2nd recast of the EPBD - Energy, IEQ, smart buildings & digitalisation

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President-elect REHVA

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28 member associations

REHVA

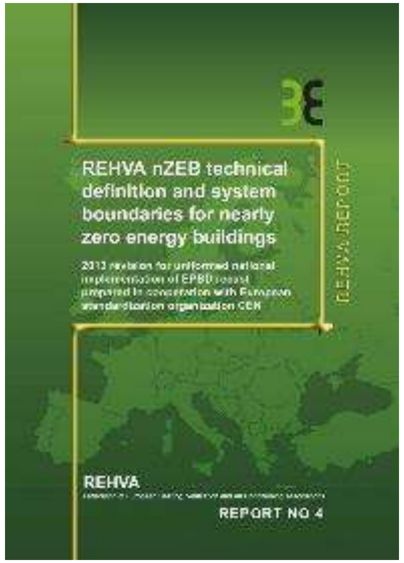
100 000 HVAC & Energy experts

Scope


Knowledge:
- Dissemination
- Education
- Research
REHVA
Supply:
- Mapping members activities
- Cross cutting activities
Demand – helping to develop:
- EU & National Government influence
- International promotion

REHVA publications

- REHVA Journal – The European HVAC Journal www.rehva.eu
- Guidebooks and reports (>25)
- REHVA app. translation



03/2017

ACREX/2017

01/2017

02/2017

Federation of European Heating and Air-conditioning Associations

(REHVA)

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Professional non-profit organization with 28 member countries representing more than 100 000 HVAC & Energy experts in Europe


News

REHVA

REHVA position paper on the European Commission proposal of the revised ENERGY PERFORMANCE OF BUILDINGS DIRECTIVE COM(2016)0765

General remarks

Ensuring high indoor environment quality and energy efficiency at the same time

Ensuring quality, proper maintenance, and performance through mandatory inspection of heating, ventilation, and air-conditioning systems

1. Setting and measuring clearly defined target values in a transparent way

2. Continuous monitoring, energy management, and building automation and control (BAC)

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Main issues in 2nd recast of the EPBD

Provisionally agreed and sealed by the the third informal trilogue on 19 December 2017, approved by the European Parliament 17 April 2018, to be published in May 2018

The latest political issues addressed:

- the content, development and implementation of the long-term renovation strategy;
- electro-mobility;
- the Smart Readiness Indicator;
- energy performance databases;
- the inspections and their alternatives;
- primary energy and weighting factors;

New EPBD items discussed in this presentation

1. Renovation strategy and NZEB performance
2. Ventilation, indoor air quality and comfort levels to be defined by MS
3. Smart readiness indicator and building automation

Long-term renovation strategy

- It is stated that Member States shall establish a long-term strategy facilitating the cost-effective **transformation of existing buildings into nearly-zero energy buildings**
- This includes setting out a roadmap with measures and domestically defined measurable progress indicators, with a view to the long-term 2050 goal of reducing greenhouse gas emissions in the Union by 80-95% compared to 1990
- The roadmap shall include indicative milestones for 2030, 2040 and 2050
- The strategy should cover:
  - policies and actions to stimulate cost-effective deep renovations
  - mobilisation of investments into the renovation

Technical challenge of nZEB performance levels

JRC 2016 data: Energy performance expressed by Member States

No consensus on NZEB EP-value

Country	Residential Buildings (kWh/m²/y or Energy Class)		Non-Residential Buildings (kWh/m²/y or Energy Class)	
	New	Existing	New	Existing
Austria	160	200	170	250
Belgium	45 (Brussels region) 30 (Flemish region) 60 (Walloon region)	~54	(95–2.5) *(V/S) (Brussels region) 40 (Flemish region) 60 (Walloon region)	~108
Bulgaria	~30–50	~40–60	~30–50	~40–60
Cyprus	100	100	125	125
Czech Republic	75%–80% PE	75%–80% PE	90% PE	90% PE
Germany	40% PE	55% PE	n/a	n/a
Denmark	20	20	25	25
Estonia	50 (detached house)	n/a n/a n/a n/a	100 (office buildings) 130 (hotels, restaurants) 120 (public buildings) 130 (shopping malls)	n/a n/a n/a n/a
	100 (apartment blocks)	n/a n/a n/a	90 (schools) 100 (day care centres) 270 (hospitals)	n/a n/a n/a
France	40–65	80 n/a	70 (offices without AC) 110 (offices with AC)	60% PE n/a
Croatia	33–41	n/a	n/a	n/a
Hungary	50–72	n/a	60–115	n/a
Ireland	45 (Energy load)	75–150	~60% PE	n/a
Italy	Class A1	Class A1	Class A1	Class A1
Latvia	95	95	95	95
Lithuania	Class A++	Class A++	Class A++	Class A++
Luxemburg	Class AAA	n/a	Class AAA	n/a
Malta	40	n/a	60	n/a
Netherlands	0	n/a	0	n/a
Poland	60–75	n/a	45–70–190	n/a
Romania	93–217	n/a	50–192	n/a
Spain	Class A	n/a	Class A	n/a
Sweden	30–75	n/a	30–105	n/a
Slovenia	45–50	70–90	70	100
Slovakia	32 (apartment buildings) 54 (family houses)	n/a n/a	60–96 (offices) 34 (schools)	n/a n/a
UK	~44	n/a	n/a	n/a

European Commission

RECOMMENDATIONS

COMMISSION RECOMMENDATION (EU) 2016/1318

of 29 July 2016

on guidelines for the promotion of nearly zero-energy buildings and best practices to ensure that, by 2020, all new buildings are nearly zero-energy buildings

Joint Research Centre

European Commission

NZEB level of energy performance	Mediterranean Zone 1: Catania (others: Athens, Larnaca, Luga, Seville, Palermo)	Oceanic Zone 4: Paris (others: Amsterdam, Berlin, Brussels, Copenhagen, Dublin, London, Macon, Nancy, Prague, Warszawa)	Continental Zone 3: Budapest (others: Bratislava, Ljubljana, Milan, Vienna)	Nordic Zone 5: Stockholm (Helsinki, Riga, Stockholm, Gdansk, Tovarene)
	Offices kWh/(m2/y)			
net primary energy	**20-30**	**40-55**	**40-55**	**55-70**
primary energy use	80-90	85-100	85-100	85-100
on-site RES sources	60	45	45	30
	New single family house kWh/(m2/y)			
net primary energy	**0-15**	**15-30**	**20-40**	**40-65**
primary energy use	50-65	50-65	50-70	65-90
on-site RES sources	50	35	30	25

Appliances not included in offices

Appliances and lighting not included in single-family

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European Commission

EC recommendations and conclusions

- Set national definitions of NZEB at a high level of ambition – not below the **cost-optimal** level of minimum requirements (20/30 year LCC calculation for res/non-res).

