentration in indoor air (not calculated)*	µg/ m^3	*0:1000*	Recommendation of Catalonia government
			5 :200	*Local objective*
D1.5 CO2 concentration in indoor air	*CO2 concentration in indoor air*	ppm	*0: 800*	*Minimum quality of air for commercial buildings, cinemas, theatres, restaurants, coffee shops, bar. Gym and computers room.*
			5 : 550	*Minimum quality of air for offices, tertiary residences, libraries, schools and swimming pools*
D2.1 Time outside of the thermal comfort rang	*Predicted Percentage Out of TC rang*	*%*	0: 30	CESBA Default value
			5 : 10	Good quality
D2.2 Thermal comfort index	*Predicted Percentage Dissatisfied (not calculated)*	*%*	0: 10	CESBA Default value
			5 : 0	Good quality
D4.1 Noise attenuation through the exterior envelope	*Attenuation degree trough the exterior envelope to environmental outdoors sound*	*dBA*	0: 27,5	CESBA Default value

			5 : 38,5	Good quality

E- SERVICE QUALITY

CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
E1.2 Risk to occupants and facilities from fire.	*Risk of level for occupants in the most vulnerable part of the building*	*text*	*0: 0*	*CESBA Default value*
			5: 5	*Best practice*
E1.3 Risk to occupants and facilities from flooding	*Probability of injury or death or major property damage in case of 100 year flood event*	*text*	*0: 0*	*High Probability of injury*
			5: 5	Very low Probability of injury
E1.6 Maintenance of core building functions during power outages	*Probability of injury in case of an accidental or wilful explosion in or near the building*	*days*	*0: 2*	*Emergency plans compliance*
			5: 5	*CESBA MED default value*
E2.6 Spatial efficiency	*The time to travel for lifts from the ground floor to the top floor*	*%*	*0: 85*	*CESBA MED default value*
			5: 90	*CESBA MED default value*
E3.1 Effectiveness of facility management control system		*text*	*0:0*	*CESBA MED default value*
			5:5	*CESBA MED default value*
E3.2 Capability for partial operation of facility technical systems		*text*	*0:0*	CESBA MED default value
			5:5	*CESBA MED default value*
E4.5 Adapting the building to a new fuel source will be		*text*	0:0	CESBA MED default value

possible with a moderate level of renovations, but installing photovoltaics will require major renovations.			5:5	CESBA MED default value
		text	*0: 0*	*CESBA MED default value*
E5.6 Retention of as-built documentation.				
			5: 5	*CESBA MED default value*

F- SOCIAL CULTURAL AND PERCEPTUAL ASPECTS

CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
F1.1	*Universal access on site and within the building*	*text*	*0: 0*	*CESBA MED default value*
			5: 5	*CESBA MED default value*
F2.3	*Impact of the design on existing streetscapes*	*text*	*0: 0*	*CESBA MED default value*
			5: 5	*CESBA MED default value*
F3.7	*Access to exterior views from interior*	*text*	*0: 0*	*CESBA MED default value*
			5:5	

G- COST AND ECONOMIC ASPECTS

CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
G1.2 Operating and maintenance cost	*Maintenance annual cost per usable floor area*	€/m^2/yr	*0: 24*	Current level in cost results
			5: 15	*Best result in public building*
G1.4 Use stage energy cost	*Energy annual cost per usable floor area*	€/m^2/yr	*0: 35*	Worst scenario in current level
			5:10	*Best scenario in different public buildings*
G1.5 Use stage water cost	*Water annual cost per usable floor area*	€/m^2/yr	*0: 5*	*CESBA MED default value*
			5: 1	*CESBA MED default value*

SBTool Criteria Specifications

A- SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
A1.8	*Use of native plant types*	*Information source*	*Measured data.* *Green area consulted on plans and type of plantation verified with City Hall.*
		Assessment method	*Determine the percentage of green area that contains native species and / or that do not require greater irrigation than alternative plants with respect to the total of gardenable space*
		Standard	*Master Plan of green areas*
A1.10	*Provision and quality of children's play area(s)*	*Information source*	Descriptive qualification
		Assessment method	*Determine what provision of spaces reserved for children is in the building and evaluate the quality of play facilities for children participating in the activity of the building.* *Assessment according to the criteria associated with each score, provided in the description of the indicator*
		Standard	*Master plan for children's play areas*
A1.12	*Provision and quality of bicycle pathways and parking*	*Information source*	*Bicibox web, city hall data and google maps to verify bicycle paths*
		Assessment method	*Determine the extent and quality of space reserved for cycling to promote its use, considering the bike lane and bicycle parking lots.* *Check the bike lanes that reach the building, the distance the building is with respect to the bike lane network and distance to the bicycle parking lots, both individual and shared*
		Standard	*Mobility masterplan of the city*
	Reducing need for commuting transport through provision mixed	*Information source*	*Verification of the functional program of the buildings according to type of activity and consultation City council*
		Assessment method	*Determine the different uses that can accommodate the same building. Hosting more than one use implies that it is deigned*

A2.2			*in transportation since more than one activity could be carried out in the same place.*
		Standard	*Know and evaluate the functional programs of each building*
A2.3	*Impact of orientation on the passive solar potential of building (s)*	*Information source*	*Calculated data (AutoCAD or similar)google maps or orthomaps*
		Assessment method	*Calculate the angle of deviation of the main axis of the building with respect to the east-west orientation, with the highest rating being the closest to the east-west axis, understanding that they are the ones that receive the highest level of sunlight.*
		Standard	*Spanish technical code of the building CTE*
A3.6	Provision of solid waste collection and sorting services	*Information source*	*Calculated data from the city hall*
		Assessment method	*Determine the existence of selective recycling and the associated type of service.* *To know the recycling system that is implanted in each centre*
		Standard	*Solid waste master plan of the city*
A3.8	*Provision of split grey / potable water services*	*Information source*	*City Hall: It is verified that none of the public buildings consists of a network of recovery and reuse of grey water.*
		Assessment method	*To learn about the sanitation network system implanted in each building to determine if there is recovery of grey water. From 2002, it is compulsory to install a grey water reuse system in all new buildings generating more than 400 m3 of grey water per year.*
		Standard	*Local water saving ordinance*
A3.10	*On-site treatment of rainwater, stormwater and greywater*	*Information source*	*City Hall: do any building consists of a network of recovery and reuse of grey water.*
		Assessment method	*To determine the existence of treatment and exploration of rainwater and greyscale to reduce the consumption of drinking water in the building.* *To learn about the sanitation network system implanted in each building to determine if there is recovery of grey water.* *Local water saving ordinance it is compulsory for all new buildings since*

			2002.
		Standard	*Local water saving ordinance, Catalonian Ecoeficiency decree*
A3.14	*Connectivity of roadways*	*Information source*	*City Hall: map of the city in AutoCAD format*
		Assessment method	*To measure the street distances to each intersection and calculate the average street and street stretch. Determining the average distance between street intersections evaluates how distances are long on foot near the building.*
		Standard	*Mobility master plan of the city*
A3.15	*Provision of access roads and facilities for freight or delivery*	*Information source*	*City Council and google to check the type of spaces / streets adjacent to the building*
		Assessment method	*To detect near each building if there are loading and unloading areas and / or spaces or service routes enabled for these purposes. If we know what kind, of areas, each building has around, the degree of ease of loading / downloading can be evaluated according to the criteria described in the indicator.*
		Standard	*Mobility master plan of the city and activity licences for business.*

B- ENERGY AND RESOURCES CONSUMPTION			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
B1.1	*Primary energy demand per area per year*	*Information source*	*City Hall: Consumptions in kWh of electricity and gas of 3 whole years of each building*
		Assessment method	*Calculated using the measured values. 1) Calculation of the final energy of electricity and gas: annual consumption (kWh) of electricity and gas, making the average consumption of the last 3 years. 2) Final energy passage to primary electricity consumption and gas with a pass factor of 2.04 for electricity and 1,195 for gas.*
		Standard	*The reference standard for the evaluation of lighting consumption must be EN 15193. References and standards Level (s) EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments). EN 52016-1*
B1.2	*Delivered thermal energy demand per*	*Information source*	*City Hall: Electricity and gas bills for a year of each building and information extracted*

	area per year		*from audits carried out in similar tertiary buildings*
		Assessment method	*Determine the percentage of electricity consumption allocated to each type of service (lighting, climate, household appliances, office automation and others) according to type of building, to assign the corresponding percentage of the total electrical consumption to each building according to the invoice. Add the gas consumption extracted from each invoice* *Distribution consumption by use (to determine% of electricity intended for climate)* *Schools (tertiary buildings)* *Lighting 78%* *Heating 3%* *Electric appliances 5%* *Office automation and other 15%* *Pilot building: Casa de Cultura* *Lighting 52.00%* *Office equipment 22.57%* *Electromagnetic and elevator 3.43%* *Heating and cooling 22.00%*
		Standard	*The reference standard for the evaluation of lighting consumption must be EN 15193.* *References and standards* *Level (s)* *EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments).* *EN 52016-1* *Governmental energy audit*
B1.3	*Delivered electric energy demand per area per year*	*Information source*	*City Hall: Consumptions in kWh of electricity*
		Assessment method	*Summary of the consumption of electrical kWh per year, for 3 years and calculation of the average annual consumption resulting from the 3 years analysed*
		Standard	*The reference standard for the evaluation of lighting consumption must be EN 15193.* *References and standards* *Level (s)* *EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments).* *EN 52016-1*
B1.4	*Primary energy demand of the building that is met by renewable sources on total primary energy demand*	*Information source*	*City council: renewable energy (EERR) production data provided*
		Assessment method	*Calculation of the sum of energy produced with EERR in buildings and compared by percentage of the total primary energy of the building*

		Standard	*The reference standard for the evaluation of lighting consumption must be EN 15193. References and standards Level (s) EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments). EN 52016-1*
B1.5	*Share of renewable energy in final thermal energy consumptions*	*Information source*	*City council: renewable energy (EERR) production data provided*
		Assessment method	*Calculation of the sum of energy produced with EERR in the building with respect to the total consumption destined to thermal use (% electric + gas). Each m2 of solar thermal plate is considered equivalent to a production of 700 kWh / m2 * 0.85 reduction coefficient of installation operation*
		Standard	*EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments). EN 52016-1 CTE HE4 spanish regulation RITE: regulation of thermal installations in building*
B1.6	*Share of renewable energy in final electric energy consumption*	*Information source*	*City council: renewable energy (EERR) production data provided. There is no production of electrical energy in any of the buildings evaluated*
		Assessment method	*Calculation of the sum of energy produced with EERR in the building with respect to the total consumption destined for electrical use.*
		Standard	*EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments*
B2.2	*Electrical peak demand for building operations*	*Information source*	*City council: to check electrical bills received for a whole year.*
		Assessment method	*Review of electrical bills to detect the peak power values of each month and make the average of one year. Once the average peak value is determined, divide it between the surface of the building to calculate the power per m2*
		Standard	*Spanish technical code of the building CTE. Specific regulation*
B3.5	*Weight of recycled materials on total weight of materials (Not for Use phase) **	*Information source*	*Models and simulation or material documents*
		Assessment method	*The General Council of Technical Architecture of Spain has agreed to the implementation of the Statistical file of materials in the processing of the visa / registration of the executions of works*

			within the scope of the LOE, to obtain State statistical data of the materials used in these works. *Catalonia has other forms adapted to the autonomous and state regulations on quality control (the "Quality Control Program" and the "Controlling relationship and its results"*
		Standard	*CTE- Spanish edification code technique. Bill of materials from the data on constructions type and materials used in project and execution phases.*
B4.2	*Water consumption per area per year*	*Information source*	*Measured data*
		Assessment method	Calculation of the total annual water consumption of the building and average annual consumption for the last 3 years. The measured consumption must be averaged over a period of 3 years
		Standard	*Water saving local ordinance*
B4.3	*Water consumption per green area per year*	*Information source*	*City council: Consultation on irrigation system implanted in each building and volume of water consumed. On a map of the city, cadastre or direct consultation at the Town Hall, calculate the area of the garden area of each building.*
		Assessment method	*Forecast of the volume of water for irrigation in the landscaped areas of the building, taking into account the possible use of grey or rainwater.* *Detect the landscaped area of each building, calculate the surface area and, in case of having an irrigation system, calculate the volume of water that is destined for this purpose.*
		Standard	*Water saving local ordinance of the city. Master plan of green areas in the city.*

C- ENVIRONMENTAL LOADINGS

CRITERION	INDICATOR	SPECIFICATIONS	
C1.3	*CO2 equivalent emissions per area per year*	*Information source*	*City hall: consumptions in kWh of electricity and gas of 3 years of each building*
		Assessment method	*Calculate the total consumption in kWh of electricity and gas for a whole year (the average of 3 years is calculated) and the kWh pass factor equivalent to kg of C02 of*

			each type of energy is applied. The Catalan Office for Climate Change (OCCC) has published on the climate change website the update of the tools for the calculation of GHG emissions (version of March 2018), useful for calculating the GHG emissions inventory of the year 2017. Conversion factors kWh — KgCO2 / kWh Electricity 0.308 Natural gas 0.182 Liquid fuels / transport 0.274 GLP 0.234 Red heat / cold 0,000 Biomass 0,000 Thermal solar 0,000 Geothermal 0,000
		Standard	*EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments)* *Catalan Office for Climate Change (OCCC)*
C3.2	*Weight of waste and materials generated per 1 m2 of useful floor area demolished or constructed (not calculated)*	*Information source*	*Visit the building / google maps or similar*
		Assessment method	*Relation of the amount of recyclable solid waste 50 meters away from the entrance of the building to the solid waste categories of reference.* *Count the number of containers destined for different waste, located at a distance less than 50 m from the entrance to the building. NOTE: 7 categories are specified in the description of the indicator but in the study municipality, they do not exist. The indicator is valued based on the maximum number of categories of Sant Cugat, which corresponds to 5: paper / packaging / organic / glass / rest*
		Standard	*Spanish Royal Decree 105/2008, of February 1, regulating the Production and management of construction and demolition waste*
C4.1	*Recharge of groundwater through permeable paving or landscaping.*	*Information source*	*City Council/Google maps: verification of the areas to be considered, along with tools like google maps.*
		Assessment method	*Percentage of precipitation rainwater that can return to the subsoil through pavement or permeable soil in the building's terrain. Detect the sum of areas with permeable floor / floor of each building, and calculate the percentage of area relative to the total of the plot where the building is located.*
		Standard	*Local water saving ordinances* *Metropolitan general plan*

C5.8	*Atmospheric light. Determine the degree of light pollution of the exterior lighting of buildings.*	*Information source*	*City council: Relation of the external lighting installed in each centre and technical sheet of each luminaire that specifies the projection opening to determine if it is inside or outside the cone of 120º.*
		Assessment method	*Determine the degree of light pollution of the exterior lighting of buildings. Calculation of the percentage of exterior lighting of the building that has a light projection outside of a 120-degree vertical cone.*
		Standard	*Spanish Royal Decree 1890/2008. Regulation of energy efficiency in outdoor lighting*

D- INDOOR ENVIRONMENTAL QUALITY			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
D1.4	*TVOC concentration in indoor air*	*Information source*	*Measured data in new buildings. Not calculated.*
		Assessment method	*Determine the level of TVOC concentration of the interior air of the building. Extraction of sensor data installed in the building and calculation of the average result of the sensors placed*
		Standard	*Content in VOC according to UNE-EN ISO 11890-1 / 2 and ASTM D2369 standards. Issuance of VOC according to ISO 16000. Determination of the formaldehyde emission on wood derived boards according to UNE-EN 717*
D1.5	*CO2 concentration in indoor air*	*Information source*	*Measured data in buildings. Cliensol query platform with sensors in different places.*
		Assessment method	Determine the level of CO2 concentration of the interior air of the building. Extraction of sensor data installed in the building and calculation of the average result of the sensors placed
		Standard	*NTP 742: General ventilation of buildings. Good practices guide*
D2.1	*Time outside of the thermal comfort rang*	*Information source*	*CLIENSOL Consultation Platform (01/10 / 2018-30 / 11/2018 period)*
		Assessment method	*Determine the percentage of hours that are out of range of comfort, within the activity schedule of the building. Extraction of temperature sensor data installed in the*

			building and calculation of the percentage of hours that are out of range of comfort within the activity hours of the building and in accordance with the opening calendar of the building downtown
		Standard	*NTP 322: Evaluation of the thermal stress risk: WBGT index. Good practices guide*
D2.2	Thermal comfort index	*Information source*	*Not calculated*
		Assessment method	*Predicted Percentage Dissatisfied (PPD)*
		Standard	*UNI EN ISO 7730 Class B*
D4.1	Noise attenuation through the exterior envelope	*Information source*	*Design documents of the building*
		Assessment method	*Ratio between DF and DF lim. Determine the degree of attenuation that exterior exterior facing external environmental noise provides. Calculation of the acoustic transmission of the windows of the building according to the composition of glass.*
		Standard	*Table 4.3.2.1 of the CTE's constructive Spanish catalogue. Standard window*

E- SERVICE QUALITY			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
E1.2	Risk to occupants and facilities from fire.	*Information source*	*City council: verification that all buildings have a plan of fire strategy in compliance with current regulations.*
		Assessment method	*Revision of fire protection plans, detection and extinction and evacuation routes of the building.*
		Standard	*Spanish regulation Royal Decree 513/2017, of May 22, approving the Regulation of fire protection facilities. Emergency plans, self-protection plans, emergency measures in buildings.*
E1.3	Risk to occupants and facilities from flooding	*Information source*	*City council: Plan "Identification of risk and basic structures" of Civil Protection where the flood areas of the municipality are specified.*
		Assessment method	*Based on the existing documentation on the probability of flooding of the zone near the building one of the risk categories for the*

			occupants described in the criteria of the indicator is established.
		Standard	*Royal Decree 638/2016 in several aspects, among which is the management of flood risks through the identification of those uses and vulnerable activities in front of avenues*
E1.6	Maintenance of core building functions during power outages	*Information source*	*Documentation of the building. Consult property (City Hall)*
		Assessment method	*Determine the number of days the building can operate autonomously in case of fall of the facilities services (ventilation, climate, lighting, internal transport systems ...). Check if there are reservation systems in the building to act in case of emergency and calculate the days that these alternative systems can install autonomy in the building.*
		Standard	*ITC-BC-28: technical guide applied to local public concurrence*
E2.6	Spatial efficiency	*Information source*	*Building plans provided by the property (Town Hall)*
		Assessment method	*Determine the relationship between the total useful surface of the building and the useful functional surface, which excludes vertical circulation and technical premises. Calculate the percentage that represents the functional surface with respect to the total usefulness.*
		Standard	*CTE Spanish construction code in buildings*
E3.1	Effectiveness of facility management control system	*Information source*	*Check property (Town Hall)*
		Assessment method	*Determine any type of monitored control that allows control of the installations.*
		Standard	*CTE Spanish construction code in buildings*
E3.2	Capability for partial operation of facility technical systems	*Information source*	*Check property (Town Hall)*
		Assessment method	*Determine the degree of sectorization of the facilities and viability of providing partial service according to zone or time.*
		Standard	*CTE Spanish construction code in buildings*
E4.5	Adapting the building to a new fuel source will be possible with a moderate level of	*Information source*	*Check property (Town Hall) and check through the existing buildings plans.*
		Assessment method	*Determine the degree of viability to install a*

	renovations, but installing photovoltaics will require major renovations.		*climate system that requires a fuel different from the existing one or the possibility of incorporating photovoltaic solar installation. Revise possible existing or available space reserves for future installations as well as checking the structural viability of the building to withstand new loads or renovations in the building.*
		Standard	*CTE Spanish construction code in buildings*
E5.6	Retention of as-built documentation.	*Information source*	*Check property*
		Assessment method	*Verification of existing documentation and punctuation application based on the cataloguing of each criterion specified in the indicator.* *Determine the scope and quality of the "as built" documentation preserved for later use by the occupants of the building.*
		Standard	*CTE Spanish construction code in buildings*
F- SOCIAL CULTURAL AND PERCEPTUAL ASPECTS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
F1.1	*Universal access on site and within the building*	*Information source*	*Plans provided by the property (Town Hall)*
		Assessment method	*Accessibility to people with mobility problems*
		Standard	*CTE Spanish construction code in buildings and activity licence*
F2.3	*Impact of the design on existing streetscapes*	*Information source*	*Check property (Town Hall) and check through the existing buildings plans*
		Assessment method	*Determine the degree of integration with the environment, height, colour and type of materials.* *Visual inspection where height is reviewed regarding neighbouring buildings, facade material, facade restriction with respect to the street limit and facade composition with types of openings and alignment with neighbouring buildings.*
		Standard	*CTE Spanish construction code in buildings*
F3.7	*Access to exterior views from interior*	*Information source*	*Check property (Town Hall) and check through the existing buildings plans*
		Assessment method	*Evaluate the quality of the external views available to an observer located in an*

			interior space of a main occupation. Calculate the distance from the interior of the adjacent room to the façade that has a window to the outside, to the nearest external obstacle to determine the visual amplitude
		Standard	*CTE Spanish construction code in buildings*