  Use **renewables in an integrated design concept** to cover the low energy requirements. Assure proper indoor environment to avoid deterioration of **IAQ, comfort and health**.

- Most NZEB **definitions implemented** at national level.

  No consensus on different aspects (e.g. system boundaries, single /building unit, on-site production, energy efficiency level, inclusion of lighting, household electricity, RES).

→ cost optimality the major NZEB criterion/tool to solve inconsistency between national NZEB and EC recommendations

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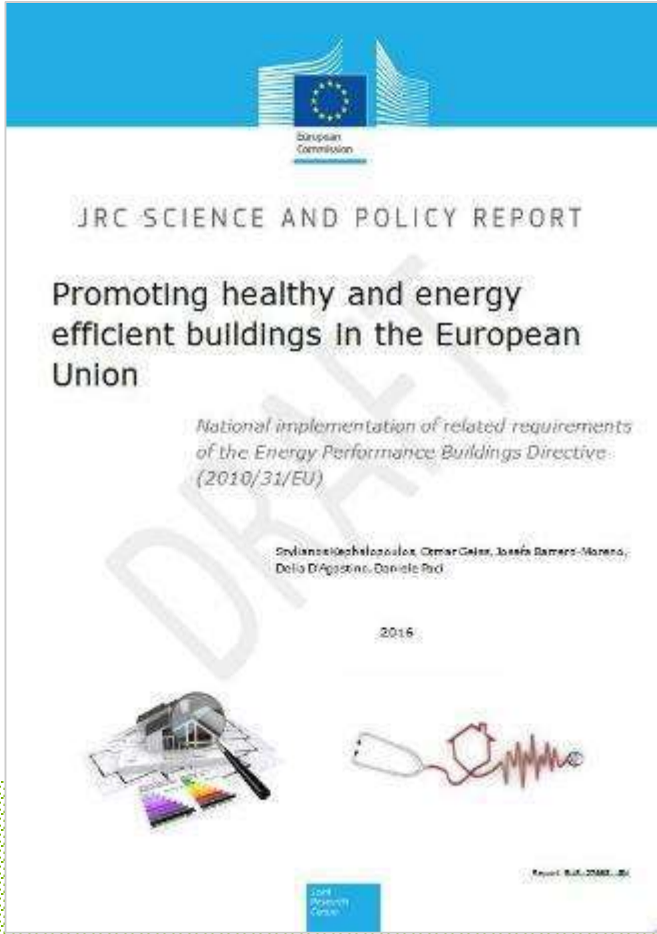
IEQ in new EPBD

Indoor Environmental Quality (IEQ) requirements in EU:

- Currently there are no binding ventilation and IEQ requirements at EU level
- From a regulatory point of view this remains under the competencies and responsibilities of the EU Member States

JRC assessment (2016) of the implementation status of the EPBD by the EU MS in terms of ventilation and indoor air quality criteria:

- Many inadequate ventilation problems reported from renovation
- New evidence that mechanical HR ventilation systems lead to an overall improvement of the IAQ and reduction of reported comfort and health related problems if properly designed and operated


JRC SCIENCE AND POLICY REPORT

Promoting healthy and energy efficient buildings in the European Union

National implementation of related requirements of the Energy Performance Buildings Directive (2010/31/EU)

2016

Example of ventilation requirements (BPIE 2015)

- Ventilation is included in all surveyed EU MS building regulations but **minimum requirements are set only for half of the countries** while for the other half there are only recommended minimum ventilation rates

⇒ Is it possible to design and construct buildings without ventilation in EU?

⇒ No doubt that possible in renovation

Country and Standard Reference	Whole Building Ventilation Rates	Living Room	Bedroom	Kitchen	Bathroom + WC	WC only
Brussels (NBN D 50-001)	3.6 $m^3/(h \cdot m^2)$ floor surface area	Minimum 75 m^3/h (limited to 150 m^3/h	Minimum 25m^3/h (limited to 72m^3/h)	Open kitchen Minimum 75 m^3/h (exhaust)	Minimum 50 m^3/hour (limited to 75 m^3/h	Minimum 25 m^3/h
Denmark (BR10)	Min. 0.3 $l/s \cdot m^2$ (supply)	Min. 0.3 $l/(s \cdot m^2)$ (supply)		20 l/s (exhaust)	15 l/s (exhaust)	10 l/s (exhaust)
France (Arrêté 24.03.82)	10-135 m^3/h (depending on room number and ventilation system)			Continuous: 20 – 45 m^3/h		Minimum 15 m^3/h
Germany (DIN 1946-6)	15-285 m^3/h (details see chapter)			45m^3/h (nominal exhaust flow)	45 m^3/h (nominal exhaust flow)	25 m^3/h (nominal exhaust flow)
Italy (Legislative Decree 192/2005, UNI EN 15251)	Naturally ventilated: 0.3 – 0.6 vol/h	0.011 m^3/s per person for an occupancy level of 0.04 persons/m^2			4 vol/h	
Poland (Art 149 (1) – Journal of Laws 2002 No. 75, item. 690, as amended and PN-B-03430:1983/Az3:2000)	20 m^3/h for each permanent occupant should be calculated according to the Polish standard but not less than 20 m^3/h	20 -30 m^3/h for each permanent occupant (for public buildings) For flats, it is a summary of flow from all rooms		30 m^3/h to 70 m^3/h without windows	50 m^3/h	30 m^3/h
Sweden (BFS2014:13 – BBR21)	Supply: min 0.35 $l/(s \cdot m^2)$ floor area					
UK (Approved Document F)	13-29 l/s (depending on bedrooms)			13-60 l/s (extract)	8-15 l/s (extract)	6 l/s (extract)
EN 15251	0.35 – 0.49 $l/(s \cdot m^2)$	0.6 – 1.4 $l/(s \cdot m^2)$		14-28 l/s	10-20 l/s	7-14 l/s

Requirement Recommendation European standard

EPBD ANNEX 1: ventilation, IAQ and comfort levels

- In EPBD Annex 1, new requirements are set:
  - "The energy needs for space heating, space cooling, domestic hot water, lighting, ventilation and other technical building systems shall be calculated in order **to optimise health, indoor air quality and comfort levels defined by Member States** at national or regional level"
- → clear mandate to MS to establish minimum ventilation and other IEQ requirements for new buildings and major renovations to implement the directive
- Mandate to The Commission to conduct before 2020 a feasibility study on stand-alone ventilation systems inspection, clarifying the possibilities/timeline to introduce this

Smart Readiness Indicator SRI

The 2nd EPBD recast is going to introduce a new indicator, the Smart Readiness Indicator (SRI)

*“an assessment of the capabilities of a building or building unit to adapt its operation to the needs of **the occupant and the grid** and to improve its energy efficiency and overall performance”*