G- COST AND ECONOMIC ASPECTS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
G1.2	Operating and maintenance cost	*Information source*	*Check property all bill consumption*
		Assessment method	*Costs of use of the building + cost of maintenance, by surface, to compare the cost of putting into operation the building evaluated (cost of energy, water and maintenance) with respect to one built under parameters of "acceptable pact". To have the expenditure for energy, water and maintenance (annual) and divide it by the total area constructed: the item "maintenance and repair of the building" has been considered + the consumption of the services of air conditioning, electricity, water and gas*
		Standard	*Good practices guides for buildings*
G1.4	Use stage energy cost	*Information source*	*Check property all bill consumption*
		Assessment method	*Calculation of the average consumption of three years for the fuels destined to energy of the building, extracted from the invoices provided by the property*
		Standard	*Insert text here*
G1.5	Use stage water cost	*Information source*	*Check property all bill consumption*
		Assessment method	*Calculation of the average water consumption of three whole years, extracted from the invoices provided by the property*
		Standard	*Insert text here*

REGIONAL TOOL

D.3.4.3 Regional Tool – University of Malta

Version 1.1

Date: March 2019

2.1: To raise capacity for better management of energy in public buildings at transnational level
Work package: WP3 TESTING
Activity: 3.4 Evaluation of test results
Deliverable: 3.4.3 – Regional CESBA MED SNTs

Responsible Partner: Andrea Moro, iiSBE Italia R&D

BUILDING SCALE ASSESSMENT

SBTool structure

A – SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	
A1	**Site regeneration and development**
A1.7	*Use of vegetation to provide ambient outdoor cooling*
A1.8	*Use of native plant types*
A1.9	*Provision of public open space(s)*
A1.12	*Provision and quality of bicycle pathways and parking*
A1.13	*Provision and quality of walkways for pedestrian use*
A2	Urban Design
A2.1	*Maximizing efficiency of land use through development density*
A2.3	*Impact of orientation on the passive solar potential of building(s)*
B – ENERGY AND RESOURCES CONSUMPTION	
B1	**Total life cycle non-renewable energy**
B1.1	*Primary energy demand*
B1.2	*Delivered energy demand*
B1.3	*Delivered electric demand*
B1.4	*Energy from renewable sources in total primary energy consumption*
B1.6	*Energy from renewable sources in total electric energy consumption*
B4	***Use of potable water, stormwater and greywater***
B4.2	*Water consumption for indoor uses*

C- ENVIRONMENTAL LOADINGS	
C1	**Greenhouse Gas Emissions**
C1.3	*Global Warming Potential*
C3.2	*Solid waste from building operations*
C5.1	*Impact on access to daylight or solar energy potential of adjacent property*
C5.8	*Degree of atmospheric light pollution caused by project exterior lighting systems*

D- INDOOR ENVIRONMENTAL QUALITY	
D1	**Indoor Air Quality and Ventilation**
D1.4	*TVOC concentration in indoor air*
D1.5	*CO2 concentration in indoor air*
D2.2	*Thermal Comfort Index*

E- SERVICE QUALITY	
E1	**Safety and Security**
E1.2	*Risk to occupants and facilities from fire*
E1.3	*Risk to occupants and facilities from flooding*

E1.7	*Personal security for building users during normal operations*
E2	**Functionality and Efficiency**
E2.2	*Functionality of layout(s) for required functions*
E2.4	*Provision of exterior access and unloading facilities for freight or delivery*
E2.5	*Efficiency of vertical or horizontal transportation systems in building*
E2.6	*Spatial efficiency*
E2.7	*Volumetric efficiency*
E3	**Controllability**
E3.3	*Degree of local control of lighting systems*
E3.4	*Degree of personal control of technical systems by occupants*

F- SOCIAL, CULTURAL AND PERCEPTUAL ASPECTS	
F2	**Culture and Heritage**
F2.2	*Provision of public open space compatible with local cultural values*
F2.3	*Impact of the design on existing streetscapes*
F2.4	*Use of traditional local materials and techniques*

G- COST AND ECONOMIC ASPECTS	
G1	**Cost and Economics**
G1.1	*Construction cost*
G1.4	*Use stage energy cost*
G1.6	*Investment Risk*

SBTool criteria selection rationale

A - SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	
CRITERION	**REASON/MOTIVATION**
A1.7 *Use of vegetation to provide ambient outdoor cooling*	*Since Malta is densely populated, vegetation needs to be protected more and introduced more in new projects.*
A1.8 *Use of native plant types*	*Using native plant types would reduce the need for irrigation which will safeguard water as a resource.*
A1.9 *Provision of public open space(s)*	*Since Malta is densely populated, public open spaces are something which need to be safeguarded. To provide public space for gathering, relaxation and recreation of the population within the project and neighbourhood.*
A1.12 *Provision and quality of bicycle pathways and parking*	*Important to promote cycling and walking instead of the use of private car which generates traffic.*
A1.13 *Provision and quality of walkways for pedestrian use*	*Since traffic is a number one issue, more walkways and pedestrianized streets would discourage the citizens in using their own private vehicle.*
A2.1 *Maximizing efficiency of land use through*	*Area in Malta is very limited with regards to the*

development density	*total population. This indicator is therefore vital for the conservation of space.*
A2.3 ***Impact of orientation on the passive solar potential of building(s)***	*Solar Energy is the best clean energy resource for Malta, since Malta has lots of sunny days. It is the most common type of renewable energy used by the Maltese. Grants are currently being given to the citizens to encourage the installation of solar panels.*

B – ENERGY AND RESOURCES CONSUMPTION	
CRITERION	**REASON/MOTIVATION**
B1.1 ***Primary energy demand***	*Important to know the primary energy requirements per year to be able to reduce them.*
B1.2 ***Delivered thermal energy demand***	*The amount of energy that is being used for thermal energy is an important factor.*
B1.3 ***Delivered electric demand***	*Same as in B1.2, this is a very important indicator to be able to reduce electrical energy consumption.*
B1.4 ***Energy from renewable sources in total primary energy consumption***	*Renewable energy, specifically solar energy is given a high priority by the government. Grants are currently being given to the citizens to encourage the installation of solar panels.*
B1.6 ***Energy from renewable sources in total electric energy consumption***	*Renewable energy, specifically solar energy is given a high priority by the government. Grants are currently being given to the citizens to encourage the installation of solar panels.*
B4 ***Use of potable water, stormwater and greywater***	*Important to reduce the potable water consumption. This indicator is crucial to highlight the importance of re-using water when possible.*
B4.2 ***Water consumption for indoor uses***	*Preservation of water is vital.*

C- ENVIRONMENTAL LOADINGS	
CRITERION	**REASON/MOTIVATION**
C1.3 ***Global Warming Potential***	*Reduction of CO2 emissions is one the government's priorities to meet the relevant targets.*
C3.2 ***Solid waste from building operations***	*Waste collection is currently being revamped in Malta. The organic bag has just recently been introduced and waste is collected every day with a schedule for: organic waste, recycled waste and inorganic waste.*
C5.1 ***Impact on access to daylight or solar energy potential of adjacent property***	*To ensure that the height, bulk or location on the site of the Design does not significantly degrade the access to direct daylight of an existing or future building on adjacent properties.*
C5.8 ***Degree of atmospheric light pollution caused by project exterior lighting systems***	*To minimize the spillage of light into the atmosphere from ground-level sources.*

D- INDOOR ENVIRONMENTAL QUALITY	
CRITERION	**REASON/MOTIVATION**
D1.4 *TVOC concentration in indoor air*	*Important to assess the Total Volatile Organic Compounds concentration in the building for the health of occupants.*
D1.5 *CO2 concentration in indoor air*	*Important to assess the amount of CO2 in air to check whether enough air is being circulated.*
D2.2 *Thermal Comfort Index*	*This was done via a short questionnaire and it is important to know whether the occupants feel comfortable with the thermal setting of the environment.*

E- SERVICE QUALITY	
CRITERION	**REASON/MOTIVATION**
E1.2 *Risk to occupants and facilities from fire*	*Important to assess the risk exposure of occupants and users of the building from fire and smoke.*
E1.3 *Risk to occupants and facilities from flooding*	*Important to assess the risk to lives and property of potential flooding incidents.*
E1.7 *Personal security for building users during normal operations*	*Important to assess the extent to which building users are relatively secure in accessing and using the building.*
E2.2 *Functionality of layout(s) for required functions*	*Important to assess the appropriateness of interior layouts to functional requirements of tenancies or occupants.*
E2.4 *Provision of exterior access and unloading facilities for freight or delivery*	*Important to do an assessment of access and unloading facilities for delivery and removal of goods and waste material.*
E2.5 *Efficiency of vertical or horizontal transportation systems in building*	*To assess the service quality and functional efficiency of vertical and horizontal transportation systems within a building.*
E2.6 *Spatial efficiency*	*Important to assess the efficiency of space utilization within buildings.*
E2.7 *Volumetric efficiency*	*Important to encourage the efficient utilization of space within buildings.*
E3.3 *Degree of local control of lighting systems*	*Important to ensure that lighting control system zones in non-residential occupancies are sufficiently small to ensure a satisfactory level of occupant control over lighting conditions.*
E3.4 *Degree of personal control of technical systems by occupants*	*Important to ensure a maximum degree of personal control over heating, ventilation and illumination systems.*

F- SOCIAL, CULTURAL AND PERCEPTUAL ASPECTS	
CRITERION	**REASON/MOTIVATION**
F2.2 *Provision of public open space compatible with local cultural values*	*Important to ensure that public open space compatible with local cultural values is provided in*

	large projects.
F2.3 ***Impact of the design on existing streetscapes***	*Important to assess the degree to which the architectural design of the building exterior is harmonious relative to adjacent buildings.*
F2.4 ***Use of traditional local materials and techniques***	*Important to assess the extent to which traditional local materials and construction techniques will used in the execution of the project.*

G- COST AND ECONOMIC ASPECTS	
CRITERION	**REASON/MOTIVATION**
G1.1 ***Construction cost***	*Important to assess the difference between the capital cost of the Design with that of a reference building designed according to standards of Acceptable Practice.*
G1.4 ***Use stage energy cost***	*Important to optimize the operating cost of buildings to reflect the potential for long term performance.*
G1.6 ***Investment Risk***	*Important to assess the extent to which the construction of the project has affected nearby property values and the investment risk.*

SBTool weights rationale

ISSUE	WEIGHT (1 to 3)	MOTIVATION
A - SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	**1**	**N.A**
B – ENERGY AND RESOURCES CONSUMPTION	1	N.A
C- ENVIRONMENTAL LOADINGS	1	N.A
D- INDOOR ENVIRONMENTAL QUALITY	1	N.A
E- SERVICE QUALITY	1	N.A
F- SOCIAL CULTURAL AND PERCEPTUAL ASPECTS	1	N.A
G- COST AND ECONOMIC ASPECTS	1	N.A

CATEGORIES	WEIGHT (%)
A1- Site regeneration and Development	4.4
A2- Urban design	2.2
A3- Project Infrastructure and Services	0
TOTAL	7
B1- In use energy consumptions	29
B2- Embodied energy	0
B3- Use of materials	0
B4 – Use of water, stormwater and greywater	2.6
TOTAL	31.6
C1- Greenhouse gas emissions	11.6
C2- Other atmospheric emissions	0
C3- Solid and liquid waste	0
C4- Impact on project site	0
C5- Other local and regional impacts	10
TOTAL	23.6
D1- Indoor air quality and ventilation	1.3
D2- Thermal comfort	0.7
D3– Visual comfort	0
D4– Acoustic comfort	0
TOTAL	2
E1- Safety and Security	13.4
E2- Functionality and efficiency	2.4
E3- Controllability	0.7

E4– Flexibility and adaptability	2.2
E5- Optimization and maintenance of operating performance	1.9
TOTAL	20.7
F1- Social aspects	3.5
F2- Culture and heritage	6.4
F3- Perceptual	2.2
TOTAL	12
G1- Cost and economics	3.1
TOTAL	3.1

CRITERIA WEIGHTS

SBTool file A – WeightA-G

A- SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE						
Ax-……						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
A1.7 *Use of vegetation to provide ambient outdoor cooling*	**0.87**	**3**	**2**	**2**	**3**	N.A
A1.8 *Use of native plant types*	**1.31**	**3**	**2**	**3**	**3**	N.A
A1.9 *Provision of public open space(s)*	**0.44**	**3**	**1**	**2**	**3**	N.A
A1.12 *Provision and quality of bicycle pathways and parking*	**0.87**	**3**	**2**	**2**	**3**	N.A
A1.13 *Provision and quality of walkways for pedestrian use*	**0.87**	**3**	**2**	**2**	**3**	N.A
A2.3 *Impact of orientation on the passive solar potential of building(s)*	**2.19**	**5**	**3**	**4**	**3**	N.A

B- ENERGY AND RESOURCES CONSUMPTION						
Bx-……						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
B1.1 *Primary energy demand*	**0**	**5**	**2**	**4**	**3**	N.A
B1.2 *Delivered energy demand*	**7.29**	**5**	**2**	**4**	**3**	N.A
B1.3 *Delivered electric demand*	**7.29**	**5**	**2**	**4**	**3**	N.A
B1.4 *Energy from renewable sources in total primary energy consumption*	**7.29**	**5**	**2**	**4**	**3**	N.A
B1.6 *Energy from renewable sources in*	**7.29**	**5**	**2**	**4**	**3**	N.A

total electric energy consumption						
B4.2 ***Water consumption for indoor uses***	**2.62**	**3**	**2**	**3**	**3**	N.A

C- ENVIRONMENTAL LOADINGS						
Cx-……						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
C1.3 ***Global Warming Potential***	**13.66**	**5**	**3**	**5**	**3**	N.A
C3.2 ***Solid waste from building operations***	**0**	**3**	**2**	**3**	**3**	N.A
C5.1 ***Impact on access to daylight or solar energy potential of adjacent property***	**6.56**	**5**	**3**	**4**	**3**	N.A
C5.8 ***Degree of atmospheric light pollution caused by project exterior lighting systems***	**3.50**	**3**	**2**	**4**	**3**	N.A

D- INDOOR ENVIRONMENTAL QUALITY						
Dx-……						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
D1.4 ***TVOC concentration in indoor air***	**0.66**	**3**	**3**	**2**	**3**	N.A
D1.5 ***CO2 concentration in indoor air***	**0.66**	**3**	**3**	**2**	**3**	N.A
D2.2 ***Thermal Comfort Index***	**0.66**	**3**	**3**	**2**	**3**	N.A

E- SERVICE QUALITY						
Ex-……						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
E1.2 ***Risk to occupants and facilities from fire***	**2.54%**	**3**	**3**	**3**	**3**	N.A
E1.3 ***Risk to occupants and facilities from flooding***	**3.39**	**4**	**3**	**3**	**3**	N.A
E1.7 ***Personal security for***	**2.12**	**5**	**3**	**3**	**3**	N.A

building users during normal operations						
E2.2 ***Functionality of layout(s) for required functions***	**0.28**	**3**	**2**	**1**	**3**	N.A
E2.4 ***Provision of exterior access and unloading facilities for freight or delivery***	**0.14**	**3**	**1**	**1**	**3**	N.A
E2.5 ***Efficiency of vertical or horizontal transportation systems in building***	**1.69**	**3**	**3**	**4**	**3**	N.A
E2.6 ***Spatial efficiency***	**0.28**	**3**	**2**	**1**	**3**	N.A
E2.7 ***Volumetric efficiency***	**0.28**	**3**	**2**	**1**	**3**	N.A
E3.3 ***Degree of local control of lighting systems***	**0.19**	**2**	**2**	**1**	**3**	N.A
E3.4 ***Degree of personal control of techinical systems by occupants***	**0.38**	**2**	**2**	**2**	**3**	N.A

F- SOCIAL CULTURAL AND PERCEPTUAL ASPECTS						
Fx-……						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
F2.2 ***Provision of public open space compatible with local cultural values***	**1.13**	**3**	**2**	**2**	**3**	N.A
F2.3 ***Impact of the design on existing streetscapes***	**1.13**	**3**	**2**	**2**	**3**	N.A
F2.4 ***Use of traditional local materials and techniques***	**1.13**	**3**	**2**	**2**	**3**	N.A

G- COST AND ECONOMIC ASPECTS						
Gx-……						
CRITERION	**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
G1.1 ***Construction cost***	**0.85**	**3**	**3**	**1**	**3**	N.A
G1.4 ***Use stage***	**0.85**	**3**	**3**	**1**	**3**	N.A

energy cost						
G1.6 *Investment Risk*	**0.38**	**3**	**3**	**1**	**3**	N.A

SBTool benchmarks rationale

A- SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
A1.7 *Use of vegetation to provide ambient outdoor cooling*	Ratio of total vegetated surface area (on ground and on roofs, and including trees), divided by total site area. The result is known as or Leaf Area Index.	*Ratio*	*0: 0.4*	*N.A*
			5: 1.0	*N.A*
A1.8 *Use of native plant types*	The percentage of landscaped area (excluding paved areas) planted with native species.	*%*	*0:40%*	*N.A*
			5:100%	*N.A*
A1.9 *Provision of public open space(s)*	To provide public space for gathering, relaxation and recreation of the population within the project and neighbourhood. (Score)	Score	*0*	*N.A*
			5	*N.A*
A1.12 *Provision and quality of bicycle pathways and parking*	Underground Sheltered bicycle path- 12 spaces + showers	Score	*0*	*N.A*
			5	*N.A*
A1.13 *Provision and quality of walkways for pedestrian use*	To assess the extent and quality of walkways for occupants and users. Pedestrian walkways shaded by trees, bridges connecting to building, parking spaces leading directly to the building	Score	*0*	*N.A*
			5	*N.A*
A2.3 *Impact of orientation on the passive solar potential of building(s)*	Deviation, in degrees (º) of main building axis from East-West (to ensure a maximum possible insolation).	Score	*0*	*N.A*
			5	*N.A*

B- ENERGY AND RESOURCES CONSUMPTION				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS

B1.1 *Primary energy demand*		%	*0: value*	*N.A*
			5: value	*N.A*
B1.2 *Delivered energy demand*			*0:*	*N.A*
			5:	*N.A*
B1.3 *Delivered electric demand*			*0:*	*N.A*
			5:	*N.A*
B1.4 *Energy from renewable sources in total primary energy consumption*			*0:*	*N.A*
			5:	*N.A*
B1.6 *Energy from renewable sources in total electric energy consumption*			*0:*	*N.A*
			5:	*N.A*
B4.2 *Water consumption for indoor uses*			*0:*	*N.A*
			5:	*N.A*

C- ENVIRONMENTAL LOADINGS

CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
C1.3 *Global Warming Potential*	*CO_2 equivalent emissions per internal useful floor area per year*	%	*0: value*	*N.A*
			5: value	*N.A*
C3.2 *Solid waste from building operations*	*Ratio of the number of collectable solid waste categories within a 100 m distance from the building's entrance to the reference solid waste categories*		*0:*	*N.A*
			5:	*N.A*
C5.1 *Impact on access to daylight or solar energy potential of adjacent property*	*Percentage of nearest face of an existing building, or a future building designed on an adjacent site in accordance with existing regulations that will be shaded by the subject building.*	%	*0:*	*N.A*
			5:	*N.A*
C5.8 *Degree of atmospheric light pollution caused by project exterior lighting systems*	*Percentage of total exterior light output that lies outside a vertical 120 degree cone, as indicated by drawings and specifications.*	%	*0:*	*N.A*
			5:	*N.A*

D- INDOOR ENVIRONMENTAL QUALITY

CRITERION	INDICATOR	UNIT OF	BENCHMARK	DERIVATIONS

		MEASURE		
D1.4 *TVOC concentration in indoor air*	*TVOC concentration in indoor air*	*%*	*0: value*	*N.A*
			5: value	*N.A*
D1.5 *CO2 concentration in indoor air*	*Designs for HVAC systems that conform to ASHRAE, CIBSE or other acceptable protocol during design phase; actual monitoring results during operations phase.*		*0:*	*N.A*
			5:	*N.A*
D2.2 *Thermal Comfort Index*			*0:*	*N.A*
			5:	*N.A*

E- SERVICE QUALITY

CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
E1.2 *Risk to occupants and facilities from fire*	*Risk level for occupants in the most vulnerable part of the building.*	*Score*	*0*	*N.A*
			5	*N.A*
E1.3 *Risk to occupants and facilities from flooding*	*Probability of injury or death or major property damage in case of 100-year flood event or other foreseeable flood risk.*	*Score*	*0*	*N.A*
			5	*N.A*
E1.7 *Personal security for building users during normal operations*	*Measures that are likely to assure adequate levels of actual and perceived personal security, according to design documentation.*	*Score*	*0*	*N.A*
			5	*N.A*
E2.2 *Functionality of layout(s) for required functions*	*Goodness of fit of provided layouts (shape, ease of access) with functional requirements.*	*Score*	*0*	*N.A*
			5	*N.A*
E2.4 *Provision of exterior access and unloading facilities for freight or delivery*	*Adequacy of the facility unloading and temporary storage capacity and measures to prevent excessive noise and visual pollution from disturbing occupants.*	*Score*	*0*	*N.A*
			5	*N.A*
E2.5 *Efficiency of vertical or horizontal transportation systems in building*	*Availability of lifts for occupant use, taking into account down-time for service and moving*	*Score*	*0:*	*N.A*
			5:	*N.A*

	needs, and the time required to travel from the ground floor to the top floor (or vice versa) during peak periods; provision, capacity and speed of horizontal passenger conveying systems.			
E2.6 *Spatial efficiency*	*The ratio of directly functional net areas to total net area in each occupancy. Total Net Areas exclude only structure and building envelope areas; Net Functional Areas (NFA) exclude interior garages, vertical circulation and building mechanical rooms.*	*%*	*0:60%* *5:90%*	*N.A* *N.A*
E2.7 *Volumetric efficiency*	*The ratio of directly functional net areas to total net area in each occupancy. Total Net Areas exclude only structure and building envelope areas; Net Functional Areas (NFA) exclude interior garages, vertical circulation and building mechanical rooms.*	*%*	*0:60%* *5:90%*	*N.A* *N.A*
E3.3 *Degree of local control of lighting systems*	*The area of typical lighting control zones in perimeter areas in m2, as shown in design documentation.*	*Score*	*0* *5*	*N.A* *N.A*
E3.4 *Degree of personal control of technical systems by occupants*	*The degree of control over key indoor environment systems that can be exercised by occupants, according to design documentation.*	*Score*	*0* *5*	*N.A* *N.A*

F- SOCIAL CULTURAL AND PERCEPTUAL ASPECTS				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
F2.2 *Provision of public open space compatible with local cultural values*	*Expert assessment of the degree to which public open space provided in the project is consistent with local cultural values.*	*%*	*0: value* *5: value*	*N.A* *N.A*

F2.3 *Impact of the design on existing streetscapes*	*Expert assessment of the harmony of the Design with adjacent existing buildings, in features such as height, bulk, set-back from the street, window size and height, colour or type of materials.*	*Score*	*0*	*N.A*
			5	*N.A*
F2.4 *Use of traditional local materials and techniques*	*Architect's estimate of the percent of the non-structural elements of the building will be constructed using traditional local materials and construction techniques.*	*%*	*0:*	*N.A*
			5:	*N.A*

G- COST AND ECONOMIC ASPECTS				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
G1.1 *Construction cost*	*Predicted construction cost per unit area, according to design documentation.*	*%*	*0: value*	*N.A*
			5: value	*N.A*
G1.4 *Use stage energy cost*	*Energy annual cost per usable floor area*	*E/m^2*	*0:*	*N.A*
			5:	*N.A*
G1.6 *Investment Risk* Etc.	*Percent change in market value of properties within 200 m of the project boundaries, 12 months after the start of construction.*	*Score*	*0*	*N.A*
			5	*N.A*

SBTool Criteria Specifications

A- SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
A1.7 *Use of vegetation to provide ambient outdoor cooling*	Ratio of total vegetated surface area (on ground and on roofs, and including trees), divided by total site area. The result is known as or Leaf Area Index.	*Information source*	*Plans of building*
		Assessment method	*Desk Analysis*
		Standard	*N.A*

A1.8 *Use of native plant types*	The percentage of landscaped area (excluding paved areas) planted with native species.	*Information source*	*Plans of building*
		Assessment method	*Desk Analysis*
		Standard	*N.A*
A1.9 *Provision of public open space(s)*	To provide public space for gathering, relaxation and recreation of the population within the project and neighbourhood. (Score)	*Information source*	*Plans of building*
		Assessment method	*Desk Analysis*
		Standard	*N.A*
A1.12 *Provision and quality of bicycle pathways and parking*	Underground Sheltered bicycle path- 12 spaces + showers	*Information source*	*Plans of building*
		Assessment method	*Desk Analysis*
		Standard	*N.A*
A1.13 *Provision and quality of walkways for pedestrian use*	To assess the extent and quality of walkways for occupants and users. Pedestrian walkways shaded by trees, bridges connecting to building, parking spaces leading directly to the building	*Information source*	*Plans of building*
		Assessment method	*Desk Analysis*
		Standard	*N.A*
A2.3 *Impact of orientation on the passive solar potential of building(s)*	Deviation, in degrees (º) of main building axis from East-West (to ensure a maximum possible insolation).	*Information source*	*Plans of building*
		Assessment method	*Desk Analysis*
		Standard	*N.A*

B- ENERGY AND RESOURCES CONSUMPTION			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
B1.1 *Primary energy demand*		*Information source*	*Measured data from meters.*
		Assessment method	*Insert text here*
		Standard	*Insert text here*
B1.2 *Delivered thermal energy demand*		*Information source*	*Measured data from VRF meters.*
		Assessment method	
		Standard	
B1.3 *Delivered electric demand*		*Information source*	*Measured data from meters.*
		Assessment method	
		Standard	
B1.4 *Energy from renewable sources in total primary energy consumption*		*Information source*	
		Assessment method	
		Standard	
B1.6 *Energy from renewable sources in total electric energy consumption*		*Information source*	
		Assessment method	
		Standard	
B4.2 *Water consumption for indoor uses*		*Information source*	

		Assessment method	
		Standard	

C- ENVIRONMENTAL LOADINGS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
C1.3 *Global Warming Potential*	*CO_2 equivalent emissions per internal useful floor area per year*	*Information source*	*Enemalta*
		Assessment method	*Insert text here*
		Standard	*Insert text here*
C3.2 *Solid waste from building operations*	*Ratio of the number of collectable solid waste categories within a 100 m distance from the building's entrance to the reference solid waste categories*	*Information source*	*Plans of building*
		Assessment method	*Desk Analysis*
		Standard	*N.A*
C5.1 *Impact on access to daylight or solar energy potential of adjacent property*	*Percentage of nearest face of an existing building, or a future building designed on an adjacent site in accordance with existing regulations that will be shaded by the subject building.*	*Information source*	*Plans of building*
		Assessment method	*Desk Analysis*
		Standard	*N.A*
C5.8 *Degree of atmospheric light pollution caused by project exterior lighting systems*	*Percentage of total exterior light output that lies outside a vertical 120 degree cone, as indicated by drawings and specifications. CO_2 equivalent emissions per internal useful floor area per year*	*Information source*	*Plans of building*
		Assessment method	*Desk Analysis*
		Standard	*N.A*

D- INDOOR ENVIRONMENTAL QUALITY		
CRITERION	**INDICATOR**	**SPECIFICATIONS**

D1.4 *TVOC concentration in indoor air*	*TVOC concentration in indoor air*	*Information source*	*Measured Data*
		Assessment method	*Desk Analysis*
		Standard	*N.A*
D1.5 *CO_2 concentration in indoor air*	*Designs for HVAC systems that conform to ASHRAE, CIBSE or other acceptable protocol during design phase; actual monitoring results during operations phase.*	*Information source*	*Measured Data*
		Assessment method	*Desk Analysis*
		Standard	*N.A*
D2.2 *Thermal Comfort Index*		*Information source*	*Questionnaire*
		Assessment method	*Short Questionnaire was distributed among occupants of the building.*
		Standard	*N.A*

E- SERVICE QUALITY			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
E1.2 *Risk to occupants and facilities from fire*	*Risk level for occupants in the most vulnerable part of the building.*	*Information source*	*Fire Assessment Plans of building*
		Assessment method	*Desk Analysis*
		Standard	*N.A*
E1.3 *Risk to occupants and facilities from flooding*	*Probability of injury or death or major property damage in case of 100-year flood event or other foreseeable flood risk.*	*Information source*	*Water Assessment Plans of building*
		Assessment method	*Desk Analysis*
		Standard	*N.A*
E1.7 *Personal security for building users during normal*	*Measures that are likely to assure adequate*	*Information source*	*Health and safety plans of building*

operations	*levels of actual and perceived personal security, according to design documentation.*	*Assessment method*	*Desk Analysis*
		Standard	*N.A*
E2.2 *Functionality of layout(s) for required functions*	*Goodness of fit of provided layouts (shape, ease of access) with functional requirements.*	*Information source*	*Plans of building*
		Assessment method	*Desk Analysis*
		Standard	*N.A*
E2.4 *Provision of exterior access and unloading facilities for freight or delivery*	*Adequacy of the facility unloading and temporary storage capacity and measures to prevent excessive noise and visual pollution from disturbing occupants.*	*Information source*	*Plans of building*
		Assessment method	*Desk Analysis*
		Standard	*N.A*
E2.5 *Efficiency of vertical or horizontal transportation systems in building*	*Availability of lifts for occupant use, taking into account down-time for service and moving needs, and the time required to travel from the ground floor to the top floor (or vice versa) during peak periods; provision, capacity and speed of horizontal passenger conveying systems.*	*Information source*	*Lift data*
		Assessment method	*Desk Analysis*
		Standard	*N.A*
E2.6 *Spatial efficiency*	*The ratio of directly functional net areas to total net area in each occupancy.*	*Information source*	*Building Plans*
		Assessment method	*Desk Analysis*
		Standard	*N.A*
E2.7 *Volumetric efficiency*	*Total Net Areas exclude only structure and building envelope*	*Information source*	*Building Plans*

	areas; Net Functional Areas (NFA) exclude interior garages, vertical circulation and building mechanical rooms. The ratio of directly functional net areas to total net area in each occupancy.	*Assessment method*	*Desk Analysis*
		Standard	*N.A*
E3.3 *Degree of local control of lighting systems*	*The area of typical lighting control zones in perimeter areas in m2, as shown in design documentation.*	*Information source*	*Building Plans*
		Assessment method	*Desk Analysis*
		Standard	*N.A*
E3.4 *Degree of personal control of technical systems by occupants*	*The degree of control over key indoor environment systems that can be exercised by occupants, according to design documentation.*	*Information source*	*Building Plans*
		Assessment method	*Desk Analysis*
		Standard	*N.A*

F- SOCIAL CULTURAL AND PERCEPTUAL ASPECTS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
F2.2 *Provision of public open space compatible with local cultural values*	*Expert assessment of the degree to which public open space provided in the project is consistent with local cultural values.*	*Information source*	*Building Plans*
		Assessment method	*Desk Analysis*
		Standard	*N.A*
F2.3 *Impact of the design on existing streetscapes*	*Expert assessment of the harmony of the Design with adjacent existing buildings, in features such as height, bulk, set-back from the street, window size and height, colour or type of materials.*	*Information source*	*Building Plans*
		Assessment method	*Desk Analysis*
		Standard	*N.A*
F2.4 *Use of traditional local materials and techniques*	*Architect's estimate of the percent of the non-structural elements of the building will be constructed using traditional local materials and construction techniques.*	*Information source*	*Building Plans*
		Assessment method	*Desk Analysis*
		Standard	*N.A*

G- COST AND ECONOMIC ASPECTS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
G1.1 *Construction cost*	*Predicted construction cost per unit area, according to design documentation.*	*Information source*	*Design documentation*
		Assessment method	*Desk analysis*
		Standard	*N.A*
G1.4 *Use stage energy cost*	*Energy annual cost per usable floor area*	*Information source*	*Design documentation*
		Assessment method	*Desk analysis*
		Standard	*N.A*
G1.6 *Investment Risk*	*Percent change in market value of properties within 200 m of the project boundaries, 12 months after the start of construction.*	*Information source*	*Property market studies*
		Assessment method	*Desk analysis*
		Standard	*N.A*

REGIONAL TOOL

D.3.4.3 Regional Tool - NOA

Version 1.1

Date: March 2019

2.1: To raise capacity for better management of energy in public buildings at transnational level
Work package: WP3 TESTING
Activity: 3.4 Evaluation of test results
Deliverable: 3.4.3 – Regional CESBA MED SNTs

Responsible Partner: Andrea Moro, iiSBE Italia R&D

BUILDING SCALE ASSESSMENT

SBTool structure

A – SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	
A1	**Site Regeneration and Development**
A1.13	*Provision and quality of walkways for pedestrian use.*
A3	**Project Infrastructure and Services**
A3.12	*Public/ Municipal transportation*
A3.13	*Provision of on-site parking facilities for private vehicles.*
A3.16	*Exterior lighting.*

B – ENERGY AND RESOURCES CONSUMPTION	
B1	**Energy**
B1.1	*Primary energy demand **
B1.2	*Delivered thermal energy demand **
B1.3	*Delivered electric energy demand **
B1.5	*Energy from renewable sources in total thermal energy consumption **
B1.6	*Energy from renewable sources in total electrical energy consumption **
B1.8	*Final total energy for all building operations*
B1.11	*Embodied energy (Not for Use phase) **
B2	**Electrical peak demand**
B2.1	*Electrical peak demand for building operations*
B3	**Use of Materials**
B3.5	*Recycled materials (Not for Use phase) **
B4	**Use of potable water, stormwater and greywater**
B4.5	*Water consumption for indoor uses **

C- ENVIRONMENTAL LOADINGS	
C1	**Greenhouse Gas Emissions**
C1.3	*Greenhouse Gas Emissions from building's operations **
C3	**Solid and Liquid Wastes**
C3.1	*Construction and demolition waste (Not for Use phase) **
C3.2	*Solid waste from building operations **

D- INDOOR ENVIRONMENTAL QUALITY	
D1	**Indoor Air Quality and Ventilation**
D1.4	*TVOC concentration in indoor air (Not for Use phase) **
D1.10	*Ventilation rate **
D2	**Air Temperature and Relative Humidity**
D2.2	*Thermal comfort index **

E- SERVICE QUALITY	
E1	**Safety and Security**
E1.2	*Risk to occupants and facilities from fire*
E1.3	*Risk to occupants and facilities from flooding*
E1.4	*Risk to occupants and facilities from earthquake*
E2	**Functionality and efficiency**
E2.5	*Elevators*
E3	**Controllability**
E3.1	*Building Management System (BMS)*
E3.2	*Building Energy Management System (BEMS)*
E3.3	*Control of lighting systems*
E3.4	*Local control of heating/cooling systems*
E4	**Flexibility and Adaptability**
E4.5	*Adaptability to future changes in type of energy supply*
E5	**Optimization and Maintenance of Operating Performance**
E5.6	*Retention of as-built documentation.*

F- SOCIAL, CULTURAL AND PERCEPTUAL ASPECTS	
F1	**Social Aspects**
F1.1	*Universal access on site and within the building.*

G- COST AND ECONOMIC ASPECTS	
G1	**Cost**
F1.4	*Use stage energy cost **
F1.5	*Use stage water cost **

SBTool criteria selection rationale

A - SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE		
	CRITERION	**REASON/MOTIVATION**
A1.13	*Provision and quality of walkways for pedestrian use.*	*Facilitate the occupants*
A3.12	*Public/ Municipal transportation*	*Facilitate the occupants*
A3.13	*Provision of on-site parking facilities for private vehicles*	*Facilitate the occupants*
A3.16	*Exterior lighting.*	*Important for occupants' safety*

B – ENERGY AND RESOURCES CONSUMPTION		
	CRITERION	**REASON/MOTIVATION**
B1.1	*Primary energy demand **	*KPI*
B1.2	*Delivered thermal energy demand **	*KPI*
B1.3	*Delivered electric energy demand **	*KPI*
B1.5	*Energy from renewable sources in total thermal energy consumption **	*KPI*
B1.6	*Energy from renewable sources in total electrical energy*	*KPI*

	*consumption **	
B1.8	*Final total energy for all building operations*	*Interesting and can be calculated*
B1.11	*Embodied energy (Not for Use phase) **	*KPI*
B2.1	*Electrical peak demand for building operations **	*KPI*
B3.5	*Recycled materials (Not for Use phase) **	*KPI*
B4.5	*Water consumption for indoor uses **	*KPI*

C- ENVIRONMENTAL LOADINGS

	CRITERION	REASON/MOTIVATION
C1.3	*Greenhouse Gas Emissions from building's operations **	*KPI*
C3.1	*Construction and demolition waste (Not for Use phase) **	*KPI*
C3.2	*Solid waste from building operations **	*KPI*

D- INDOOR ENVIRONMENTAL QUALITY

	CRITERION	REASON/MOTIVATION
D1.4	*TVOC concentration in indoor air (Not for Use phase) **	*KPI*
D1.10	*Ventilation rate **	*KPI*
D2.2	*Thermal comfort index **	*KPI*

E- SERVICE QUALITY

	CRITERION	REASON/MOTIVATION
E1.2	*Risk to occupants and facilities from fire*	*Important for occupants' safety*
E1.3	*Risk to occupants and facilities from flooding*	*Important for occupants' safety*
E1.4	*Risk to occupants and facilities from earthquake*	*Important for occupants' safety*
E2.5	*Elevators*	*Interesting and can be calculated*
E3.1	*Building Management System (BMS)*	*Important for building's energy consumption*
E3.2	*Building Energy Management System (BEMS)*	*Important for building's energy consumption*
E3.3	*Control of lighting systems*	*Important for building's energy consumption*
E3.4	*Local control of heating/cooling systems*	*Important for building's energy consumption*
E4.5	*Adaptability to future changes in type of energy supply*	*Interesting and can be calculated*
E5.6	*Retention of as-built documentation.*	*Useful*

F- SOCIAL, CULTURAL AND PERCEPTUAL ASPECTS

	CRITERION	REASON/MOTIVATION
F1.1	*Universal access on site and within the building.*	*Important*

G- COST AND ECONOMIC ASPECTS

	CRITERION	REASON/MOTIVATION
G1.4	*Use stage energy cost **	*KPI*
G1.5	*Use stage water cost **	*KPI*

SBTool weights rationale

ISSUE	WEIGHT (1 to 3)	MOTIVATION
A - SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE		
B – ENERGY AND RESOURCES CONSUMPTION	3	
C- ENVIRONMENTAL LOADINGS	3	
D- INDOOR ENVIRONMENTAL QUALITY	2	
E- SERVICE QUALITY		
F- SOCIAL CULTURAL AND PERCEPTUAL ASPECTS		
G- COST AND ECONOMIC ASPECTS	1	

* Issue weighting is from the "CESBA KPIs SBTool v1.0" tool

COMMENT: We do not have weighting factors for issues (issues are replaced by primary issue or system, which is factor D). Additionally, reporting of factor A is missing.