SRI Indicator hierarchical structure

By VITO et alt. based on multi-criteria decision making method

SRI INDICATOR

↳ 10 DOMAINS

Importance depends on building category

↳ SERVICES — each domain: 3 to 17

↳ FUNCTIONALITY LEVELS — each service: 2 to 5

Different importance given by the score

↳ IMPACT SCORES — 8 impact categories

Impact categories provisionally equally important

SRI Domains

- 10 Domains:
  - Heating
  - Domestic hot water
  - Cooling
  - Mechanical ventilation
  - Lighting
  - Dynamic building envelope
  - Energy generation
  - Demand side management
  - Electric vehicle charging
  - Monitoring and control

SRI Final Assessment

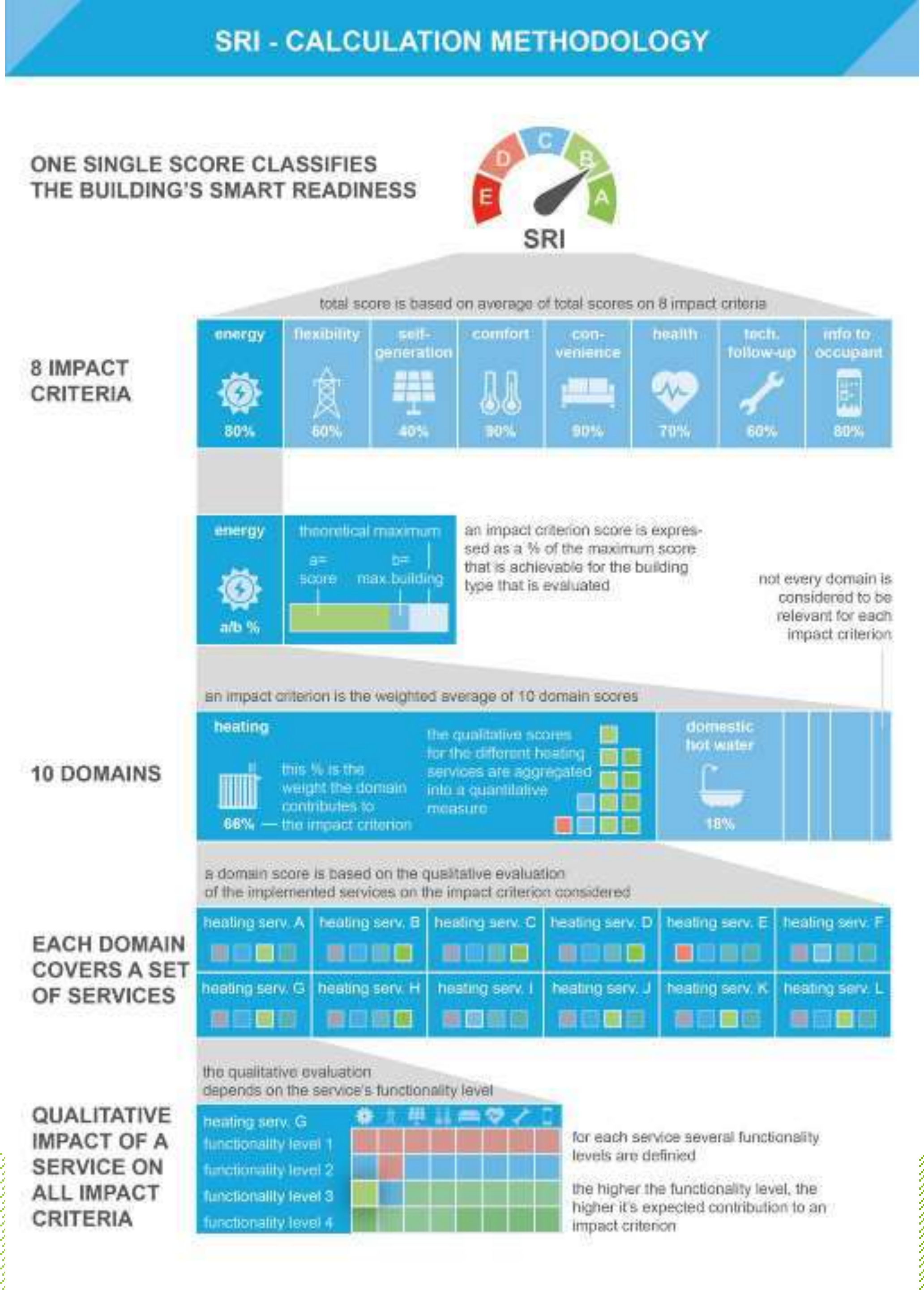
Based on multi-criteria decision making (MCDM) method (linear weighted method), *SRI* is then:

$$SRI = \frac{1}{N_I} \sum_{I=1}^{N_I} NSC_I \cdot w_I \leq 100 \quad ; \quad \sum_{I=1}^{N_I} w_I = 1$$

to have a final *smart readiness indicator SRI* between 0 and 100 for the building.

In this case, N_I = 8 always, because all impacts have to be evaluated.