Primary issue or system directly affected	WEIGHT (1 to 5)	MOTIVATION
COST AND ECONOMICS	1	
FUNCTIONALITY AND SERVICABILITY	1	
WELL-BEING AND PRODUCTIVITY OF OCCUPANTS	2	
SOCIAL AND CULTURAL ISSUES	2	
LAND RESOURCES	3	
NON-RENEWABLE MATERIAL RESOURCES	3	
NON-RENEWABLE WATER RESOURCES	3	
HEALTH, SAFETY AND SECURITY OF INDIVIDUALS	3	
RENEWABLE ENERGY RESOURCES	4	
NON-RENEWABLE ENERGY RESOURCES	4	
GLOBAL CLIMATE	5	

CATEGORIES	WEIGHT (%)
A1- Site regeneration and Development	1.3
A3- Project Infrastructure and Services	5.2
TOTAL	6.5
B1- Energy	22.0
B2- Electrical peak demand	5.1
B3- Use of materials	-
B4 – Use of water, stormwater and greywater	1.4
TOTAL	28.5
C1- Greenhouse gas emissions	26.5
C3- Solid and liquid waste	10.1

TOTAL	36.6
D1- Indoor air quality and ventilation	-
D2- Thermal comfort	0.5
TOTAL	0.5
E1- Safety and Security	3.6
E2- Functionality and efficiency	0.2
E3- Controllability	3.8
E4– Flexibility and adaptability	5.1
E5- Optimization and maintenance of operating performance	0.0
TOTAL	12.6
F1- Social aspects	4.3
TOTAL	4.3
G1- Cost	11.0
TOTAL	11.0

CRITERIA WEIGHTS

SBTool file A – WeightA-G

A- SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE

A1 Site Regeneration and Development

CRITERION		Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
A1.13	*Provision and quality of walkways for pedestrian use.*	*1.26*	*3*	*2*	*1*	*4*	*Pedestrian and bicycle paths are important for future plans*

A3 Project Infrastructure and Services

CRITERION		Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
A3.12	*Public/ Municipal transportation*	*2.83*	*3*	*3*	*1*	*4*	*Municipal transportation system is important for future plans*
A3.13	*Provision of on-site parking facilities for private vehicles*	*0.47*	*1*	*3*	*1*	*2*	*Parking is less important*
A3.16	*Exterior lighting.*	*1.89*	*1*	*3*	*3*	*4*	*Exterior lighting is important for security reasons*
TOTAL		**6.4**					

B - ENERGY AND RESOURCES CONSUMPTION

B1 Energy

CRITERION		Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
B1.1	*Primary energy demand*	*3.77*	*3*	*3*	*4*	*4*	*Energy consumption is an important issue*
B1.2	*Delivered thermal energy demand*	*3.77*	*3*	*3*	*4*	*4*	*Energy consumption is an important issue*
B1.3	*Delivered electric energy demand*	*3.77*	*3*	*3*	*4*	*4*	*Energy consumption is an important issue*
B1.5	*Energy from renewable sources in total thermal*	*0.94*	*3*	*3*	*4*	*1*	*Energy consumption is an important issue*

	energy consumption						
B1.6	*Energy from renewable sources in total electrical energy consumption*	*4.72*	*3*	*3*	*4*	*5*	*Installation of PV are of extremely importance for the Municipality strategic plan*
B1.8	*Final total energy for all building operations*	*3.77*	*3*	*3*	*4*	*4*	*Energy consumption is an important issue*
B1.11	*Embodied energy*	*1.05*	*5*	*1*	*4*	*1*	*Not so important for now*
B2	**Electrical peak demand**						
CRITERION		**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
B2.1	*Electrical peak demand for building operations*	*5.03*	*2*	*3*	*4*	*2*	*Not so important for now*
B3	**Use of Materials**						
CRITERION		**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
B3.5	*Recycled materials (Not for Use phase)*	*-*	*4*	*2*	*3*	*2*	Not very common practice
B4	**Use of potable water, stormwater and greywater**						
CRITERION		**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
B4.5	*Water consumption for indoor uses*	*1.42*	*3*	*2*	*3*	*3*	
TOTAL		**28.2**					

C- ENVIRONMENTAL LOADINGS							
C1	**Greenhouse Gas Emissions**						
CRITERION		**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
C1.3	*Greenhouse Gas Emissions from building's operations*	*26.21*	*5*	*2*	*5*	*4*	*Reduction of CO2 is an important issue*
C3	**Solid and Liquid Wastes**						
CRITERION		**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
C3.1	*Construction and demolition waste (Not for Use phase)*	*-*	*4*	*2*	*3*	*3*	
C3.2	*Solid waste from building operations*	*10.01*	*4*	*2*	*3*	*4*	*Recycling is an important issue*
TOTAL		**36.3**					

D- INDOOR ENVIRONMENTAL QUALITY							
D1	**Indoor Air Quality and Ventilation**						
CRITERION		**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
D1.4	*TVOC concentration in indoor air (Not for Use phase)*	*-*	*1*	*3*	*3*	*3*	
D1.10	*Ventilation rate*	*0.94*	*2*	*3*	*2*	*3*	
D2	**Air Temperature and Relative Humidity**						

CRITERION		Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
D2.2	*Thermal comfort index*	*0.47*	*1*	*3*	*2*	*3*	
TOTAL		**1.4**					

E- SERVICE QUALITY

E1 Safety and Security

CRITERION		Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
E1.2	*Risk to occupants and facilities from fire*	*1.42*	*1*	*3*	*3*	*3*	
E1.3	*Risk to occupants and facilities from flooding*	*1.42*	*1*	*3*	*3*	*3*	
E1.4	*Risk to occupants and facilities from earthquake*	*0.71*	*1*	*3*	*3*	*3*	

E2 Functionality and efficiency

CRITERION		Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
E2.5	*Elevators*	*0.21*	*1*	*2*	*1*	*4*	

E3 Controllability

CRITERION		Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
E3.1	*Building Management System (BMS)*	*0.16*	*2*	*1*	*1*	*3*	
E3.2	*Building Energy Management System (BEMS)*	*1.68*	*2*	*2*	*4*	*4*	
E3.3	*Control of lighting systems*	*1.26*	*2*	*2*	*4*	*3*	
E3.4	*Local control of heating/cooling systems*	*0.63*	*2*	*2*	*2*	*3*	

E4 Flexibility and Adaptability

CRITERION		Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
E4.5	*Adaptability to future changes in type of energy supply*	*5.03*	*3*	*2*	*4*	*4*	*Turning to PV systems is in future plans*

E5 Optimization and Maintenance of Operating Performance

CRITERION		Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
E5.6	*Retention of as-built documentation*	*0.03*	*1*	*1*	*1*	*1*	*Of no importance for now*
TOTAL		**12.5**					

F- SOCIAL CULTURAL AND PERCEPTUAL ASPECTS

F1 Social Aspects

CRITERION		Weight (%)	B	C	D	L.F.	L.F. REASON/MOTIVATION
F1.1	*Universal access on site and within the*	*4.25*	*3*	*3*	*3*	*3*	

	building		
TOTAL		**4.2**	

G- COST AND ECONOMIC ASPECTS							
G1 Cost							
CRITERION		**Weight (%)**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
G1.4	*Use stage energy cost*	*2.36*	*3*	*3*	*1*	*5*	*Reduction of energy cost is very important*
G1.5	*Use stage water cost*	*8.49*	*3*	*3*	*3*	*3*	
TOTAL		**10.8**					

SBTool benchmarks rationale

A- SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE				
CRITERION	**INDICATOR**	**UNIT**	**BENCHMARK**	**DERIVATIONS**
A1.13	*Existence and usability of bicycle and pedestrian paths around the building*	*text*	*0:*	*Short network of pedestrian or bicycle paths or shared areas near the building*
			5:	*Large network of pedestrian or bicycle paths or shared areas near the building leading to public transport stops, schools or public spaces*
A3.12	*Public/ Municipal transportation*	*text*	*0:*	*One stop of public/municipal transportation within 400m from the building, with travel frequency up to 15 minutes.*
			5:	*At least two stops of public/municipal transportation (covering different directions) within 400m from the building, with travel frequency up to 10 minutes.*
A3.13	*Provision of on-site parking facilities for private vehicles*	*Spaces/60m²*	*0: 1*	*ΦΕΚ 76/ΜΑΡΤΙΟΣ 2004* Official journal 76 / March 2004
			5: 1.3	*Based on discussions with National Local Committee Members*
A3.16	*Exterior lighting.*	*text*	*0:*	*Adequate exterior and public lighting around the building with old lighting fixtures, no visual discomfort*
			5:	*Adequate exterior and public lighting around the building with new lighting fixtures, no visual discomfort*

B- ENERGY AND RESOURCES CONSUMPTION				
CRITERION	**INDICATOR**	**UNIT**	**BENCHMARK**	**DERIVATIONS**

B1.1	*Primary energy demand **	*kWh/m²*	*0: 310.6* *5: 87.6*	*Very difficult to get metered data, especially for residential and privately owned non-residential buildings. Use of statistical / calculated data.* *Score 0 corresponds to the consumption of the dominant energy class, while Score 5 to energy class A+ (33% of class B).* *Primary energy consumption per building use for the dominant energy class and class B, were defined using data from the Energy Performance Certificates (EPC) electronic repository (buildingcert), for whole buildings adapted for external (TEEKENAK) to internal (CESBAMED) dimensions.* *All end uses (space heating, space cooling, domestic hot water, ventilation, lighting and auxiliaries) were taken into account.*
B1.2	*Delivered thermal energy demand **	*kWh/m²*	*0: 69.1* *5: 11.5*	*Very difficult to get metered data, especially for residential and privately owned non-residential buildings. Use of statistical / calculated data.* *Score 0 corresponds to the consumption of the dominant energy class, while Score 5 to energy class A+ (33% of class B).* *Thermal energy consumption per building use for the dominant energy class and class B, were defined using data from the Energy Performance Certificates (EPC) electronic repository (buildingcert), for whole buildings, adapted for external (TEEKENAK) to internal (CESBAMED) dimensions.* *All end uses (space heating, space cooling and domestic hot water) were taken into account.*
B1.3	*Delivered electric energy demand **	*kWh/m²*	*0: 99.4* *5: 29.1*	*Very difficult to get metered data, especially for residential and privately owned non-residential buildings. Use of statistical / calculated data.* *Score 0 corresponds to the consumption of the dominant energy class, while Score 5 to energy class A+ (33% of class B).* *Electricity consumption per building use for the dominant energy class and class B, were defined using data from the Energy Performance Certificates (EPC) electronic repository (buildingcert), for whole buildings, adapted for external (TEEKENAK) to internal (CESBAMED) dimensions.* *All end uses (space heating, space cooling, domestic hot water, ventilation, lighting and auxiliaries) were taken into account.*
B1.5	*Energy from renewable sources in total thermal energy consumption **	*%*	*0: 16* *5: 80*	*Building use solar collectors for pre-heating* *Building use solar collectors for pre-heating and partial coverage*

				of heating loads
B1.6	*Energy from renewable sources in total electrical energy consumption **	*%*	*0: 20* *5: 100*	*Very difficult to get metered data.* *Use of statistical/ estimated data*
B1.8	*Final total energy for all building operations*	*kWh/m²*	*0: 168.5* *5: 40.6*	*Based on B1.2 and B1.3*
B1.11	*Embodied energy (Not for Use phase) **	*MJ/m²*	*0: 6230* *5: 3000*	*Based on discussions with National Local Committee Members*
B2.1	*Electrical peak demand for building operations **	*W/m²*	*0: 225.3* *5: 9*	*From typical installed power for heating, cooling, mechanical ventilation, lighting, and equipment for office buildings* *For nzeb buildings*
B3.5	*Weight of recycled materials on total weight of materials (Not for Use phase) **	*%*	*0: 3* *5: 40*	*Based on discussions with National Local Committee Members and common practice in Greece*
B4.5	*Potable water consumption per occupant per year**	*m³/occupant*	*0: 6.0* *5: 1.5*	*From typical values for offices* *Based on discussions with National Local Committee, consumption can be reduced to 75%*

C- ENVIRONMENTAL LOADINGS				
CRITERION	**INDICATOR**	**UNIT**	**BENCHMARK**	**DERIVATIONS**
C1.3	*CO2 equivalent emissions per internal useful floor area per year **	*kg CO2 eq/m²/yr*	*0: 7.5* *5: 2.0*	*Based on thermal and electricity consumption benchmarking as estimated in B1.2 and B1.3. It is assumed that thermal energy is covered by fuel oil.* *Score 0 corresponds to CO2 equivalent emissions for the thermal and electrical energy consumption of the buildings of the dominant energy class* *Score 5 corresponds to the CO2 equivalent emissions for consumptions of energy class A+.*
C3.1	*Weight of waste and materials generated per 1 m2 of useful floor area demolished or constructed (Not for Use phase) **	*kg/m²/life cycle stage*	*0: 120* *5: 36*	*As an assumption of 8 m³/100 m² X 1500 kg/m³* *70% x120kg/m² =1.8 kg/m² reuse, recycling and recovery of CDW should be reduced by 70% at 2020*
C3.2	*Ratio of the number of collectable solid waste categories within a 100 m distance from the building's entrance to the reference solid waste categories **	*%*	*0: 57* *5: 100*	*Based on discussions with National Local Committee Members and common practice*

D- INDOOR ENVIRONMENTAL QUALITY				
CRITERION	**INDICATOR**	**UNIT**	**BENCHMARK**	**DERIVATIONS**
D1.4	*TVOC concentration in indoor air (Not for Use phase) **	*µg/ m^3*	*0: 1000* *5: 200*	From punished material
D1.10	*Ventilation rate **	*l/s/m^2*	*0: 0.29* *5: 0.83*	*Common practice in NR buildings for fresh air* *Based on National guidelines for fresh air for office buildings*
D2.2	*Thermal comfort index **	*%*	*0: 25* *5: 5*	*Based on discussions with National Local Committee Members*

E- SERVICE QUALITY				
CRITERION	**INDICATOR**	**UNIT**	**BENCHMARK**	**DERIVATIONS**
E1.2	*Risk to occupants and facilities from fire*	*text*	*0:* *5:*	*The building fulfils the requirements for fire protection. Basic training of the occupants* *The building fulfils the requirements for fire protection. Periodical training of the occupants and fire drills. System connected to a BMS.*
E1.3	*Risk to occupants and facilities from flooding*	*text*	*0:* *5:*	*Area facing flooding problems (during the last 100years), building partially equipped, OR building in an area with no flooding problems (during the last 100years).* *Area facing flooding problems (during the last 100years), building fully equipped, which faced flooding incident successfully*
E1.4	*Risk to occupants and facilities from earthquake*	*text*	*0:* *5:*	*Building has passed successfully, a pre-earthquake inspection.* *Building has passed successfully, a pre-earthquake inspection and fully complies with National Regulations. Periodical training of the occupants*
E2.5	*Elevators*	*text*	*0:* *5:*	*Certified elevators, with regular maintenance but don't comply with regulations for disabled persons. Maximum waiting time about 45 sec.* *Certified elevators, with regular maintenance,*

				complied with updated standards EN81.20, and with disabled persons' requirements. Maximum waiting time about 25 sec. System connected to a BMS.
E3.1	*Building Management System (BMS)*	*text*	*0:* *5:*	*The building is equipped with a BMS, but it doesn't provide monitoring of system operations, or diagnostic reporting.* *The building is equipped with a BMS, capable of ensuring that building technical systems operate at peak efficiency during all operating conditions, and the system provides full monitoring of system operations, as well as diagnostic reporting.*
E3.2	*Building Energy Management System (BEMS)*	*text*	*0:* *5:*	*Central control system for heating, cooling and ventilation, on building level* *Central control system for heating, cooling, ventilation and lighting on zone level*
E3.3	*Control of lighting systems*	*text*	*0:* *5:*	*Automatic control of lighting turning on and off per building part.* *Automatic control of lighting turning on and off per zone. Daylight and occupancy sensors in all zones. System connected to a BEMS or BMS.*
E3.4	*Local control of heating/cooling systems*	*text*	*0:* *5:*	*Thermostatic control of terminal units or/and central heating system with timer* *Automatic local control of terminal units per room. Thermostatic control per room for central heating systems.*
E4.5	*Ease in installing heating or cooling equipment that require a different fuel/ energy carrier, or photovoltaic systems.*	*text*	*0:* *5:*	*Adapting the building to a new fuel source will be possible with a moderate level of renovations, but installing photovoltaics will require major renovations.* *Adapting the building to a new fuel source or installing photovoltaics will require only minor adjustments to architectural, HVAC or electrical systems.*
E5.6	*Retention of as-built documentation*	*text*	*0:*	*A full set of systems manuals and complete as-built drawings will be been*

				provided. There will be a partial recording, reporting and documentation protocol for maintenance, but somewhat inconsistent with the size and complexity of the building.
			5:	*A full set of operations and maintenance documentation, including a full set of systems manuals, complete as-built drawings and an operations and maintenance guide will be provided in both hard-copy and electronic forms.*

F- SOCIAL CULTURAL AND PERCEPTUAL ASPECTS				
CRITERION	**INDICATOR**	**UNIT**	**BENCHMARK**	**DERIVATIONS**
F1.1	*Ease of access and use of facilities for persons with mobility or perceptual disabilities.*	*text*	*0:*	*All key facilities, including outdoor facilities, entry points and hallways, are accessible to wheelchair users and visually impaired persons*
			5:	*All key facilities, including outdoor facilities, entry points and hallways, are accessible to wheelchair users and visually impaired persons.*

G- COST AND ECONOMIC ASPECTS				
CRITERION	**INDICATOR**	**UNIT**	**BENCHMARK**	**DERIVATIONS**
G1.4	*Annual energy cost per usable floor area **	*€/m2*	*0: 18.9*	*From benchmarking of B1.2 and B1.3, taking an average fuel and electricity cost. (taking +20% of total for taking into account energy cost for equipment and other installations)*
			5: 4.7	
G1.5	*Annual water cost per usable floor area **	*€/m2*	*0: 0.59*	*From benchmarking of B4.5, taking into account 10 occupants/100m2 and an average of water cost.*
			5: 0.15	

SBTool Criteria Specifications

A- SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
A1.13	Existence and usability of bicycle and pedestrian paths around the	*Information source*	*Qualitative indicator - Estimations*

	building	*Assessment method*	*CESBAMED calculation steps* Estimate the existence and usability of bicycle and pedestrian paths around the building *NOA pilot steps/comments:* From area plots and from the on-site audit, three of the building's facades are facing "shared paths", connected to a larger network of "shared areas"
		Standard	
A3.12	Existence and effectiveness of public/municipal transportation near the building	*Information source*	*Qualitative indicator – Estimations – Metered data*
		Assessment method	*CESBAMED calculation steps* Estimate the existence and effectiveness of public/municipal transportation within 400m from the building *NOA pilot steps/comments:* *From metered data. From a study carried out by the Municipality for the public transport, the number and location of public transport stops was defined. (1 stop of a certain transportation line within 400m)*
		Standard	
A3.13	*Ratio of exterior and interior parking spaces to the total usable area of non-residential occupancies (spaces/60 m2)*	*Information source*	*Metered data - Estimations*
		Assessment method	*CESBAMED calculation steps* *1. Calculate the total usable area of non-residential occupancies* *2. Calculate the total parking spaces (exterior and interior)* *3. Calculate the ratio of total parking spaces per 60m^2 total usable area* *NOA pilot steps/comments:* *From metered data.from bluilding plots, the usable area was defined. From the on-site audit the number of total parking spaces was defined. (0.73)*
		Standard	*ΦΕΚ 76/ΜΑΡΤΙΟΣ 2004* *Official Journal 76 / March 2004*
A3.16	*Efficiency and adequacy of the exterior lighting and the public lighting around the building*	*Information source*	*Qualitative indicator – Estimations – Metered data*
		Assessment method	*CESBAMED calculation steps* *Estimation of the efficiency and adequacy of the exterior lighting and the public lighting around the building* *NOA pilot steps/comments:*

			From the on-site audit the number and type of exterior and public lighting was defined. (Adequate exterior and public lighting around the building, with old lighting fixtures, no visual discomfort)
		Standard	

B- ENERGY AND RESOURCES CONSUMPTION			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
B1.1	*Primary energy demand **	*Information source*	*Metered data – Calculated data - Estimations*
		Assessment method	*CESBAMED calculation steps* *National calculation methods used to meet performance requirements or to complete Energy Performance Certificates (EPCs), aligned with the EN standards series, can be used. In-built lighting may not be specifically covered in all national or regional calculation methods. As a result, either the omission from the calculations, or a separate calculation method if used, shall be noted in the reporting. The reference unit is one square meter of useful internal floor area (Level(s) Part 3 – 1.3.1).* *NOA pilot steps/comments:* *From calculated data based on National calculation merthod for the energy performance of building and the issuing of Energy Performance Certificates (semi-steady, monthly method). From an energy study carried out for the Municipal Unit of Ano Liosia, data for primary energy consumption and heated area (external dimensions) for the public buildings within testing area were available, and also adapted for external to internal (CESBAMED) dimensions.(442.4 kWh/m^2)* ***Comment: Lighting is taken into account. Hot water is not taken into account for office buildings***
		Standard	*EN 15603 (Energy performance of buildings - Overall energy use and definition of energy ratings)* *EN ISO 13790 (Energy performance of buildings)* *EN 15193 (Energy performance of buildings — Energy requirements for lighting)*
B1.2	*Delivered thermal energy demand **	*Information source*	*Metered data – Calculated data - Estimations*
		Assessment	*CESBAMED calculation steps*

		method	*Energy uses taken into account: heating, cooling, ventilation, domestic hot water* *National calculation methods used to meet performance requirements or to complete Energy Performance Certificates (EPCs), aligned with the EN standards series, can be used. The reference unit is one square meter of useful internal floor area (Level(s) Part 3 – 1.3.1).* *In case of existing buildings, the delivered thermal energy should be evaluated using data from metering.* *The metered delivered thermal energy demand (i.e. fuel consumption data) has to be calculated taking the average value over 3 years period.* *NOA pilot steps/comments:* *From calculated data based on National calculation merthod for the energy performance of building and the issuing of Energy Performance Certificates (semi-steady, monthly method). From an energy study carried out for the Municipal Unit of Ano Liosia, data for thermal energy consumption and heated area (external dimensions) for the public buildings within testing area were available, and also adapted for external to internal (CESBAMED) dimensions.(100.1 kWh/m^2)* ***Comment: Hot water is not taken into account for office buildings***
		Standard	*EN 15603 (Energy performance of buildings - Overall energy use and definition of energy ratings)* *EN ISO 13790 (Energy performance of buildings)* *EN 15193 (Energy performance of buildings — Energy requirements for lighting)*
B1.3	*Delivered electric energy demand* *	*Information source*	*Metered data – Calculated data - Estimations*
		Assessment method	*CESBAMED calculation steps* *National calculation methods used to meet performance requirements or to complete Energy Performance Certificates (EPCs), aligned with the EN standards series, can be used. The reference unit is one square meter of useful internal floor area (Level(s) Part 3 – 1.3.1).* *In case of existing buildings, the delivered electrical energy should be evaluated using data from metering. The metered delivered electric energy demand (i.e. electricity consumption data) has to be calculated taking the average value over 3 years period bills.*