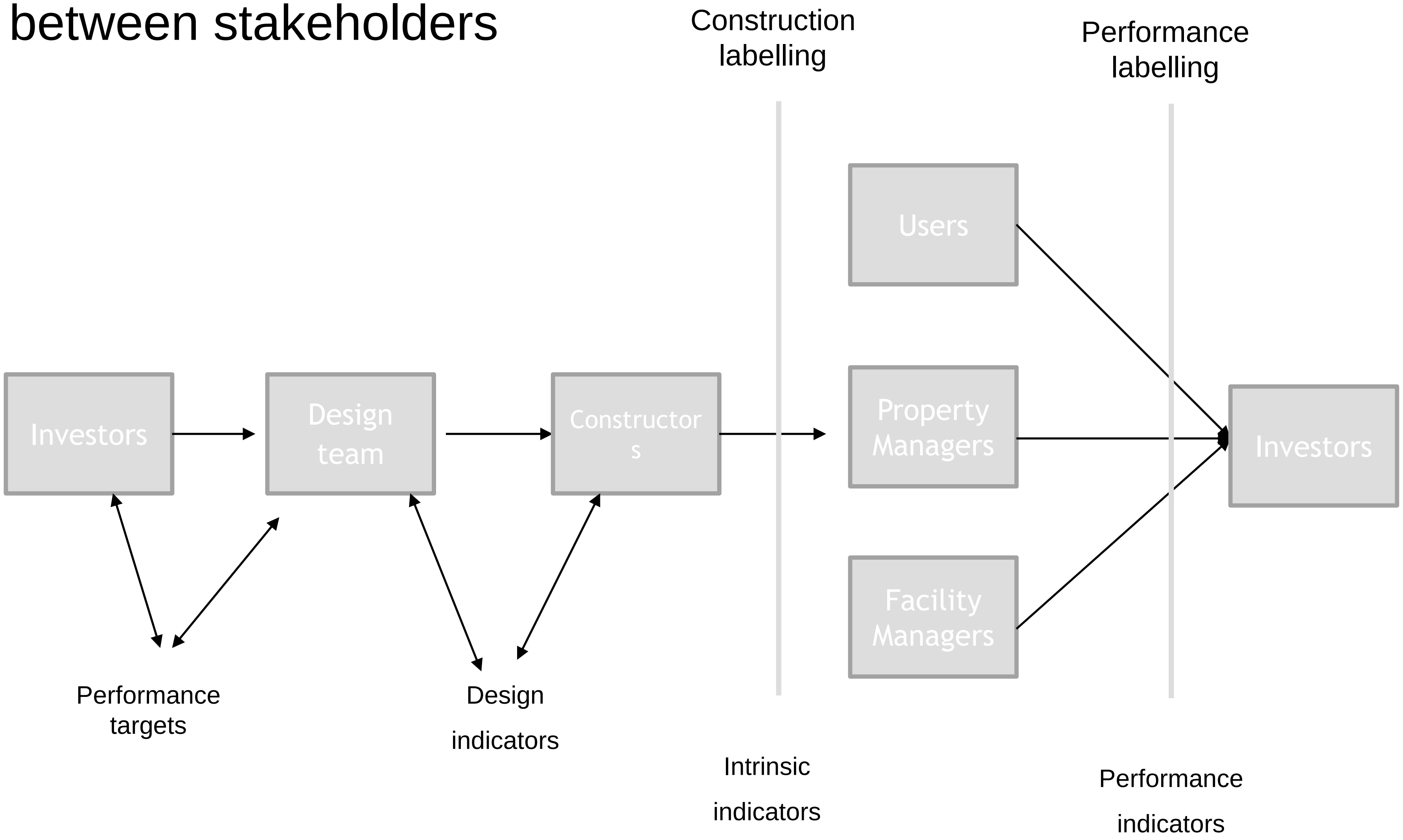
Method Overview



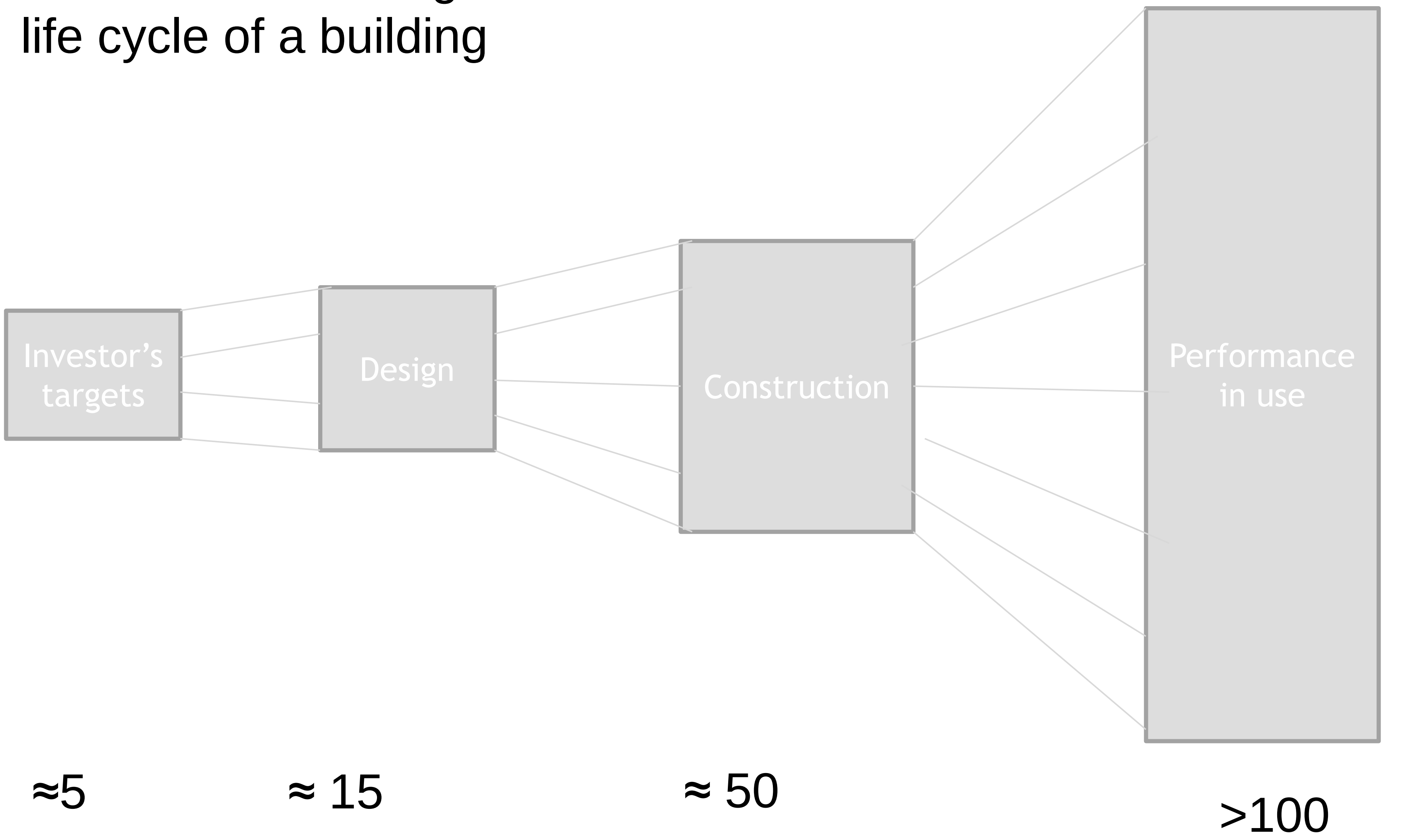
Weak points to be addressed

- Qualitative assessment of scores for almost all functionalities:
  - reference is made to EPBD standards, as EN15232 for BACS, but in an useless way: no any performance based scale is given; ➔ **TOO MUCH SUBJECTIVE**
- The multi-criteria decision making (MCDM) method is based on weights at different levels:
  - to provide significant weighting coefficients a public enquire among buildings energy experts more than politicians has to be carried out;
  - this can be at the National level or at the European Level.