			NOA pilot steps/comments: *From calculated data based on National calculation merthod for the energy performance of building and the issuing of Energy Performance Certificates (semi-steady, monthly method). From an energy study carried out for the Municipal Unit of Ano Liosia, data for electric energy consumption and heated area (external dimensions) for the public buildings within testing area were available, and also adapted for external to internal (CESBAMED) dimensions (114.6 kWh/m^2)* ***Comment: Lighting is taken into account. Hot water is not taken into account for office buildings***
		Standard	*EN 15603 (Energy performance of buildings - Overall energy use and definition of energy ratings)* *EN ISO 13790 (Energy performance of buildings)* *EN 15193 (Energy performance of buildings — Energy requirements for lighting)*
B1.5	*Energy from renewable sources in total thermal energy consumption ****	*Information source*	*Metered data – Calculated data - Estimations*
		Assessment method	*CESBAMED calculation steps* *Share of renewable energy in final thermal energy consumption of the building. In case of existing buildings, it should be evaluated by energy metering* *NOA pilot steps/comments:* *From an on site audit there were no renewable sources for thermal energy installed on the building (0%)*
		Standard	*Level(s) Part 1-2 – Beta version* *EN 15603 (Energy performance of buildings - Overall energy use and definition of energy ratings)* *2013/114/EU: Commission Decision of 1 March 2013.* *Directive 2009/28/EC (RES Directive)*
B1.6	*Energy from renewable sources in total electrical energy consumption **	*Information source*	*Metered data – Calculated data - Estimations*
		Assessment method	*CESBAMED calculation steps* *Share of renewable energy in final electric energy consumption. In case of existing buildings, it should be evaluated by energy metering* *NOA pilot steps/comments:* *From an on site audit there were no renewable sources for electric energy installed on the building (0%)*

		Standard	*Level(s) Part 1-2 – Beta version* *EN 15603 (Energy performance of buildings - Overall energy use and definition of energy ratings)* *2013/114/EU: Commission Decision of 1 March 2013.* *Directive 2009/28/EC (RES Directive)*
B1.8	*Final total energy for all building operations*	*Information source*	*Metered data – Calculated data - Estimations*
		Assessment method	*CESBAMED calculation steps* *During early design stages a screening tool may be used, but in later stages an hour-by-hour simulation program should be used* *NOA pilot steps/comments:* *From calculated data based on National calculation merthod for the energy performance of building and the issuing of Energy Performance Certificates (semi-steady, monthly method). From an energy study carried out for the Municipal Unit of Ano Liosia, data for final energy consumption and heated area (external dimensions) for the public buildings within testing area were available, and also adapted for external to internal (CESBAMED) dimensions (214.7 kWh/m^2)* ***Comment: Lighting is taken into account. Hot water is not taken into account for office buildings***
		Standard	*EN 15603 (Energy performance of buildings - Overall energy use and definition of energy ratings)* *EN ISO 13790 (Energy performance of buildings)* *EN 15193 (Energy performance of buildings — Energy requirements for lighting)*
B1.11	*Embodied energy (Not for Use phase) **	*Information source*	*Calculated data - Estimations*
		Assessment method	*CESBAMED calculation steps* *The following steps should be followed in order to compile the BoM:* *- Compile the Bill of Quantities: A BoQ is compiled which comprises the building elements accounting for at least 99% of the mass of the building.* *- Identify the basic composition of each building element. A breakdown of its constituent materials has to be carried out. The mass of each constituent material has to be estimated;* *- Aggregation by material: The mass for each constituent material should thereafter be aggregated to obtain the total mass for each type of material.* *Once the BoM has been compiled, it is*

			possible to calculate the indicator associating to each constituent material the relative embodied primary non-renewable energy by multiplying the specific mass (i.e. kg) with its corresponding embodied energy coefficient (i.e. MJ/kg). The total value of embodied primary non-renewable energy is finally normalized by the gross area of the building *NOA pilot steps/comments:* ***Not for Use phase***
		Standard	*EN 15978 "Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method".* *ISO 14040/44* *EN 15804 (Sustainability of construction works. Environmental product declarations. Core rules for the product category of construction products)*
B2.1	*Electrical peak demand for building operations*	*Information source*	*Metered data – Calculated data - Estimations*
		Assessment method	*CESBAMED calculation steps* *Review of contract documentation and sample equipment specifications by an ouside electrical engineer.* *NOA pilot steps/comments:* *From an on site audit, the installed power of heating, cooling and lighting systmes was defined. For equipment, typical values for office, taken from National Guidelines. An increasement of about 15% to include other systmes (i.e. elevators, circulators, pumps). (434.7 W/m^2)* **COMMENT**: **Usefull area with internal dimensions is used.**
		Standard	
B3.5	*Recycled materials (Not for Use phase) **	*Information source*	*Calculated data - Estimations*
		Assessment method	*CESBAMED calculation steps* *- Compile the Bill of Quantities: A BoQ is compiled which comprises the building elements accounting for at least 99% of the mass of the building.* *- Identify the basic composition of each building element. A breakdown of its constituent materials has to elaborated. The mass of each constituent material has to be estimated;* *- Aggregation by material: the mass of all constituent material should thereafter be aggregated to obtain the total mass of*

			materials used in the building (A); *- Identify the recycled content of each constituent material (in mass);* *- Aggregation by material: the recycled mass of all constituent materials should thereafter be aggregated to obtain the total recycled mass of materials (B) used in the building;* *- The indicator's value is calculated as B/A (total mass of recycled materials on the total mass of materials).* *NOA pilot steps/comments:* ***Not for Use phase***
		Standard	*EN ISO 14021 (Environmental labels and declarations - Self-declared environmental claims - Type II environmental labelling)*
B4.5	*Water consumption for indoor uses **	*Information source*	*Metered data – Estimations*
		Assessment method	*CESBAMED calculation steps* *Includes the use of potable water for: drinking water; water for sanitation; water for cleaning; water for washing machine; water for dishwasher; domestic hot water. The user must include in the calculation the sanitary devices/fittings (i.e. toilets, taps and showers) and water using appliances (i.e dishwashers and washing machines). Consumption rates for different sanitary devices and fittings are determined through specific data from suppliers. The specific usage factors have to be established. The number of days that the building is expected to be occupied per year has to be defined by the user. See KPIs Card document for the principle of the per occupant potable water consumption calculation.* *In case of existing buildings, the potable area water consumptions should be evaluated using data from metering. The metered consumptions have to be estimated taking the average value over 3 years period bills.* *NOA pilot steps/comments:* *Metered data not available for the public buildings of the Municipality. From the corresponding department of the Municipality, the annual water consumption was not officially reported, but estimated. From an energy study carried out for the Municipal Unit of Ano Liosia, the number of employyes was defined. The ratio of annual total water consumption to the number of employees was calculated (6 m^3/person)*

		Standard	*Level(s) Part 1-2 – Beta version. EN 15978 (Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method)*

C- ENVIRONMENTAL LOADINGS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
		Information source	*Metered data – Calculated data - Estimations*
C1.3	*Greenhouse Gas Emissions from building's operations **	*Assessment method*	*CESBAMED calculation steps* *1. For each building in the area calculate the emissions of CO2 eq. with the following formula:* $E = [\sum (Q_{fuel,i} \times LHV_i \times k_{em,i}) + (Q_{el} \times k_{em,el}) + (Q_{dh} \times k_{em,dh})]$ *Qfuel,I = annual quantity of i-th fuel (m3 or Kg)* *Qel = annual quantity of electric energy from the grid (kWh)* *Qdh = annual quantity of energy from district heating/cooling (kWh)* *LHVi = lower heating value of the i-th fuel (kWh/m3 or kWh/Kg)* *Kem,i = CO2 eq. emission factor of the i-th fuel (Kg CO2/kWh)* *Kem,i = CO2 eq. emission factor of the electric energy from the grid (Kg CO2/kWh)* *Kem,i = CO2 eq. emission factor of energy from district heating/cooling (Kg CO2/kWh)* *2. Calculate the aggregated annual total CO2 equivalent emissions from all buildings / total useful internal floor area of all buildings* *NOA pilot steps/comments:* *From calculated data based on National calculation merthod for the energy performance of building and the issuing of Energy Performance Certificates (semi-steady, monthly method). From an energy study carried out for the Municipal Unit of Ano Liosia using the national method, data for thermal and electrical energy consumption and heated area (external dimensions) for the public buildings within testing area were available, and also adapted for external to internal (CESBAMED) dimensions. Using the national conversion factors to COeq (20704.1 kg/GWh for fuel oil and 61123.9 kg/GWh for electricity), total CO2 equivalent emissions to total useful internal floor area*

			of the building (9.1 kg/m^2)
		Standard	*EN 15603 (Energy performance of buildings - Overall energy use and definition of energy ratings).* *Level(s) Part 1-2 – Beta version*
C3.1	*Construction and demolition waste (Not for Use phase) **	*Information source*	*Metered data –Estimations*
		Assessment method	*CESBAMED calculation steps* *<u>Design stage (based on estimations)</u>* *Estimations of waste based on surveys of existing buildings that will undergo major renovation or where the structure will be reused (life cycle stage B5).* *Estimations based on scenarios for deconstruction and demolition of the building at a future point in time beyond the end of its service life (life cycle stages C1/3, D).* *<u>Construction stage (based on data recorded from the site)</u>* *Data from deconstruction and demolition of (a) building(s) in order to clear a site for a new building construction (as part of a previous life cycle).* *Data from the part deconstruction of (a) building(s) in order to prepare useful parts for in-situ reuse. Data from construction on site of a new building and/or the prefabrication/construction of parts and elements off site (life cycle stages A3/5).* *Data from preparation of a building in order to facilitate a major renovation.* *<u>Completion stage (based on estimations supported by as-built drawings)</u>* *Estimations based on scenarios for deconstruction and demolition of the building at a future point in time beyond the end of its service life (life cycle stages C1/3, D).* *NOA pilot steps/comments:* ***Not for Use phase***
		Standard	*Level(s) Part 1-2 – Beta version*
C3.2	*Ratio of the number of collectable solid waste categories within a 100 m distance from the building's entrance to the reference solid waste categories **	*Information source*	*Metered data – Calculated data - Estimations*
		Assessment method	*CESBAMED calculation steps* *The seven reference categories of solid waste are: Paper, Plastic, Metal, Glass, Wet waste, Textiles, Special hazardous waste.*

			1. Identify the availability and position of bins and containers for each of the seven solid waste categories. *2. Calculate the walking distance (m) from the building's main entrance to each identified bin or container.* *3. Evaluate how many of the 7 categories of solid waste is possible to collect within a 100 m walking distance from the building's entrance (A).* *4. Calculate the value of the indicator as : A/7* *NOA pilot steps/comments:* *From calculated data. From an on-site audit in the testing area, the number and the type of collectable solid waste categories within a 100 m distance was defined. In this case there were single bins used to collect different types of waste that will be later separated at the waste facility. (57%)*
		Standard	

D- INDOOR ENVIRONMENTAL QUALITY			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
		Information source	*Metered data*
D1.4	*TVOC concentration in indoor air (Not for Use phase) **	*Assessment method*	*CESBAMED calculation steps* *<u>Post completion phase</u>* *Testing shall be carried out for a minimum of 10% of the apartments and be representative of any significant variations in the house or apartment typologies, configurations and materials. Samples shall be taken in the living room and the smallest bedroom of each property* *NOA pilot steps/comments:* ***Not for Use phase*** ***COMMENT: TVOC concentrations have been in the past used as an indicator of the ability of combined VOC exposures to produce adverse health effects. This approach is no longer supported (e.g. ASHRAE), because the irritant potential and toxicity of individual VOCs vary widely, and measured concentrations are highly dependent on the sampling and analytical methods used. The available data do not allow establishing of thresholds for TVOC (ECA-IAQ***

			European Collaborative Action, JRC)
		Standard	*CEN/TS 16516 (Construction products - Assessment of release of dangerous substances - Determination of emissions into indoor air).* *EN 15251 (Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics).* *Level(s) Part 1-2 – Beta version*
D1.10	*Ventilation rate **	*Information source*	*Metered data – Calculated data*
		Assessment method	*CESBAMED calculation steps* *<u>ONLY for ventilated buildings</u>* *The ventilation rate (l/s/m2) must be calculated in all the main rooms, excluding circulation spaces and service rooms (i.e. toilets).* *The indicator must be calculated as weighted sum all the calculated ventilation rates.* *NOA pilot steps/comments:* *Building not mechanically ventilated.*
		Standard	*EN 16798-7 (Energy performance of buildings - Ventilation for buildings - Part 7: Calculation methods for the determination of air flow rates in buildings including infiltration)*
D2.2	*Predicted Percentage Dissatisfied (PPD) **	*Information source*	*Metered data – Calculated data - Estimations*
		Assessment method	*CESBAMED calculation steps* *<u>Design stage (mechanically conditioned)</u>* *For all main occupied room:* *1. Estimate PMV* *2. Calculate PPD* *NOA pilot steps/comments:* *From short ohn site occupant survey.* *From on site audit there were some spaces with no heating system and there was difficulty in controlling internal conditions and natural ventilation. (18%)*
		Standard	*EN ISO 7730 – Ergonomics of the thermal environment – Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria.* *EN 16798-1:2017 - Energy performance of buildings - Part 1: Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal*

			environment, lighting and acoustics - Module M1-6 (revision of EN 15251). Brussels: European Committee for Standardization. Level(s) Part 1-2 – Beta version. Brussels: European Commission

E- SERVICE QUALITY			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
E1.2	*Risk to occupants and facilities from fire*	*Information source*	*Metered data*
		Assessment method	*CESBAMED calculation steps* *Estimate the level of compliance with the requirements for fire protection as well as of the occupnats training* *NOA pilot steps/comments:* *From and on site audit and information from the corresponding department. (The building fulfils the requirements for fire protection. Basic training of the occupants)*
		Standard	*Insert text here*
E1.3	*Risk to occupants and facilities from flooding*	*Information source*	*Metered data*
		Assessment method	*CESBAMED calculation steps* *Estimate the area's flooding risk as well as the building equipment.* *NOA pilot steps/comments:* *From an on site audit and information from the corresponding department. (*Area often facing floodings, building properly equipped)
		Standard	
E1.4	*Risk to occupants and facilities from earthquake*	*Information source*	*Metered data*
		Assessment method	*CESBAMED calculation steps* *Evaluate the building's anti-earthquaqe protection.* *NOA pilot steps/comments:* *From an on site audit and information from the corresponding department. (Building has passed successfully, a pre-erthquaqe inspection. Basic training of the occupants)*
		Standard	

E2.5	*Elevators*	*Information source*	*Metered data*
		Assessment method	*CESBAMED calculation steps* *Assess the service quality and functional efficiency of elevators within a building, as well as their compliance with the existing regulations.* *NOA pilot steps/comments:* *From an on site audit and information from the corresponding department. (The elevator is certified, but it is too small)*
		Standard	
E3.1	*Building Management System (BMS)*	*Information source*	*Metered data*
		Assessment method	*CESBAMED calculation steps* *Visual inspection and review of specifications.* *NOA pilot steps/comments:* *From an on site audit and information from the corresponding department. (The building has no BMS)*
		Standard	
E3.2	*Building Energy Management System (BEMS)*	*Information source*	*Metered data*
		Assessment method	*CESBAMED calculation steps* *Visual inspection and review of specifications.* *NOA pilot steps/comments:* *From an on site audit and information from the corresponding department. (Building is equipped with a compensation system)*
		Standard	
E3.3	*Control of lighting systems*	*Information source*	*Metered data*
		Assessment method	*CESBAMED calculation steps* *Visual inspection and review of specifications for lighting control zones, control types and locations* *NOA pilot steps/comments:* *From an on site audit and information from the corresponding department. (The building has no lighting control system)*
		Standard	

		Information source	*Metered data*
E3.4	*Local control of heating/cooling systems*	*Assessment method*	*CESBAMED calculation steps* *Type of mechanical and electrical equipment accessible by occupants, and the extent to which local systems can be operated and modulated by occupants.* *NOA pilot steps/comments:* *From an on site audit and information from the corresponding department.* *(Thermostatic control of terminal units)*
		Standard	
		Information source	*Estimations*
E4.5	*Adaptability to future changes in type of energy supply*	*Assessment method*	*CESBAMED calculation steps* *Evaluate the ease or difficulty in installing heating or cooling equipment that require a different fuel, or to install photovoltaic systems.* *NOA pilot steps/comments:* *From an on site audit and information from the corresponding department. (Adapting the building to a new fuel source or installing photovoltaics will require only a minor level of renovations).*
		Standard	
		Information source	*Metered data*
E5.6	*Retention of as-built documentation*	*Assessment method*	*CESBAMED calculation steps* *Evaluate the availability of architectural, mechanical and electrical drawings, and equipment manuals.* *NOA pilot steps/comments:* *From an on site audit and information from the corresponding department.* (*Building drawing, operation and maintenance manuals exist but are deficient)*
		Standard	

F- SOCIAL CULTURAL AND PERCEPTUAL ASPECTS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
F1.1	*Universal access on site and within the building*	*Information source*	*Metered data*

		Assessment method	*CESBAMED calculation steps* *Assess the ease of access and use of facilities for persons with mobility or perceptual disabilities.* *NOA pilot steps/comments:* *From an on site audit. (Outdoor facilities, entry points and ground-floor hallways, are accessible to wheelchair users and visually impaired persons)*
		Standard	

G- COST AND ECONOMIC ASPECTS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
G1.4	*Energy annual cost per usable floor area **	*Information source*	*Metered data – Estimations*
		Assessment method	*CESBAMED calculation steps* *In case of existing buildings, the total annual cost of actual thermal and electrical energy use from energy bills should be calculated taking the average energy cost over 3 years period.* *NOA pilot steps/comments:* *Metered data not available for the public buildings of the Municipality. From the corresponding department of the Municipality, the annual water consumption was not officially reported, but estimated. From the architectural plans, the total internal surface of the building was defined. (23.8 €/m^2)* **COMMENT**: **All uses are taken into account, including equipment and installations (unlike energy related indicators). Usefull area with internal dimensions is used.**
		Standard	*Level(s) Part 1-2 – Beta version*
G1.5	*Water annual cost per usable floor area **	*Information source*	*Metered data – Estimations*
		Assessment method	*CESBAMED calculation steps* *In case of existing buildings, the total annual cost of water use from water bills should be calculated taking the average water cost over 3 years period.* *NOA pilot steps/comments:*

	(0.37 €/m²) **COMMENT: Gross area with internal dimensions is used.**
Standard	*Level(s) Part 1-2 – Beta version*

REGIONAL TOOL

D.3.4.3 Regional Tool - EIHP

Version 1.1

Date: March 2019

2.1: To raise capacity for better management of energy in public buildings at transnational level
Work package: WP3 TESTING
Activity: 3.4 Evaluation of test results
Deliverable: 3.4.3 – Regional CESBA MED SNTs

Responsible Partner: Andrea Moro, iiSBE Italia R&D

BUILDING SCALE ASSESSMENT

SBTool structure

A – SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	
A1	**Site regeneration and development**
A1.7	Use of vegetation to provide ambient outdoor cooling
A1.10	*Provision and quality of children's play area(s)*
A3	*Project Infrastructure and Services*
A3.13	*Provision of on-site parking facilities for private vehicles*

B – ENERGY AND RESOURCES CONSUMPTION	
B1	**Total life cycle non-renewable energy**
B1.1	*Primary energy demand*
B1.2	*Delivered thermal energy demand*
B1.3	*Delivered electric energy demand*
B1.4	*Energy from renewable sources in total primary energy consumption*
B1.5	*Energy from renewable in total thermal energy consumption*
B1.6	*Energy from renewable sources in total electric energy consumption*
B1.11	*Embodied non-renewable primary energy*
B2	***Electrical peak demand***
B2.1	*Electrical peak demand for building operations.*
B3	***Use of material***
B3.5	*Recycled materials – only in construction phase*
B4	***Use of potable water, stormwater and greywater***
B4.5	Potable water consumption for indoor uses.