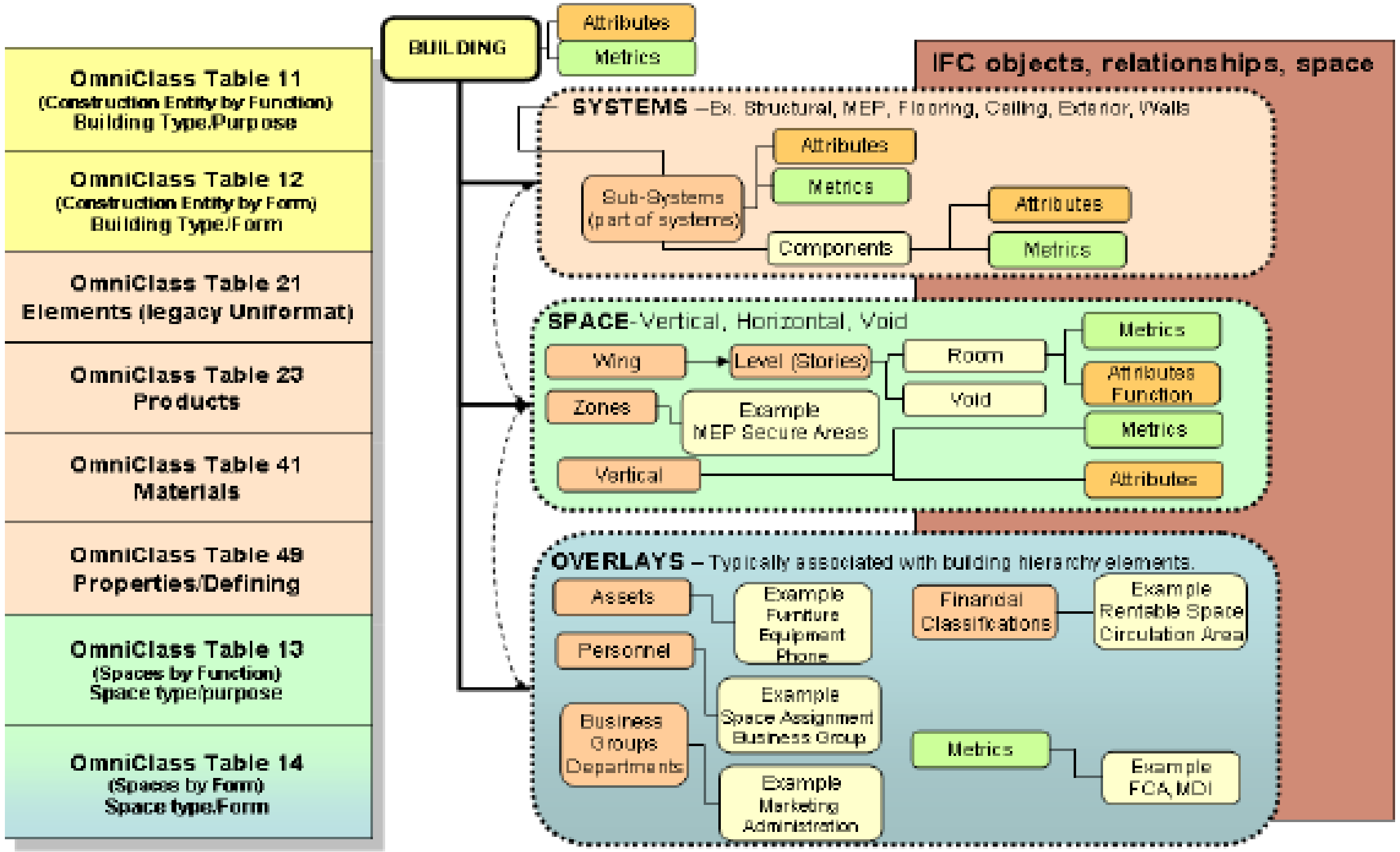
Data flow and disruption between stakeholders



Indicators list during the life cycle of a building



BIM INFORMATION HIERARCHY & INFORMATION CLASSIFICATION



Systems represent the physical entities of the building. Systems use NA classifications such as Omni-Class and Uniformat and are transported/exchanged via IFCs

Space is physical in nature, but can be unbounded (have no or cross physical boundaries) but it will always be tied to the physical structure or systems in some way

Overlays are more abstract data - organizational, operational, functional, financial, non-fixed assets, resources, personnel, etc. that is data tied to the Systems and Space

Hierarchy 1.5

Définition des exigences d'échanges d'informations (EIR)