C- ENVIRONMENTAL LOADINGS	
C1	**Greenhouse gas emissions**
C1.3	*Global Warming Potential*
C3	***Solid and liquid waste***
C3.1	*Construction and demolition waste – not active for this phase*
C3.2	*Solid waste from building operations*

D- INDOOR ENVIRONMENTAL QUALITY	
D1	**Indoor air quality and ventilation**
D1.4	*TVOC concentration in indoor air – unable to measure*
D1.5	*CO_2 concentration in indoor air*
D1.10	*Ventilation rate – only for mechanical ventilation*
D2	***Air Temperature and Relative humidity***
D2.1	*Time outside of the thermal comfort range*
D2.2	*Thermal comfort index*

E- SERVICE QUALITY	
E3	**Controllability**
E.3.4	*Degree of personal control of technical systems by occupants.*
E4	***Flexibility and Adaptability***
E.4.5.	*Adaptability to future changes in type of energy supply*

F- SOCIAL, CULTURAL AND PERCEPTUAL ASPECTS	
F1	**Social Aspects**
F1.2	Access to direct sunlight from living areas of dwelling units.
F2	**Culture and Heritage**
F2.4	Use of traditional local materials and techniques

G- COST AND ECONOMIC ASPECTS	
G1	**Cost and economics**
G1.4	*Use stage energy cost*
G1.5	*Use stage water cost*

SBTool criteria selection rationale

A - SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE	
CRITERION	**REASON/MOTIVATION**
A1. - Site regeneration and development	
A1.7. - Use of vegetation to provide ambient outdoor cooling	To increase use of green zones (parks) for children playgrounds and green roofs.
A1.10. - *Provision and quality of children's play area(s)*	Have all places on one location to motivate children to play
A3. - *Project Infrastructure and Services*	
A3.13. - *Provision of on-site parking facilities for private vehicles*	Availability of parking spaces to avoid morning and afterwork crowds when parents come to their children

B – ENERGY AND RESOURCES CONSUMPTION	
CRITERION	**REASON/MOTIVATION**
B.1.1 Primary energy demand	Use of ecological fuel
B.1.2 Delivered thermal energy demand	To improve well-being of occupants and reduce consumption and emission
B.1.3 Delivered electric energy demand	To reduce consumption and emission
B.1.4 Energy from renewable sources in total primary energy consumption	To encourage use of renewable energy sources
B.1.5 Energy from renewable in total thermal energy consumption	To encourage use of renewable energy sources
B.1.6 Energy from renewable sources in total	To encourage use of renewable energy

electric energy consumption	sources
B1.11 *Embodied non-renewable primary energy*	To lower consumption of energy in planning / construction phase with different material use.
B2.1. *Electrical peak demand for building operations.*	To ensure availability and safety of power grid on location, and ensure batter planning of power grid
B3.5 *Recycled materials – only in construction phase*	To ensure lower resources consumption during construction and decommissioning phase, and to increase use of recyclable resources
B.4.5 Potable water consumption for indoor uses.	

C- ENVIRONMENTAL LOADINGS	
CRITERION	**REASON/MOTIVATION**
C1.3 Global Warming Potential	*Lower GWP to reduce local and global pollution*
C3.1 Construction and demolition waste – not active for this phase	
C3.2 *Solid waste from building operations*	*Increase awareness of necessity of waste separation*

D- INDOOR ENVIRONMENTAL QUALITY	
CRITERION	**REASON/MOTIVATION**
D1.4 TVOC concentration in indoor air – unable to measure	*To ensue healthy space before space is used for primary purpose*
D1.5 *CO_2 concentration in indoor air*	*To ensure normal level of carbon dioxide during use phase*
D1.10 *Ventilation rate – only for mechanical ventilation*	*To ensure enough fresh air from mechanical ventilation during occupancy*
D2.1 Time outside of the thermal comfort range	*Increase high level of comfort in building during both winter and summer period*
D2.2 *Thermal comfort index*	*Measure comfort inside space*

E- SERVICE QUALITY	
CRITERION	**REASON/MOTIVATION**
E3.4 *Degree of personal control of technical systems by occupants*	*To motivate installation of controllable systems that can be adjusted by occupant need*
E4.5 *Adaptability to future changes in type of energy supply*	Motivate planers to plan building that can easily run on multiple energy sources

F- SOCIAL, CULTURAL AND PERCEPTUAL ASPECTS	
CRITERION	**REASON/MOTIVATION**
F1.2 Access to direct sunlight from living areas of dwelling units	*Lowering consumption for lighting, increase daily lighting in building. Motivate planers to optimize orientation of building and shades.*
F2.4 Use of traditional local materials and techniques	Motivate to use local materials and manufacturers in renovation/construction phase

F- SOCIAL, CULTURAL AND PERCEPTUAL ASPECTS	
CRITERION	**REASON/MOTIVATION**
F1.2 Access to direct sunlight from living areas of dwelling units	*Lowering consumption for lighting, increase daily lighting in building. Motivate planers to optimize orientation of building and shades.*
F2.4 Use of traditional local materials and techniques	Motivate to use local materials and manufacturers in renovation/construction phase

G- COST AND ECONOMIC ASPECTS	
CRITERION	**REASON/MOTIVATION**
G.1.4 Use stage energy cost	Lowering energy cost during operation phase is best way to motivate owner
G.1.5 Use stage water cost	Lowering water cost during operation phase is best way to motivate owner

SBTool weights rationale

ISSUE	WEIGHT (1 to 5)	MOTIVATION
Cost and economics	3	Although this should be main driver in most scenarios, this weight is set because of more important issue on global scale
Functionality and serviceability	2	Since main motivation of building is it functionality weight to this issue should be lower
Well-being and productivity of occupants	4	Ensure healthy space for all occupant and prevent health issue
Social and cultural issues	2	Preserve cultural heritage and improve social component
Land resources	3	Improve land use, better planning
Non-renewable material resources	3	Reduce local production of cement
Non-renewable water resources	3	Increase reusing water
Health, safety and security of individuals	3	-
Renewable energy resources	4	Increase use of renewable energy sources mainly
Non-renewable energy resources	2	Decrease use of non-renewable resources
Ecosystem(s)	3	Preserve local ecosystem
Local and regional atmosphere	2	Preserve local atmosphere and reduce air pollution from local pollutants
Global climate	5	Improving global climate should be main goal

CATEGORIES	WEIGHT (%)
A1- Site regeneration and Development	6,17
A2- Urban design	-
A3- Project Infrastructure and Services	1,45
TOTAL	7,62
B1- In use energy consumptions	40,34
B2- Embodied energy	-
B3- Use of materials	4,36
B4 – Use of water, stormwater and greywater	6,53
TOTAL	51,23
C1- Greenhouse gas emissions	15,13
C2- Other atmospheric emissions	-
C3- Solid and liquid waste	4,36
C4- Impact on project site	-
C5- Other local and regional impacts	-
TOTAL	19,48
D1- Indoor air quality and ventilation	3,63
D2- Thermal comfort	4,36
D3– Visual comfort	-
D4– Acoustic comfort	-
TOTAL	7,99
E1- Safety and Security	-
E2- Functionality and efficiency	-

E3- Controllability	2,42
E4– Flexibility and adaptability	-
E5- Optimization and maintenance of operating performance	0,73
TOTAL	3,15
F1- Social aspects	2,18
F2- Culture and heritage	2,90
F3- Perceptual	-
TOTAL	5,08
G1- Cost and economics	5,45
TOTAL	5,45

CRITERIA WEIGHTS

SBTool file A – WeightA-G

A- SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE							
A1- Site regeneration and Development							
CRITERION	**Weight (%)**	**A**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
A1.7	*3,46*	*2*	3	*2*	*4*	*3*	
A1.10	*3,90*	*3*	3	*2*	*3*	*3*	
A3 - Project Infrastructure and Services							
A.3.13	*1,73*	*3*	2	*2*	*2*	*3*	
TOTAL	6,17						

B- ENERGY AND RESOURCES CONSUMPTION							
B1- In use energy consumptions							
CRITERION	**Weight (%)**	**A**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
B1.1	*4,03*	*2*	*5*	*5*	*2*	*2*	Too much impacts on final decision
B1.2	*4,03*	*2*	*5*	*5*	*2*	*2*	Too much impacts on final decision
B1.3	*4,03*	*2*	*5*	*5*	*2*	*2*	Too much impacts on final decision
B1.4	*8,07*	*2*	*5*	*5*	*2*	*2*	Too much impacts on final decision
B1.5	*8,07*	*2*	*5*	*5*	*2*	*2*	Too much impacts on final decision
B1.6	*8,07*	*2*	*5*	*5*	*2*	*2*	Too much impacts on final decision
B1.11	*4,03*	*2*	*5*	*5*	*2*	*2*	Too much impacts on final decision
B3 - Use of materials							
B3.5	*4,36*	*4*	*3*	*2*	*3*	*3*	
B4 - Use of water, stormwater and greywater							
B4.5	*6,53*	*4*	*3*	*3*	*3*	*3*	
TOTAL	51,23						

C- ENVIRONMENTAL LOADINGS							
C1- Greenhouse gas emissions							
CRITERION	**Weight (%)**	**A**	**B**	**C**	**D**	**L.F.**	**L.F. REASON/MOTIVATION**
C1.3	*15,13*	5	5	*3*	*5*	*2*	Too much impacts on final decision
C3 - Solid and liquid waste							
C.3.2.	*4,36*	*4*	*3*	*2*	*3*	*3*	
TOTAL	19,48						

D- INDOOR ENVIRONMENTAL QUALITY

D1- Indoor air quality and ventilation

CRITERION	Weight (%)	A	B	C	D	L.F.	L.F. REASON/MOTIVATION
D1.4	*0,73*	*1*	1	*3*	*4*	*3*	
D1.5	*2,18*	*1*	*3*	*3*	*4*	*3*	
D1.10.	*0,73*	*1*	*3*	*3*	*2*	*3*	
D1- Indoor air quality and ventilation							
D2.1	*2,18*	*1*	*3*	*3*	*4*	*3*	
D2.2	*2,18*	*1*	*3*	*3*	*4*	*3*	
TOTAL							

E- SERVICE QUALITY

E3- Controllability

CRITERION	Weight (%)	A	B	C	D	L.F.	L.F. REASON/MOTIVATION
E3.4	*2,42*	1	*2*	*3*	*4*	*5*	Motivation to increase controllability of systems and comfort of occupant.

E4- Flexibility and adaptability

E4.5	*0,73*	*1*	*2*	*3*	*2*	*3*	
TOTAL	3,15						

F- SOCIAL CULTURAL AND PERCEPTUAL ASPECTS

F1- Social aspects

CRITERION	Weight (%)	A	B	C	D	L.F.	L.F. REASON/MOTIVATION
F1.2	*2,18*	*1*	3	*3*	*4*	*3*	
F2 - Culture and Heritage							
F2.4	*2,90*	*3*	*2*	*2*	*3*	*4*	*Support local and circular economy*
TOTAL	**5,08**						

G- COST AND ECONOMIC ASPECTS

G1 - Cost and Economic Aspects

CRITERION	Weight (%)	A	B	C	D	L.F.	L.F. REASON/MOTIVATION
G1.4	*3,27*	2	3	*3*	*3*	*3*	
G1.5	*2,18*	*2*	*3*	2	*3*	*3*	
TOTAL	5,45						

SBTool benchmarks rationale

A- SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
A1 - Site Regeneration and Development				
A1.7.	*Use of vegetation to provide ambient outdoor cooling.*	%	*0: 40%*	*Value taken from urban plan decreased by access roads and parking spaces*
			5: 95%	*Max value if all surfaces are under vegetation*
A1.10	Provision and quality of children's play area(s).	-	*0: description*	*Personal assessment*
			5: description	*Personal assessment*
A3 - Project Infrastructure and Services				
A3.13	*Provision of on-site parking facilities for private vehicles.*	Spaces/classrooms	*0: 1*	*Value taken from urban plan*
			5: 0,50	*Double then minimal requirements*

B- ENERGY AND RESOURCES CONSUMPTION				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
B1 - Total Life Cycle Non-Renewable Energy				
B1.1	*Primary energy demand*	kWh/m²a	*0: 90*	*Standard value for this region*
			5: 55	Value to achieve NZEB standard in Croatia
B1.2	Delivered thermal energy demand	kWh/m²a	*0: 50*	*Standard value for this region*
			5: 10	Value to achieve NZEB standard in Croatia
B1.3	*Delivered electrical energy demand*	kWh/m²a	*0: 30*	*Standard value for this region*
			5: 0	*Entire production of electrical energy comes from RES (photovoltaics)*
B1.4	Energy from renewable sources in total primary energy consumption.	%	*0: 20*	Minimal value to for new buildings
			5: 90	Nearly zero energy house, passive house
B1.5	*Energy from renewable sources in total thermal energy consumption.*	%	*0: 20*	Minimal value to for new buildings – not in standards
			5: 90	Nearly zero energy house, passive house
B1.6	Energy from renewable sources in total electrical energy consumption.	%	*0: 5*	Minimal value to for new buildings – not in standards
			5: 90	Nearly zero energy house, passive house
B1.11	*Embodied non-renewable primary energy*	GJ/m²	*0: 14*	Standard value for existing building typology
			5: 3	Value for new passive buildings
B3 - Use of Materials				
B3.5	Recycled materials	%	*0: 5*	*Same as in tool. Unable to find relevant percentage for Croatia*
			5: 40	*Same as in tool. Unable to find relevant percentage for Croatia*
B4 - Use of potable water, stormwater and greywater				
B4.5	*Potable water consumption for indoor uses.*	m³/occupant/a	*0: 5,5*	*Average consumption of water in schools*
			5: 2	

C- ENVIRONMENTAL LOADINGS				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
C1 - Greenhouse Gas Emissions				
C1.3	*Global Warming Potential*	kg CO_2 eq/m²/a	*0: 40*	*Average CO_2 emission for this region.*
			5: 5	*Average for passive houses*
C3 - Solid and Liquid Wastes				
C3.2	Solid waste from building operations.	%	*0: 28*	*Don't know what is final KPI, the one from "Testing protocol" or the one from last excel file. As result took the one from "Testing protocol" since it was already calculated.*
			5: 100	

D- INDOOR ENVIRONMENTAL QUALITY				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
D1 - Indoor Air Quality and Ventilation				
D1.4	*TVOC concentration in indoor air.*	µg / m³	*0: 300*	*Guidelines*
			5: 0	*Best practice without TVOC*
D1.5	CO_2 concentrations in indoor air.	ppm	*0: 700*	*Allowed concentration of CO_2 in space*
			5: 350	*Outdoor concentration of CO_2*
D1.10	*Ventilation rate.*	l/s/m²	*0: 2,77*	*Required by algorithm for mechanical ventilation*
			5: 6,00	*High level of air quality*
D2 - Air Temperature and Relative Humidity				
D2.1	Time outside of the thermal comfort range	%	*0: 30*	*Keep the same value as in tool*
			5: 10	*Keep the same value as in tool*
D2.2	*Thermal comfort index*	%	*0: 25*	*Keep the same value as in tool*
			5: 5	*Keep the same value as in tool*

E- SERVICE QUALITY				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
E3 - Controllability				
E3.4	*Degree of personal control of technical systems by occupants.*		*0: description*	*Assessment based on location status*
			5: description	*Assessment based on location status*
E4 - Flexibility and Adaptability				
E4.5	Adaptability to future changes in type of energy supply		*0: description*	*Assessment based on location status*
			5: description	*Assessment based on location status*

F- SOCIAL CULTURAL AND PERCEPTUAL ASPECTS				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
F1 - Social Aspects				
F1.2	*Access to direct sunlight from living areas of dwelling units.*	%	*0: 60*	*Guidelines for school designed*
			5: 90	*Optimal design of classroom*
F2 - Culture and Heritage				
F2.4	Use of traditional local materials and techniques	%	*0: 10*	*Keep the same value as in tool*
			5: 25	*Keep the same value as in tool*

G- COST AND ECONOMIC ASPECTS				
CRITERION	INDICATOR	UNIT OF MEASURE	BENCHMARK	DERIVATIONS
G1 - Cost and Economics				
G1.4	*Use stage energy cost.*	€ / m²	*0: 7,50*	*Average cost on location*
			5: 1,50	*Average cost for NZEB buildings*
G1.5	Use stage water cost.	€ / m²	*0: 0,50*	*Average cost of elementary schools*
			5: 0,20	*Lowest cost of elementary schools*

SBTool Criteria Specifications

A- SITE REGENERATION AND DEVELOPMENT, URBAN DESIGN AND INFRASTRUCTURE			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
A1.7.	*Use of vegetation to provide ambient outdoor cooling.*	*Information source*	*Satellite images of country (http://preglednik.arkod.hr/ARKOD-Web/)* solin.hr/detaljni_plan/UPU%20NASELJE%20MRAVINCE%202-NOVI.zip
		Assessment method	*Measure on image green area of land plot and divide it with total area of land plot*
		Standard	
A1.10.	Provision and quality of children's play area(s).	*Information source*	*Satellite images of country (http://preglednik.arkod.hr/ARKOD-Web/)*
		Assessment method	*Asses by description*
		Standard	*Assessments with description*
A3.13	*Provision of on-site parking facilities for private vehicles.*	*Information source*	*Urban plan of settlement solin.hr/detaljni_plan/UPU%20NASELJE%20MRAVINCE%202-NOVI.zip*
		Assessment method	*Total number of classrooms divided by total amount of parking spaces*
		Standard	

B- ENERGY AND RESOURCES CONSUMPTION			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
B1.1	*Primary energy demand*	*Information source*	*Measured data of energy consumption on site or calculations*
		Assessment method	*Energy consumption for energy sources multiplied by primary energy factor*
		Standard	*Algorithm for calculation of energy demand or measured data*
B1.2	Delivered thermal energy demand	*Information source*	*Measured data of energy consumption on site or calculations*
		Assessment method	*Calculation of thermal energy demand or data measured on site*
		Standard	*Algorithm for calculation of energy demand or measured data*
B1.3	*Delivered electrical energy demand*	*Information source*	*Measured data on site, or in design phase by calculation*
		Assessment method	*Measured data on site, or by algorithm for lightning*
		Standard	*Measured data on site, or by algorithm for lightning*
B1.4	Energy from renewable sources in total primary energy consumption.	*Information source*	*Measured data of energy consumption on site or calculations* https://www.rehva.eu/ , https://mgipu.gov.hr/UserDocsImages//dokumenti/EnergetskaUcinkovitost/meteoroloski_podaci//Metodologija-2017.pdf
		Assessment method	*Energy consumption of each energy sources multiplied by renewable primary energy factor for each energy sources divided by energy consumption of each energy sources multiplied by total primary energy factor for each energy*
		Standard	
B1.5	*Energy from renewable sources in total thermal energy consumption.*	*Information source*	*Measured data of energy consumption on site or calculations* https://www.rehva.eu/, ,

			https://mgipu.gov.hr/UserDocsImages//dokumenti/EnergetskaUcinkovitost/meteoroloski_podaci//Metodologija-2017.pdf
		Assessment method	*Energy consumption of each energy sources for heating multiplied by renewable primary energy factor for each energy sources divided by energy consumption for heating of each energy sources multiplied by total primary energy factor for each energy source for heating*
		Standard	
B1.6	Energy from renewable sources in total electrical energy consumption.	*Information source*	*Measured data on location, or calculation*
		Assessment method	*Electrical energy produced on location divided by total electrical energy demand*
		Standard	*Energy performance of building*
B1.11	*Embodied non-renewable primary energy*	*Information source*	*BoQ, BoM*
		Assessment method	*Amount of material embedded in building multiplied by embodied factor for each material divided by floor area of building*
		Standard	*EN 15978 "Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method"*
B3.5	Recycled materials	*Information source*	*BoQ, BoM*
		Assessment method	*Total weight of reused materials divided by total weight materials*
		Standard	*EN ISO 14021*
B4.5	*Potable water consumption for indoor uses.*	*Information source*	*Measured data on location*

	Assessment method	*Total annually water used divided by occupants*
	Standard	*-*

C- ENVIRONMENTAL LOADINGS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
C1.3	*Global Warming Potential*	*Information source*	*Measured data on location, or calculation* https://mgipu.gov.hr/UserDocsImages/dokumenti/EnergetskaUcinkovitost/meteoroloski_podaci/FAKTORI_primarne_energije.pdf
		Assessment method	*Consumption of each energy source on location multiplied by CO_2 factor for each energy source*
		Standard	
C3.2	Solid waste from building operations.	*Information source*	*Tour around building*
		Assessment method	*Number of different can trash can / 7*
		Standard	*-*

D- INDOOR ENVIRONMENTAL QUALITY			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
D1.4	*TVOC concentration in indoor air.*	*Information source*	*Measurement on location after completion of building*
		Assessment method	*Measure with instrument on location after building completion*
		Standard	*EN 15251, https://www.epa.gov/indoor-air-quality-iaq/technical-overview-volatile-organic-compounds#measurement*
D1.5	CO_2 concentrations in indoor air.	*Information source*	*Measurement on location or calculated*
		Assessment method	*Measure with instrument on location periodically or calculate in design phase*
		Standard	*Measuring, ASHRE https://www.researchgate.net/publication/289566619_Examining_CO2_levels_in_school_classrooms*

D1.10	*Ventilation rate.*	*Information source*	*Measured with blower door test, algorithm, design https://mgipu.gov.hr/UserDocsImages/dokumenti/EnergetskaUcinkovitost/meteoroloski_podaci/Algoritam_HVAC_2017.pdf*
		Assessment method	*Assessment from Algorithm or from design of HVAC system. Air exchange (m^3/h) of HVAC system divided by total heated volume of building*
		Standard	
D2.1	Time outside of the thermal comfort range	*Information source*	*Calculation based on simplified hourly method.*
		Assessment method	*If demand for heating or cooling on each hour is higher than nominal power of heating or cooling system, then that hour is temperature outside thermal comfort range*
		Standard	*Simplified hourly method EN 13790*
D2.2	*Thermal comfort index*	*Information source*	*Models and simulations https://www.researchgate.net/publication/255971260_SPREADSHEETS_FOR_THE_CALCULATION_OF_THERMAL_COMFORT_INDICES_PMV_AND_PPD*
		Assessment method	*Measure temperature inside each space and calculate PPD, in winter and summer period*
		Standard	*ISO 7730 – Fanger"s method -*

E- SERVICE QUALITY			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
E3.4	*Degree of personal control of technical systems by occupants.*	*Information source*	*From main design or walkthrough audit*
		Assessment method	*Asses from description*
		Standard	*Assessment*
E4.5	Adaptability to future changes in type of energy supply	*Information source*	*From main design or walkthrough audit*
		Assessment method	*Asses from description*
		Standard	*Assessment*

F- SOCIAL CULTURAL AND PERCEPTUAL ASPECTS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
F1.2	*Access to direct sunlight from living areas of dwelling units.*	*Information source*	*Calculation*
		Assessment method	*Simple calculation of direct sunlight in each classroom. Also, should be applicable on schools.*
		Standard	*Review assessment of design team or do own calculation*
F2.4	Use of traditional local materials and techniques	*Information source*	*BoQ, BoM*
		Assessment method	*Architect estimation of percent building elements (non-structural) that has been constructed using traditional local materials. (we think structural should be also include in design phase)*
		Standard	*Estimation*

G- COST AND ECONOMIC ASPECTS			
CRITERION	**INDICATOR**	**SPECIFICATIONS**	
G1.4	*Use stage energy cost.*	*Information source*	*Measured data (operational phase) calculated data (design phase)*
		Assessment method	*Collect bills for energy in operational phase and divide it with total floor area. Calculate amount of energy that should be spent, multiply it with unit price and divide it with total floor area.*
		Standard	*Levels*
G1.5	Use stage water cost.	*Information source*	*Measured data (operational phase) calculated data (design phase)*
		Assessment method	*Collect bills for water in operational phase and divide it with total floor area. Calculate amount of water that should be spent, multiply it with unit price and divide it with total floor area, or compare it with similar buildings.*
		Standard	*Estimation or measurement*

COMPARATIVE ANALYSIS

Total number of criteria calculated

N° Criteria TOT	City of Turin	City of Udine	EVBDM	AURA-EE	GEN CAT	Sant Cugat	UoM	NOA	EIHP	*Average*
Building	16	31	16	19	38	40	36	33	27	**28,44**

Table1: Number of criteria that compose the 9 Regional Tools.

Exactly as has been done for the urban scale analysis, a first information collected from the analysis of the 9 Regional reports concerns the number of criteria selected by the partners to compose their Regional Tools at building scale. Obviously each of them has had to calculate the 16 mandatory KPIs and, to these criteria, others have been added to be calculated, depending on their regional needs.

Compared to the urban analysis, a smaller number of criteria has been selected for the building scale with an average value of about 29 criteria. Also in this case some partners have limited the calculation to those which are mandatory or a little more, while others have composed regional instruments with about 40 criteria. The bar chart below shows the numerical distribution of the criteria one by one, for all the nine partners involved in the task; the range of fluctuation of values has as minimum value the 16 criteria selected by the City of Turin and EnvirobatBDM and reaches the maximum value of 40 criteria selected and calculated by Sant Cugat del Vallès.

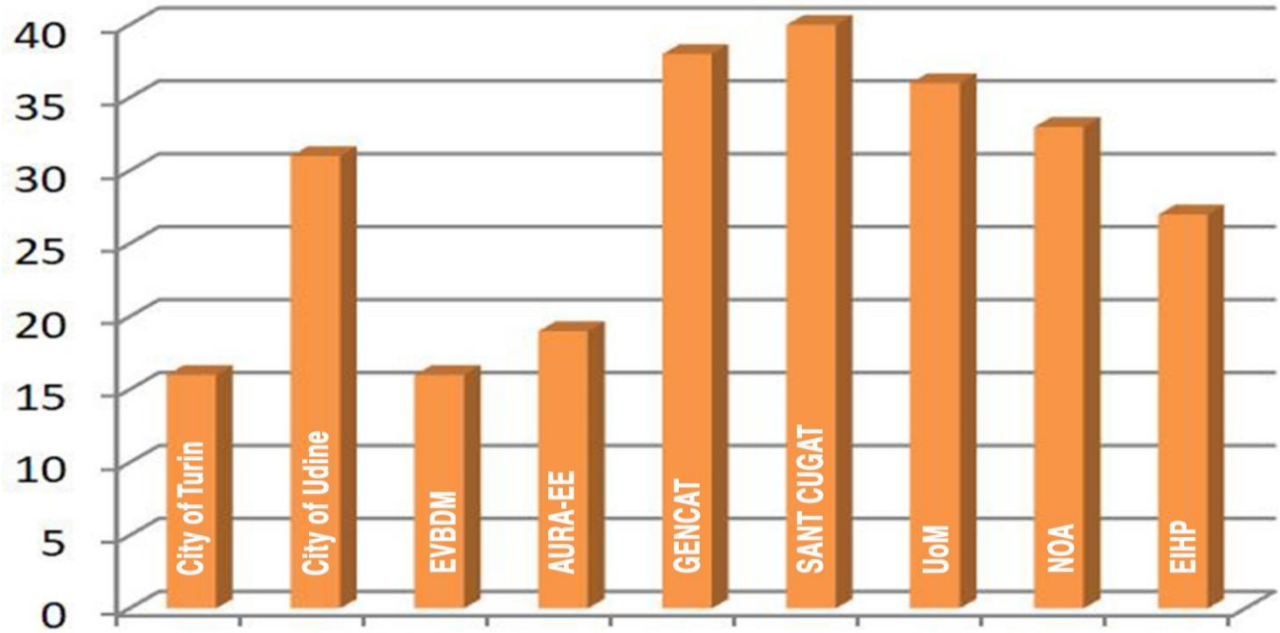

Chart1: Bar chart showing the numerical distribution of criteria selected by each partner.

Number of criteria per area

The table below describes the number of criteria selected by each partners for each areas of the building tool, it helps to understand the areas that are most densely populated and the criteria distribution.

N° of Criteria per Area	City of Turin	City of Udine	EVBDM	AURA-EE	GEN CAT	Sant Cugat	UoM	NOA	EIHP	*Average*
A	0	5	0	0	4	10	7	4	3	**3,7**
B	7	11	8	9	12	9	6	10	10	**9,1**
C	2	5	3	3	4	3	4	3	3	**3,3**
D	5	5	3	5	5	3	3	3	5	**4,1**
E	0	1	0	0	10	8	10	10	2	**4,6**
F	0	2	0	0	1	3	3	1	2	**1,3**
G	2	2	2	2	2	4	3	2	2	**2,3**

Table2: Numerical distribution of criteria making up the 9 Regional Tools, distributed in the seven areas. In the last column there are the weighted average values of this distribution.

Lots of partners have not selected criteria in areas A - site regeneration and development, urban, design and infrastructure, E – service quality and F – social, cultural and perceptual aspects and thanks to the distributive analysis of the criteria within the different seven areas, it can be stated that the area most densely populated of criteria is Area B, related to energy and resource consumption. The 32% of the all pie chart it's covered by criteria belonging from Area B, as it is possible to note from the chart below, to follow with almost the same percentage and relevance there are Area E with the 16%, Area D with the 14%, Area A with the 13% and Area C with the 12% of the all pie chart.

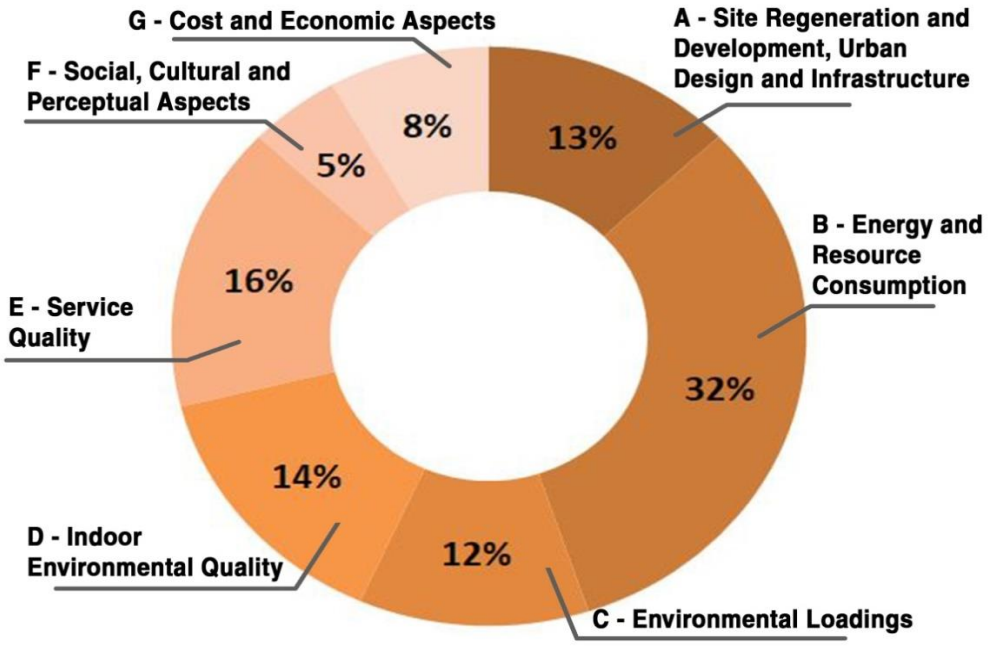

Chart2: Pie chart showing the percentage distribution of the criteria within the 7 areas making up the tool, resulting from the weighted average of the individual values of the 9 Regional Tools.

The areas with the lowest number of criteria are Area F - social, cultural and perceptual aspects with the 5% and Area G - cost and economic aspects with the 8%. Exactly as happened in the urban analysis, also in this case the economic aspects have less importance and relevance than the others. While, for what concerns Area F, probably, the reason why few criteria have been selected is related to the fact that lots of criteria in this area are qualitative and not – quantifiable and may be less relevant for the evaluation.

A comparative analysis between the total number of criteria that there are in the Generic Framework Building scale and the average value of the total number of criteria selected by partners for each of the seven areas has been produced.

The image below describes graphically the ratio of the two values in a specific area; as can be seen by looking at the bar chart, this ratio is often not proportional, like for example in Area A in which lots of criteria are contained into the Generic Framework but few have been selected by partners, the same happened for Area F, while in Area B, as stated in the previous analysis, a large number of criteria have been calculated by the partners involved in the task.

Areas	Generic Framework	Average in Regional Tools
A	34	3,7
B	25	9,1
C	21	3,3
D	19	4,1
E	29	4,6
F	17	1,3
G	7	2,3

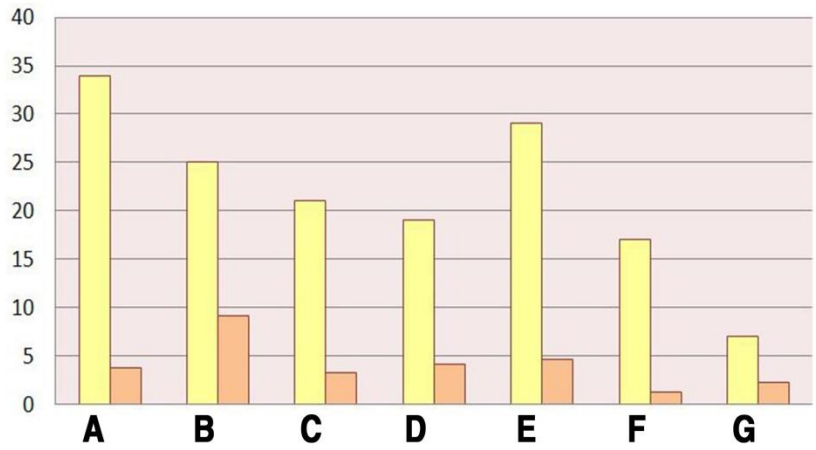

Chart3: On the left, the table shows the number of criteria existing in the Generic Framework broken down by area, subsequently compared with the average value obtained from the analysis of the 9 Regional Tools. On the right, the bar chart that graphically translates the results.

Average value of Priority factors per KPIs

For each criterion included within the Regional Tool it was necessary to assign a priority factor concerning the Impact, the Extent and the Duration of the effect of that specific criterion , with the purpose of defining an order of importance and relevance between the criteria, being able to more easily complete the weighing operation.

The table below summarizes the average values obtained from the analysis of the 9 Regional Tools for each of the 16 KPIs, in relation to:

- B= Impact of the Potential effect (1-3)
- C= Extent of potential effect (1-5)
- D= Duration of potential effect (1-5)

Code	Criterion	*Value*	*Average*
B1.1	Primary energy demand	*B= Impact*	**4**
		C=Extent	**4**
		D=Duration	**3**
B1.2	Delivered thermal energy demand	*B= Impact*	**4**
		C=Extent	**4**
		D=Duration	**3**
B1.3	Delivered electric energy demand	*B= Impact*	**4**
		C=Extent	**4**
		D=Duration	**3**
B1.5	Energy from renewable sources in total thermal energy consumption	*B= Impact*	**4**
		C=Extent	**5**
		D=Duration	**3**
B1.6	Energy from renewable sources in total electric energy consumption	*B= Impact*	**4**
		C=Extent	**4**
		D=Duration	**3**
B1.11	Embodied non-renewable primary energy	*B= Impact*	**4**
		C=Extent	**4**
		D=Duration	**3**
B3.5	Recycled materials	*B= Impact*	**3**
		C=Extent	**3**
		D=Duration	**3**
B4.5	Potable water consumption for indoor uses	*B= Impact*	**3**
		C=Extent	**3**
		D=Duration	**3**
C1.3	Global Warming potential	*B= Impact*	**5**
		C=Extent	**4**
		D=Duration	**4**

C3.1	Construction and demolition waste	*B= Impact*	**3**
		C=Extent	**3**
		D=Duration	**3**
C3.2	Solid waste from building operation	*B= Impact*	**3**
		C=Extent	**3**
		D=Duration	**3**
D1.4	TVOC concentration in indoor air	*B= Impact*	**2**
		C=Extent	**2**
		D=Duration	**3**
D1.10	Ventilation rate	*B= Impact*	**2**
		C=Extent	**3**
		D=Duration	**3**
D2.2	Thermal comfort index	*B= Impact*	**2**
		C=Extent	**3**
		D=Duration	**3**
G1.4	Use stage energy cost	*B= Impact*	**3**
		C=Extent	**3**
		D=Duration	**2**
G1.5	Use stage water cost	*B= Impact*	**2**
		C=Extent	**3**
		D=Duration	**2**

Weight per area

The weighting is one of the crucial aspect in the all process, it consists in the assignment of a weight to each criterion, category and issue. The weight is expressed as a percentage. This process allows to align the assessment tool to local environmental, social and economic priorities.

The table below shows the percentage distribution of the weights assigned by the partners to the seven areas of the Generic Framework at building scale. The average value is reported in the last column and it is calculated for every areas; it is meaningful of the importance given to the different aspects of the tool given by the partners involved in the activity. As stated in the previous paragraph, lots of partners haven't selected criteria in Area A, E and F, for that reason, many of them gave no importance to those areas by assigning the 0% of weight (easily identified by looking the yellow boxes in the table).

For an easy reading of the results of the table below, colors have been used to identify in green the higher percentage given by each partners to the area with the greatest importance in the tool and marked in yellow the area with the least relevance among the others six. In this way it is possible to see at a glance what areas are the ones with the higher weight and, in the same way, the ones with the lower importance for the partners involved in this task.

Weight of Areas	City of Turin	City of Udine	EVBDM	AURA-EE	GEN CAT	Sant Cugat	UoM	NOA	EIHP	*Average*
A	0,0%	0,0%	0,0%	0,0%	4,9%	11,6%	7,0%	6,5%	7,6%	4,2%
B	58,0%	69,8%	72,0%	72,0%	62,9%	54,9%	31,6%	28,5%	51,2%	55,7%
C	23,0%	24,3%	25,0%	25,0%	19,5%	20,4%	23,6%	36,6%	19,5%	24,1%
D	11,0%	4,2%	2,0%	2,0%	2,1%	1,5%	2,0%	0,5%	8,0%	3,7%
E	0,0%	0,0%	0,0%	0,0%	7,9%	8,1%	20,7%	12,6%	3,2%	5,8%
F	0,0%	0,0%	0,0%	0,0%	1,9%	2,7%	12,0%	4,3%	5,1%	2,9%
G	8,0%	1,8%	2,0%	2,0%	0,8%	0,8%	3,1%	11,0%	5,5%	3,9%

Table3: Percentage distribution of the weights assigned by the partners to the seven Areas of the Tool. Cells in yellow represent the lower weight given while the green ones represent the higher weight.

Analyzing the results achieved by the comparison study, basically almost all the project partners involved in the activity have given the higher weight, and so the higher relevance, to Area B, the one related to the energy and resource consumption. More than the 55% of the total weight is devoted to this aspect that is, of course, very important in the evaluation of the sustainability of a building. Considering the areas with the higher percentage in term of weight, immediately after Area B there is Area C the one related to the environmental loading, with the 24% of importance. It is another really important aspect to take into account for almost all the partners.

While, all the other five areas of the Tool seem not to have a great importance; by looking at the percentages achieved, Area A has receive the 4,2%, Area D the 3,7%, Area E the 5,8% area G the 3,9% and

the area with the lowest weight is Area F, devoted to the social, cultural and perceptual aspects, with only the 2,9% of weight compared to the total.

By looking at the horizontal bar chart, the importance of the Area B within the Tool is immediately visible, almost all the partners attributed the greater weight to this area and to follow Area C, than all the others, justifying this choice because of the importance that energy aspects and environmental loading have in terms of environmental sustainability.