-> Instructions

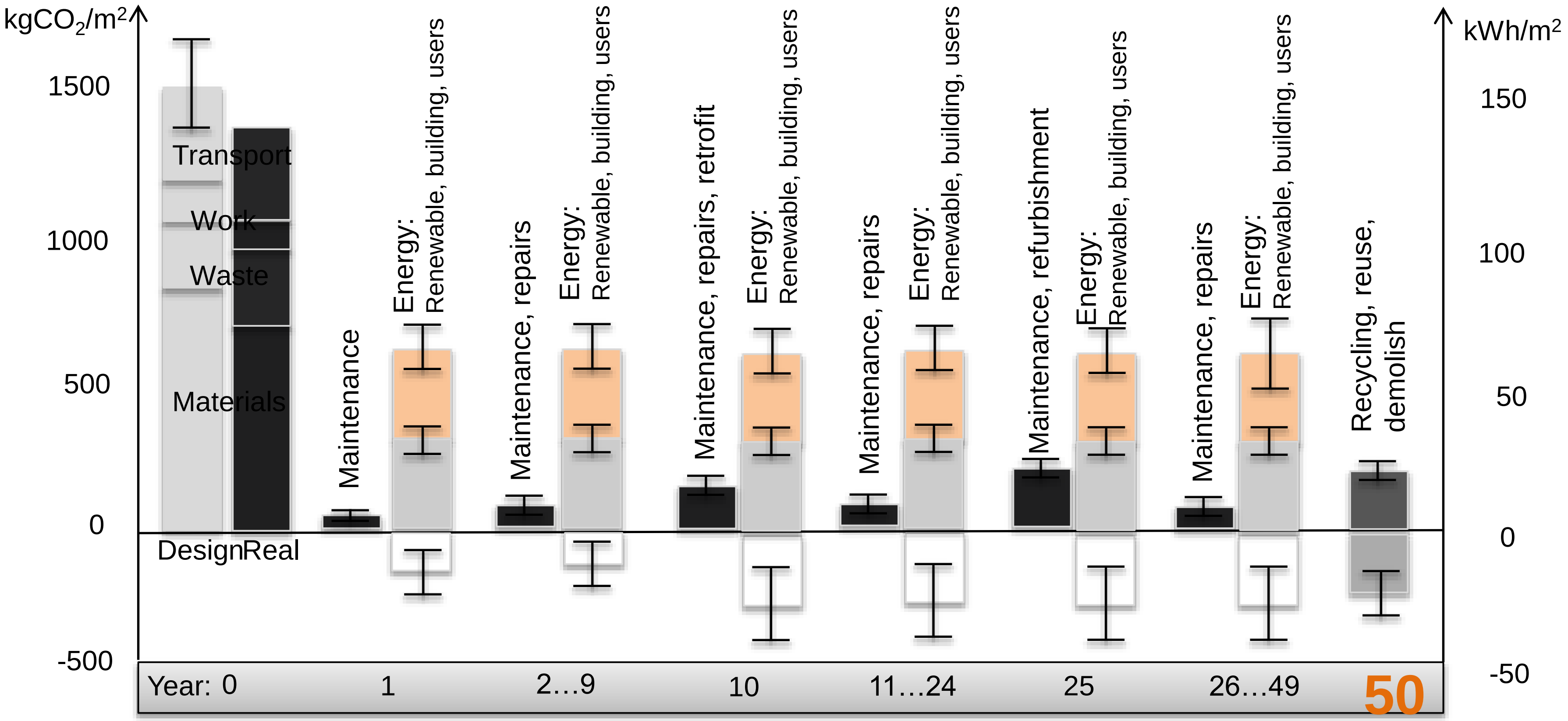
Uniformat Level					Omniclass Level							
1	2	3	4	5	Table	1	2	3	4	5	Termes anglais	Termes français (et liens vers les fiches)
-					13-						SPACE	ESPACE
A					21-	01	00	00	00	00	SUBSTRUCTURE	Sous-structure
A	10				21-	01	10	00	00	00	Foundations	Fondations
A	10	10			21-	01	10	10	00	00	Standard Foundations	Fondations standards
A	10	20			21-	01	10	20	00	00	Special Foundations	Fondations spéciales
A	20				21-	01	20	00	00	00	Subgrade Enclosures	Enceinte en sous-sol
A	20	10			21-	01	20	10	00	00	Walls for Subgrade Enclosures	Murs d'enceinte en sous-sol
A	40				21-	01	40	00	00	00	Slabs-on-Grade	Dalle inférieure
A	40	10			21-	01	40	10	00	00	Standard Slabs-on-Grade	Dalle inférieure standard (dallage)
A	40	20			21-	01	40	20	00	00	Structural Slabs-on-Grade	Dalle inférieure structurelle (radier)
A	40	30			21-	01	40	30	00	00	Slab Trenches	Tranchées de dalles
A	40	40			21-	01	40	40	00	00	Pits and Bases	Puits et bases
A	40	90			21-	01	40	90	00	00	SlabOn-Grade Supplementary Components	Composants supplémentaires
A	60				21-	01	60	00	00	00	Water and Gas Mitigation	Atténuation de l'eau et du gaz
A	60	10			21-	01	60	10	00	00	Building Subdrainage	Sous-drainage du bâtiment
A	60	20			21-	01	60	20	00	00	Off-Gassing Mitigation	Atténuation du dégagement de gaz
A	90				21-	01	90	00	00	00	Substructure Related Activities	Activités relatives à la sous-structure
A	90	10			21-	01	90	10	00	00	Substructure Excavation	Excavation en sous-structure
A	90	20			21-	01	90	20	00	00	Construction Dewatering	Drainage
A	90	30			21-	01	90	30	00	00	Excavation Support	Support à l'excavation
A	90	40			21-	01	90	40	00	00	Soil Treatment	Dépollution
B					21-	02	00	00	00	00	SHELL	Enveloppe
B	10				21-	02	10	00	00	00	Superstructure	Superstructure
B	10	10			21-	02	10	10	00	00	Floor Construction	Construction des dalles supérieures
B	10	20			21-	02	10	20	00	00	Roof Construction	Construction des toitures
B	10	80			21-	02	10	80	00	00	Stairs	Escaliers
B	20				21-	02	20	00	00	00	Exterior Vertical Enclosures	Enceinte verticale extérieure
B	20	10			21-	02	20	10	00	00	Exterior Walls	Murs extérieurs
B	20	20			21-	02	20	20	00	00	Exterior Windows	Fenêtres extérieures
B	20	50			21-	02	20	50	00	00	Exterior Doors and Grilles	Portes extérieures
B	20	70			21-	02	20	70	00	00	Exterior Louvers and Vents	Jalousies et conduits extérieurs
B	20	80			21-	02	20	80	00	00	Exterior Wall Appurtenances	Accessoires des murs extérieurs
B	20	90			21-	02	20	90	00	00	Exterior Wall Specialties	Spécialités du murs extérieurs
B	30				21-	02	30	00	00	00	Exterior Horizontal Enclosures	Enceinte horizontale extérieure
B	30	10			21-	02	30	10	00	00	Roofing	Toiture
B	30	20			21-	02	30	20	00	00	Roof Appurtenances	Accessoires de toit
B	30	40			21-	02	30	40	00	00	Traffic Bearing Horizontal Enclosures	Toiture terrasse
B	30	60			21-	02	30	60	00	00	Horizontal Openings	Ouvertures horizontales
B	30	80			21-	02	30	80	00	00	Overhead Exterior Enclosures	Couvertures externes

Building Passport

Name:
Address:
Year of completion:
Heated floor area:
Number of occupants:

Designed indoor climate class: A/B/C	Measured user satisfaction: %

Indoor Environment Quality



Primary kWh/m^2	Embodied: $kgCO_2/m^2$	Operational: $kgCO_2/m^2,a$	Embodied: $kgCO_2/m^2,a$	-	Recycling: $kgCO_2/m^2$	Measured kWh/m^2	Energy $kgCO_2/pers,a$	Travel $kgCO_2/pers,a$	Water $m^3/pers,a$
Energy Performance Certificate	Designed carbon footprint of building					Display Energy Certificate	Annual Footprint	Recycling of waste %	Landfill waste kg/pers,a