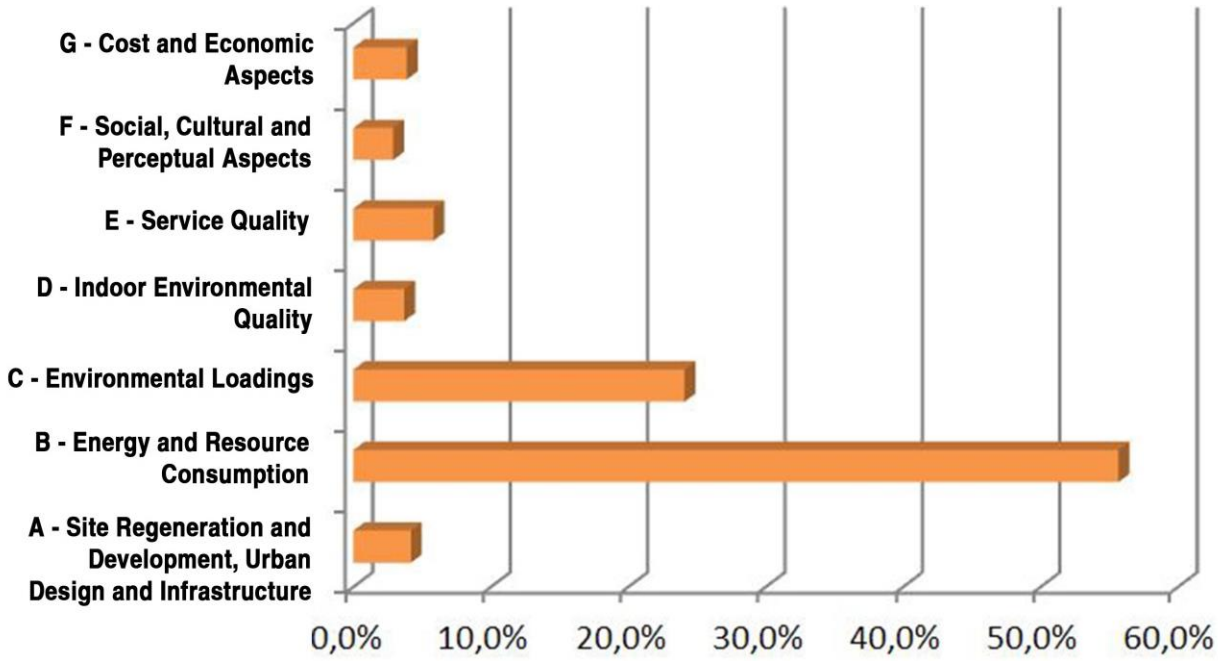

Chart4: Bar chart showing the average percentage weight obtained for each Area.

There is a very evident disparity among the results, only two areas (Area b and C) have been able to get even the 80% of the total percentage achievable, the others five have very low weighting percentage.

It is also interesting to note that the results achieved in these two areas are fairly homogeneous, in fact there were no significant numerical fluctuations between scores given by partners.

Average value of Minimum/Best value

Code	Criterion	Unit of Measure	Value	City of Turin	City of Udine	EnvirobatBDM	AURA-EE	GEN CAT	Sant Cugat	UoM	NOA	EIHP	Average
B1.1	Primary energy demand	$kWh/m^2/yr$	Minimum	80	140	48	140	225	292		310,6	90	**165,7**
			Best Value	30	23	0	0	70	58		87,6	55	**40,5**
B1.2	Delivered thermal energy demand	$kWh/m^2/yr$	Minimum	70	80	40	130	22	75		69,1	50	**67,0**
			Best Value	20	10	0	30	12	20		11,5	10	**14,2**
B1.3	Delivered electric energy demand	$kWh/m^2/yr$	Minimum	30	23	40	140	75	70		99,4	30	**63,4**
			Best Value	20	5	0	0	20	30		29,1	0	**13,0**
B1.5	Energy from renewable sources in total thermal energy consumption	%	Minimum	30	25	25	10	30	30		16	20	**23,3**
			Best Value	100	50	100	100	100	100		80	90	**90,0**
B1.6	Energy from renewable sources in total electric energy consumption	%	Minimum	40	35	10	10	40	40		20	5	**25,0**
			Best Value	100	75	200	100	100	100		100	90	**108,1**
B1.11	Embodied non-renewable primary energy	MJ/m^2	Minimum	2500		180	900				6230	14	**1964,8**
			Best Value	1000		90	504				3000	3	**919,4**
B3.5	Recycled materials	%	Minimum	15	15	5	5		15		3	5	**9,0**
			Best Value	50	50	75	75		50		40	40	**54,3**
B4.5	Potable water consumption for indoor uses	m^3/occupant/year	Minimum	40	47	40	90	100	11		6	5,5	**34,2**
			Best Value	25	23	20	20	20	5		1,5	2	**13,8**
C1.3	Global Warming potential	kg CO_2 eq./m^2/yr	Minimum	30	28	20	80	30	96,31		7,5	40	**43,1**
			Best Value	0	5	5	5	10	19,26		2	5	**5,9**
C3.1	Construction and demolition waste	kg/m^2/life cycle stage	Minimum	100		1400	1700		1700		120		**1004,0**
			Best Value	20		600	1200		600		36		**491,2**
C3.2	Solid waste from building operation	%	Minimum	50	14	0,4	0,4	15			57	28	**23,5**
			Best Value	80	100	1	1	100			100	100	**68,9**
D1.4	TVOC concentration in indoor air	µg/ m^3	Minimum	5000	2000	300	300		1000		1000	300	**1414,3**
			Best Value	1000	1000	200	100		200		200	0	**385,7**
D1.10	Ventilation rate	l/s/m^2	Minimum	10	0,35	0,5		6			0,29	2,77	**3,3**
			Best Value	20	0,49	0,9		12			0,83	6	**6,7**
D2.2	Thermal comfort index	%	Minimum	10	10	10	10	25	10		25	25	**15,6**
			Best Value	0	6	5	0	5	0		5	5	**3,3**
G1.4	Use stage energy cost	€/m^2/yr	Minimum	20	10,7	15	15	60	35		18,9	7,5	**22,8**
			Best Value	10	1,75	5	5	40	10		4,7	1,5	**9,7**
G1.5	Use stage water cost	€/m^2/yr	Minimum	5	1,55	10	13		5		0,59	0,5	**5,1**
			Best Value	1	0,7	3	2,3		1		0,15	0,2	**1,2**

Table4: Benchmark e Best values set out by each partners for all the 16 KPIs at building scale.

As stated for the urban analysis, benchmarking consists in the definition of the scoring scale for each selected criterion. The benchmark is a quantification of the indicator's value corresponding to the minimum acceptable performance and the one that is considered the best at regional level and the assignment of a reference value is not at all a simple matter. Like for the urban scale investigation, for some criteria, there are legal limits to refer to, or national or regional regulations but finding these values is not always easy. A minimum and a best value have been defined by each partners for all the 16 KPIs of the Tool, as it is possible to note from the previous table summarizes them. This table also contains an average value of these two parameters and exactly how happened for the urban scale, these mean values in most cases are not particularly meaningful because the reference values are definitely different one country from another.

The rationale adopted by partners and the data sources investigated to define the reference values for the analyzed KPIs at building scale are summarized below.

Code	Criterion	Benchmark Rationale/Data source
B1.1	Primary energy demand	- Level(s) Part 1-2 – Beta version. - EN 15603 (Energy performance of buildings - Overall energy use and definition of energy ratings). - CEN standards that support the implementation of the Directive on the Energy Performance of Buildings (EPBD) in the European Union. - EN ISO 52000 (Energy performance of buildings - Calculation of energy requirements for space heating and cooling). - New collective dwellings RT2012. - Building regulation (2020). - Energy Performance Certificates (EPC). - Consumption bills. - National Agency for new technologies, energy and sustainable economic development (ENEA). -TABULA EU Project: http://episcope.eu/building-typology/ - CasaClima.
B1.2	Delivered thermal energy demand	- New collective dwellings RT2012. - Level(s) Part 1-2 – Beta version. - EN 15603 (Energy performance of buildings - Overall energy use and definition of energy ratings). - CEN standards that support the implementation of the Directive on the Energy Performance of Buildings (EPBD) in the European Union. - EN ISO 52000 (Energy performance of buildings - Calculation of energy requirements for space heating and cooling). - Building regulation (2020). - Energy Performance Certificates (EPC). - Consumption bills.

		- National Agency for new technologies, energy and sustainable economic development (ENEA). - CasaClima.
B1.3	Delivered electric energy demand	- CEN standards that support the implementation of the Directive on the Energy Performance of Buildings (EPBD) in the European Union. - EN 52000 (Energy performance of buildings. Overall energy consumption and definition of energy assessments). - EN ISO 56001 (Energy performance of buildings - Calculation of energy requirements for space heating and cooling). - New collective dwellings RT2012. - Energy Performance Certificates (EPC). - (Level(s) Part 3 – 1.3.1). - EN 15603 (Energy performance of buildings - Overall energy use and definition of energy ratings). - EN ISO 13790 (Energy performance of buildings). - EN 15193 (Energy performance of buildings — Energy requirements for lighting). - Energy bills.
B1.5	Energy from renewable sources in total thermal energy consumption	- Level(s) Part 1-2 – Beta version. - EN 15603 (Energy performance of buildings - Overall energy use and definition of energy ratings). - 2013/114/EU: Commission Decision of 1 March 2013. - Directive 2009/28/EC (RES Directive). - EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments). - National regulation of thermal installations in building.
B1.6	Energy from renewable sources in total electric energy consumption	- CEN standards that support the implementation of the Directive on the Energy Performance of Buildings (EPBD) in the European Union. - EN 52000 Energy performance of buildings: overall energy consumption and definition of energy assessments. - Level(s) Part 1-2 – Beta version. - EN 15603 (Energy performance of buildings - Overall energy use and definition of energy ratings). - 2013/114/EU: Commission Decision of 1 March 2013. - Directive 2009/28/EC (RES Directive). - Reference Autonomous building nZEB.
B1.11	Embodied non-renewable primary energy	- CSTB report "Capitalization of the results of the HQE Performance experimentation, Statistical analysis, Action 22" of October 2013.

		- ISO 14040/44, EN 15804 (Contribution of construction works to sustainable development - Environmental product declarations - Rules governing categories of construction products). - EN 15978 (Contribution of construction works to sustainable development - Evaluation of the environmental performance of buildings - Calculation method). - EN 15804 (Sustainability of construction works. Environmental product declarations. Core rules for the product category of construction products).
B3.5	Recycled materials	- EN ISO 14021 (Environmental labels and declarations - Self-declared environmental claims - Type II environmental labelling). - Autonomous and state regulations on quality control concerning recycled materials. - UNI PdR 13 ITACA. - CAM edilizia, DM 11/10/2017.
B4.5	Potable water consumption for indoor uses	- Level(s) Part 1-2 – Beta version. - EN 15978 (Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method). - UNI PdR 13 ITACA. - Consumption bills.
C1.3	Global Warming potential	- EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments). - National calculation method for the energy performance of building. - Energy Performance Certificates (EPC). - EN 15603 (Energy performance of buildings - Overall energy use and definition of energy ratings). - Level(s) Part 1-2 – Beta version. - National Office for Climate Change. - Energy bills.
C3.1	Construction and demolition waste	- Level(s) Part 1-2 – Beta version. - National Office for Climate Change. - EN 52000 (Energy performance of buildings: overall energy consumption and definition of energy assessments). - UNI PdR 13 ITACA.
C3.2	Solid waste from building operation	- Plan of the availability and position of bins and containers for each of the seven solid waste categories. - Google maps. - National Decree regulating the Production and management of construction and demolition waste.

D1.4	TVOC concentration in indoor air	- Recommendation of National Federal Agency. - ISO 16000-6 (Indoor Air - Part 6: Determination of Volatile Organic Compounds in Indoor Air and Active Sampling Chambers on Tenax TA (R) Sorbent, Desorption thermal and gas chromatographic using MS or MS / FID) or equivalent. - EN 16516 (Construction products - evaluation of the emission of dangerous substances - Determination of indoor air emissions). - EN 15251 (Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics). - CEN/TS 16516 (Construction products - Assessment of release of dangerous substances - Determination of emissions into indoor air). - Level(s) Part 1-2 – Beta version. - Content in VOC according to UNE-EN ISO 11890-1 / 2 and ASTM D2369 standards. - Determination of the formaldehyde emission on wood derived boards according to UNE-EN 717. - UNI PdR 13 ITACA.
D1.10	Ventilation rate	- EN 16798-7 (Energy performance of buildings - Ventilation for buildings - Part 7: Calculation methods for the determination of air flow rates in buildings including infiltration). - UNI EN 15251 Table B.5 Cat III. - Standard UNI 10339.
D2.2	Thermal comfort index	- EN 7730 (Ergonomics of the thermal environment - Analytical determination and interpretation of thermal comfort by calculation of the PMV and PPD indices and by local thermal comfort criteria. - ISO 7730 Ergonomics of the thermal environment - - Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria. - EN 16798-1:2017 - Energy performance of buildings - Part 1: Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics - Module M1-6 (revision of EN 15251). Brussels: European Committee for Standardization. - Level(s) Part 1-2 – Beta version.
G1.4	Use stage energy cost	- Energy bills. - Level(s) Part 1-2 – Beta version.
G1.5	Use stage water cost	- Water bills. - Level(s) Part 1-2 – Beta version.

Standard for calculation

Exactly how it was important to define, in the previous paragraph, the reference data sources of the criteria in order to extrapolate benchmark and best practice data, in the same way, it is fundamental to identify the support tools useful to perform the calculations for the quantification of the value of the indicators.

The table below summarizes the main support tools used by the partners to perform the calculations.

Code	Criterion	Information source
B1.1	Primary energy demand	- Models and simulation. - Measured data of energy consumption on site or calculations. - Metered data. - Calculated data.
B1.2	Delivered thermal energy demand	- Models and simulation. - Measured data of energy consumption on site or calculations. - Metered data. - Calculated data.
B1.3	Delivered electric energy demand	- Models and simulation. - Measured data on site.
B1.5	Energy from renewable sources in total thermal energy consumption	- Metered data. - Calculated data. - Monitoring of produced energy. - Models and simulation.
B1.6	Energy from renewable sources in total electric energy consumption	- Models and simulation. - Statistical/ estimated data - Metered data. - Calculated data. - Monitoring of produced energy.
B1.11	Embodied non-renewable primary energy	- Models and simulation. - Calculated data – Estimations.
B3.5	Recycled materials	- Models and simulation or material documents. - Calculated data – Estimations.
B4.5	Potable water consumption for indoor uses	- Models and simulation. - French Tool “Water calculator”. - Metered data – Estimations.
C1.3	Global Warming potential	- Models and simulation. - Calculated data.
C3.1	Construction and demolition waste	- Models and simulation. - Metered data –Estimations.
C3.2	Solid waste from building operation	- Calculated data. - Metered data –Estimations.

D1.4	TVOC concentration in indoor air	- Measured data.
D1.10	Ventilation rate	- Measured with blower door test, algorithm. - Metered data. - Calculated data.
D2.2	Thermal comfort index	- Models and simulation. - Measured method. - Estimations.
G1.4	Use stage energy cost	- Models and simulation. - Calculated data.
G1.5	Use stage water cost	- Models and simulation. - Calculated data.

KPIs value

Code	Criterion	City of Turin	City of Udine	EnvirobatBDM	AURA-EE	GEN CAT	Sant Cugat	UoM	NOA	EIHP
B1.1	Primary energy demand	253	160,66	48,9	47,5	279,39	161,02	133,91	442,4	50,93
B1.2	Delivered thermal energy demand	170	108,48	27,6	36,5	18,47	54,05	14,68	100,1	42,19
B1.3	Delivered electric energy demand	21	19,26	15,1	23,3	128,26	63,42	63,54	114,6	28,34
B1.5	Energy from renewable sources in total thermal energy consumption	0	0	44	43	0	0	N.A.	0	100
B1.6	Energy from renewable sources in total electric energy consumption	0	0	0	0	1,68	0	25,2	0	0
B1.11	Embodied non-renewable primary energy	0	N.A.	no data	No Data	N.A.	N.A.	N.A.	Not for use phase	9274
B3.5	Recycled materials	0	N.A.	no data	No Data	N.A.	N.A.	N.A.	Not for use phase	3,27
B4.5	Potable water consumption for indoor uses	77	52,23	no data	30	6,74	18,91	N.A.	6	6,02
C1.3	Global Warming potential	42,5	31,65	4	4,58	11,22	24,35	41,2	9,1	8,16
C3.1	Construction and demolition waste	0	N.A.	no data	No Data	N.A.	N.A.	N.A.	Not for use phase	Not for use phase
C3.2	Solid waste from building operation	60	0	70	0,42	100	100	N.A.	57	43
D1.4	TVOC concentration in indoor air	200	N.A.	no data	No Data	N.A.	N.A.	1474,4	Not for use phase	No Data
D1.10	Ventilation rate	0,225	N.A.	no data	not calculated	12	N.A.	N.A.	-	No Data
D2.2	Thermal comfort index	5	Not detected	no data	No Data	7	N.A.	N.A.	18	48
G1.4	Use stage energy cost	17,7	12,07	no data	10	16,9	12,97	N.A.	23,8	6,38
G1.5	Use stage water cost	6,16	2,17	no data	3,5	1,01	0,74	N.A.	0,37	3,26

KPIs score

Code	Criterion	City of Turin	City of Udine	EnvirobatBDM	AURA-EE	GEN CAT	Sant Cugat	UoM	NOA	EIHP
B1.1	Primary energy demand	0,4	-1	1	3	-1	3	4	-1	0,2
B1.2	Delivered thermal energy demand	2	-1	2	3	1,8	3	5	-1	0,04
B1.3	Delivered electric energy demand	2,5	-1	0,5	3	-1	3	5	-1	0,01
B1.5	Energy from renewable sources in total thermal energy consumption	0,1	-1	1	0	0	4		-1	0,41
B1.6	Energy from renewable sources in total electric energy consumption	2,5	-1	-1	-1	-1	4	-1	-1	-0,08
B1.11	Embodied non-renewable primary energy	-1	No Data	No Data	No Data	No Data	No Data	not calculated	Not for use phase	0,09
B3.5	Recycled materials	0,6	No Data	No Data	No Data	No Data	Not for use phase	not calculated	Not for use phase	-0,04
B4.5	Potable water consumption for indoor uses	1,7	-1	No Data	3	4,13	3	5	0	0,22
C1.3	Global Warming potential	2,8	-1	5	5	4,7	3,5	-0,3	-1	0,7
C3.1	Construction and demolition waste	2,5	No Data	No Data	No Data	No Data	No Data	not calculated	Not for use phase	Not for use phase
C3.2	Solid waste from building operation	0,3	-1	3	0	5	3	not calculated	0	0,05
D1.4	TVOC concentration in indoor air	-1	No Data	No Data	No Data	No Data	No Data	3	Not for use phase	not calculated
D1.10	Ventilation rate	0	No Data	0,5	not calculated	5	not calculated	not calculated	Not for use phase	not calculated
D2.2	Thermal comfort index	1,5	-1	no cooling	No Data	4,5	No Data	not calculated	1,8	-0,02
G1.4	Use stage energy cost	2	-1	No Data	0	0	4	no value	-1	0,03
G1.5	Use stage water cost	2,5	-1	No Data	3	No Data	4	no value	2,5	-0,02

Thanks to the testing activity at building scale carried out by the nine partners involved in this task, some assumptions related to the selection of the Key Performance Indicators have been questioned. As it is possible to see from the results contained in the table concerning the minimum and best value, lots of partners have had many problems in finding data about the following criteria:

- B1.11 Embodied non-renewable primary energy
- B3.5 Recycled materials
- C3.1 Construction and demolition waste
- D1.4 TVOC concentration in indoor air
- D1.10 Ventilation rate

In accordance with all the partners of the project, it has been decided to remove from the KPIs list criteria B3.5, C3.1 and D1.4, because of the general inability in calculating them due to the difficulty in finding data. Anyway, they are still in the Generic Framework at Building scale and so they are selectable and calculable in any future regional tool.

For what concerns criterion B1.11 Embodied non-renewable primary energy and criterion D1.10 Ventilation rate, they are both complex issues but, at the same time, a priority in the action program of Agenda 2030 and for that reason, despite the difficulties encountered in data acquisition and calculation, it has been decided to maintain them in the Building scale KPIs list.

With regard to the minimum and the best values proposed by partners for all the KPIs at Building scale, in most cases they are very different from each other. This happens because the data sources used are not the same and consequently the benchmarks fixed are different one country from another. Sometimes, also when the data sources taken into account are the same, values set out are not so similar. For that reason, the average value calculated for each minimum and best value of every KPIs is not always so significant.

There are, however, few cases in which the results are very close to each other, for example, the energy criteria B1.5 - Energy from renewable sources in total thermal energy consumption and B1.6 - Energy from renewable sources in total electric energy consumption, both for the minimum and best value they received similar and comparable values. Similarly, also criterion D2.2 - Thermal comfort index has achieved from partners minimum and best values absolutely similar, using in most case as data source Level(s) Part 1-2 – Beta version.

On the contrary, criterion B4.5 - Potable water consumption for indoor uses has obtained minimum and best values completely different and non-comparable and the same inconsistency is visible also for criterion B1.1 - Primary energy demand.