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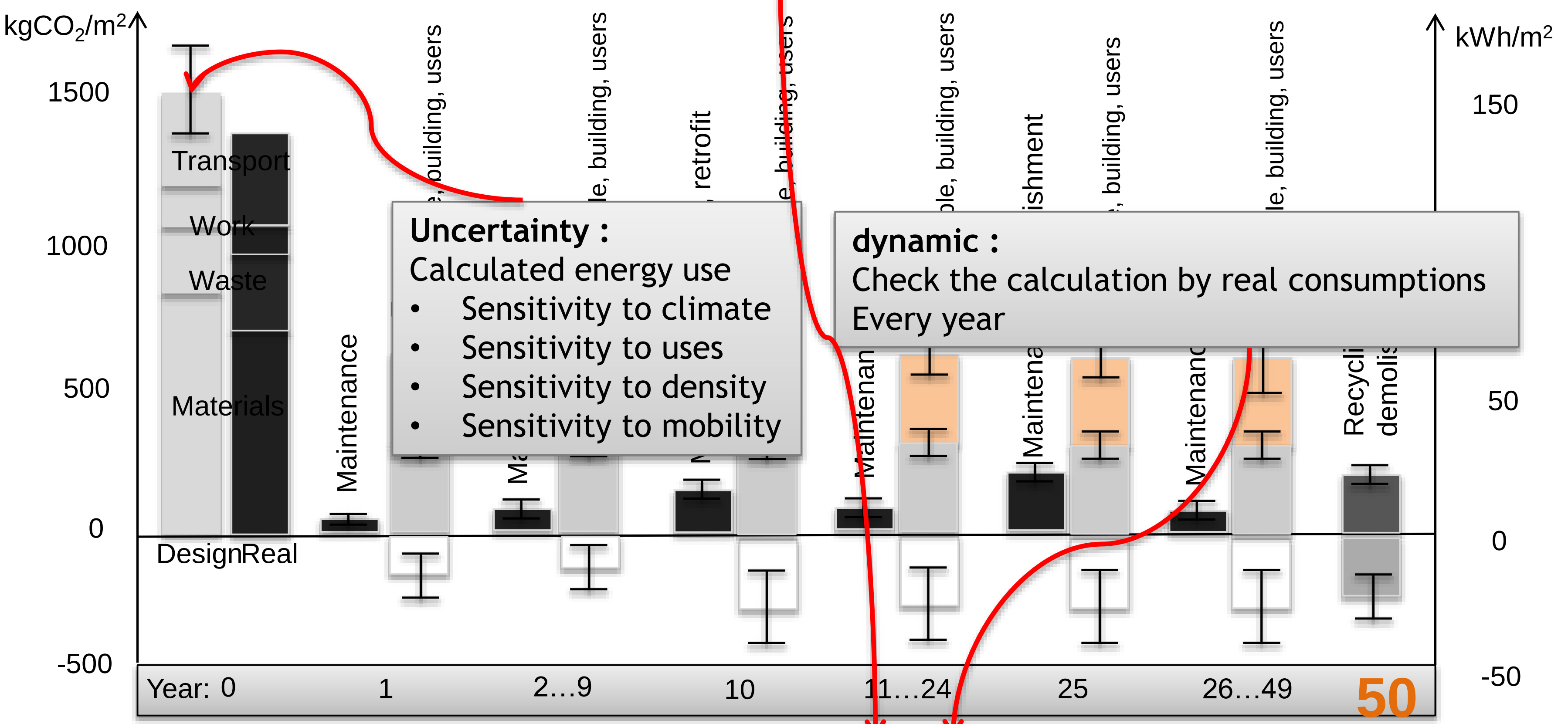
Building Passport

Name:
Address:
Year of completion:
Heated floor area:
Number of occupants:

Designed | Measured user satisfaction: % — Indoor Environment Quality

IPMS and IPMVP :
Measurement definition



Uncertainty :
Calculated energy use

- Sensitivity to climate
- Sensitivity to uses
- Sensitivity to density
- Sensitivity to mobility

dynamic :
Check the calculation by real consumptions
Every year

Primary kWh/m²	Embodied: $kgCO_2/m^2$	Operational: $kgCO_2/m^2$,a	Embodied: $kgCO_2/m^2$, a	- Recycling: $kgCO_2/m^2$	Measured kWh/m²	Energy $kgCO_2$/pers,a	Travel $kgCO_2$/pers,a	Water m^3/pers, a
Energy Performance Certificate	Designed carbon footprint of building				Display Energy Certificate	Annual Footprint	Recycling of waste %	Landfill waste kg/pers, a

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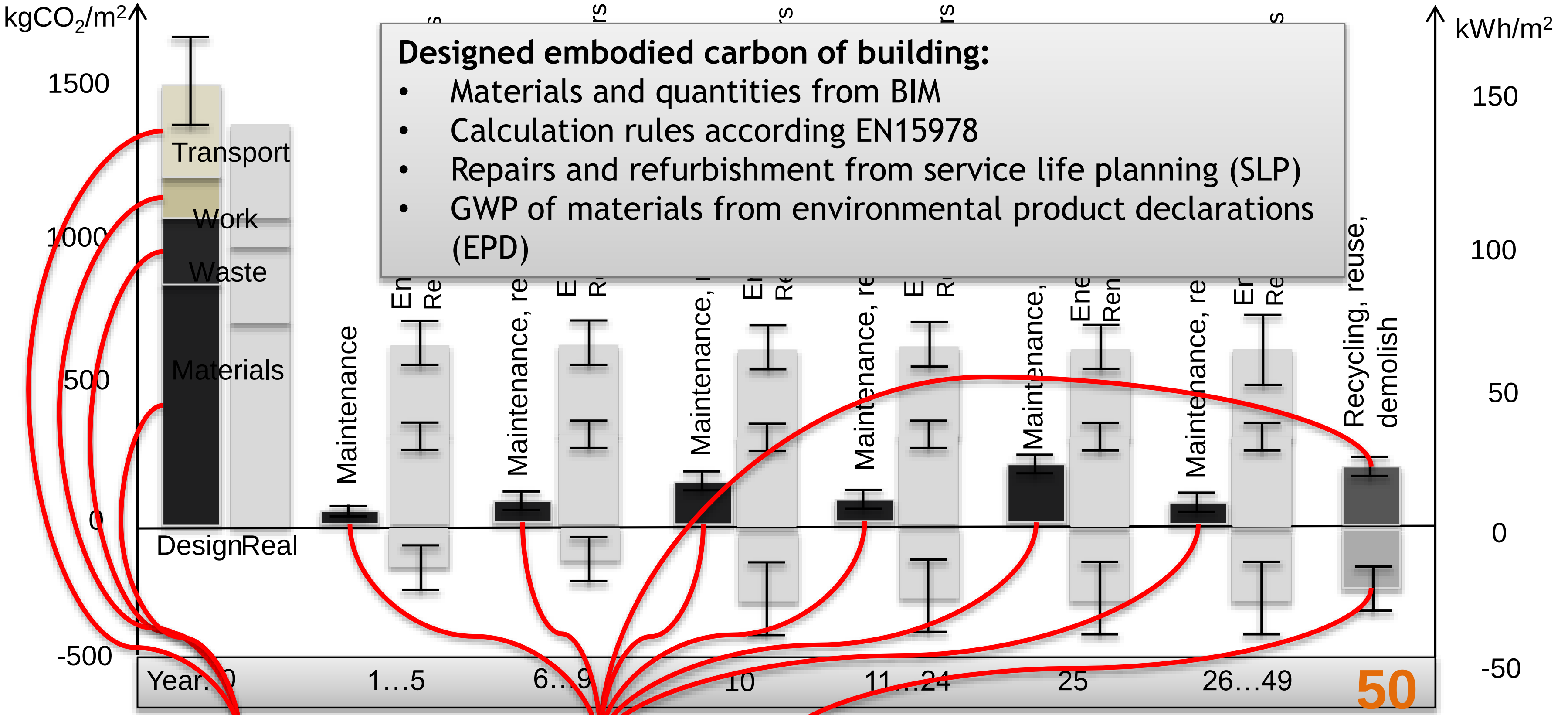
Building Passport

Name:
Address:
Year of completion:
Heated floor area:
Number of occupants:

Designed indoor climate class: A/B/C	Measured user satisfaction: %

Indoor Environment Quality



Designed embodied carbon of building:

- Materials and quantities from BIM
- Calculation rules according EN15978
- Repairs and refurbishment from service life planning (SLP)
- GWP of materials from environmental product declarations (EPD)

Primary kWh/m^2

Energy Performance Certificate

Embodied: $kgCO_2/m^2$ | Operational: $kgCO_2/m^2,a$ | Embodied: $kgCO_2/m^2,a$ - Recycling: $kgCO_2/m^2$

Designed carbon footprint of building

Measured kWh/m^2

Display Energy Certificate

Energy $kgCO_2$/pers,a | Travel $kgCO_2$/pers,a | Water m^3/pers,a

Recycling of waste % | Landfill waste kg/pers,a

Annual Footprint

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Holistic approach with 8 metrics

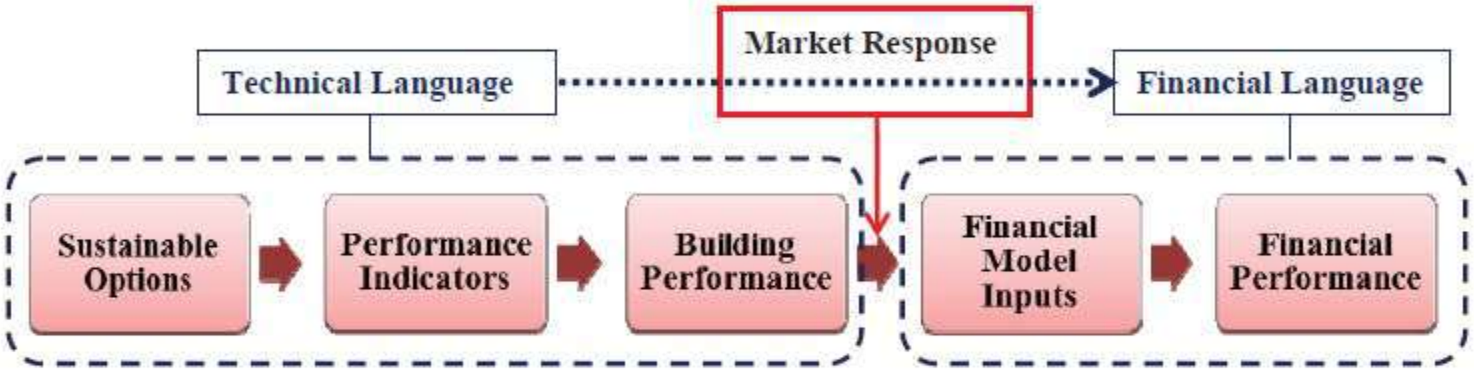
Economy
- Lifecycle Cost (EN 15643-4)

Energy
- Imported energy
- Imported primary energy
- Baseload power

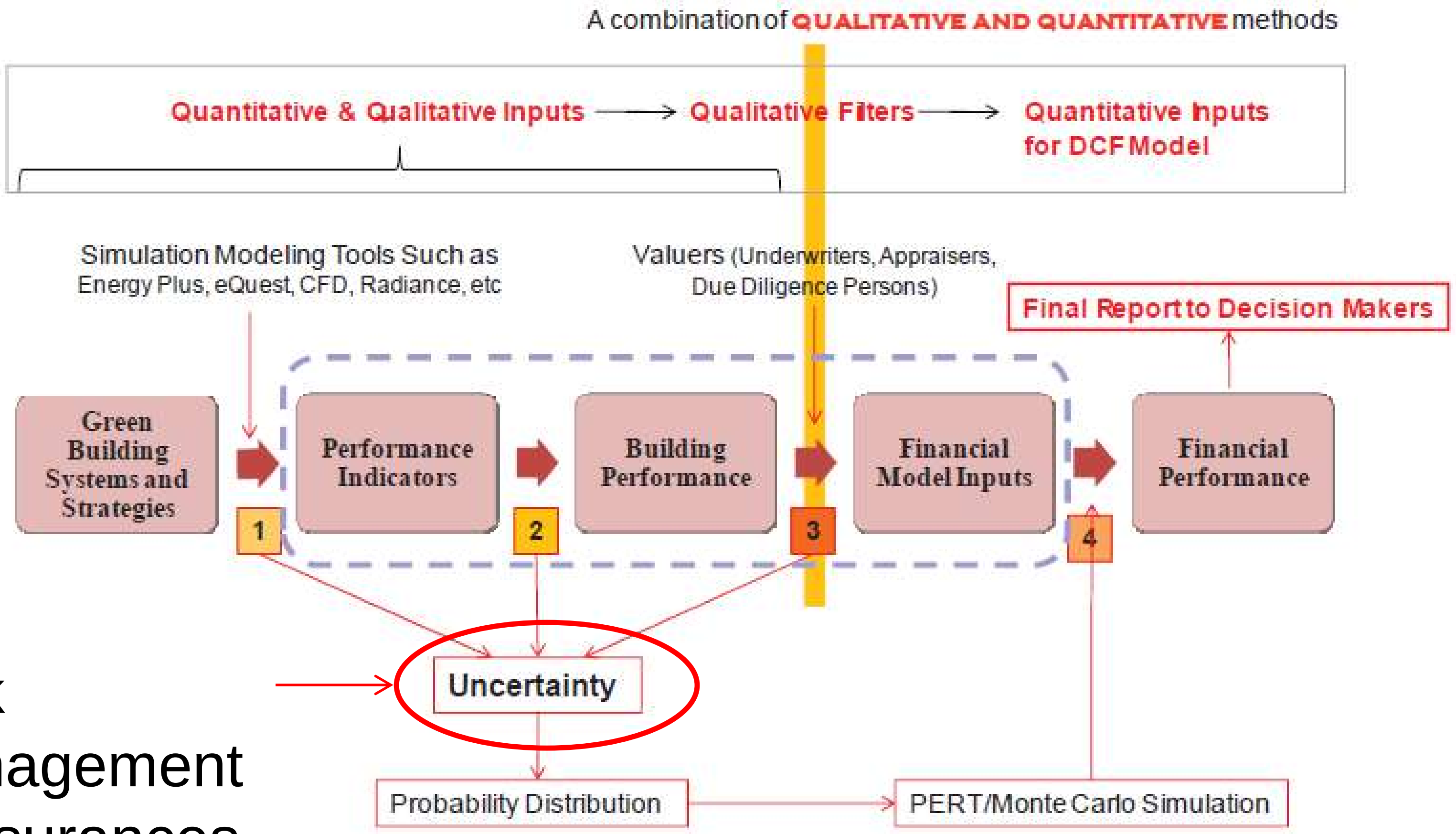
Global warming
- Life-cycle carbon footprint (EN 15978)
- Operating carbon footprint (GHG Protocol)

Occupants
- Indoor air quality classification
- Share of satisfied occupants

Communication but mainly translation



The challenge



Risk management & insurances

A FRAMEWORK FOR INTEGRATING VALUE AND UNCERTAINTY IN THE SUSTAINABLE OPTIONS ANALYSIS IN REAL ESTATE INVESTMENT

Alireza Bozorgi

- BAS : Building As a Service ?