

# Selection and Evaluation of Indicators for a Building Energy Labeling System for Colombia

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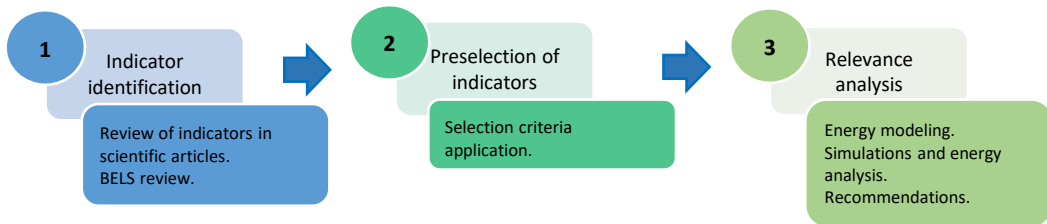
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## INTRODUCTION

- Buildings are responsible for 37% and 39% of total energy consumption and related polluting emissions.
- Buildings with energy-efficient and environmentally friendly designs have become the world trend to reduce energy consumption.
- Colombia has a dynamic construction sector and is making progress in establishing a legal framework for energy efficiency in buildings (RES 0459, CONPES 3919).
- In terms of certification and sustainable construction seals, the Colombian Council for Sustainable Construction (CCCS) reported in 2021 about 700 registered projects to obtain any of the certifications that are available in Colombia (LEED, EDGE, CASA, HQE, WELL among others).
- Despite these advances, the revitalization of the market for energy-efficient buildings requires, among other things, tools that make the benefits of efficient projects visible and stimulate their supply and demand. Therefore, an energy labeling system - BELS for buildings is a priority.
- This work seeks to select a group of indicators of potential application in the BELS for Colombia.

## METHOD



## RESULTS

### Indicator identification

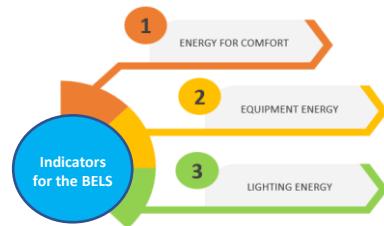


Assessed aspect	Indicators
Energy performance	Total annual energy consumption [kW/m <sup>2</sup> ]
	Annual energy consumption in refrigeration [kW/m <sup>2</sup> ]
	Annual energy consumption in lighting [kW/m <sup>2</sup> ]
	Energy savings by generation on-site [kW/m <sup>2</sup> ]
	Energy savings through high energy efficiency strategies [kW/m <sup>2</sup> ]
Thermal comfort	Energy sustainability level
	Annual hours of thermal discomfort [Hours/year]
	Thermal comfort indices
	Air temperature [°C]
	RH [%]
Polluting emissions	Airspeed [m/s]
	Annual emissions CO <sub>2</sub> [kg <sub>eq</sub> CO <sub>2</sub> /m <sup>2</sup> ]

### Preselection of indicators

Selection criteria application.

- Scientific literature review.
- BELS review.
- Results of energy simulation tools.
- Expert opinion.



### Relevance analysis



Result type		Low Income Multifamily Housing	Median Income Multifamily Housing	High-Income Multifamily Housing	Offices
Distribution of consumption in apartments/offices	Equipment [%]	95.72	83	71.27	46.4
	Lighting [%]	8.75	11	5.15	15.6
	HVAC [%]	-	14 – Only in two buildings	23.55	38
Distribution of energy consumption in common areas	Elevators and pumps [%]	56.10	83	87.4	62.4
	Lighting [%]	12.59	16	8.4	9.6
	HVAC [%]	-	2.4 – In a building	2.4	18.4
	Others [%]	11.7	-	1.8	9.6
	PPD [%]	30.31	26	16.9	20.3
Thermal comfort	PMV	Hot	Slightly hot	Slightly hot	Neutral
	Hours of discomfort [%]	29.8	12.22	5.6	41.3
	Occupation [%]	18.46	20.70	10.2	6.7
	Lighting [%]	1.48	3.07	1.1	6.6
	Equipment [%]	15.16	16.15	12.4	39.3
Distribution of thermal gains	Solar radiation through windows [%]	53.10	50.55	72.8	41.0
	Air between zones [%]	0.80	5.17	2.1	2.8
	Infiltrations [%]	0.03	0.00	0.00	0.7
	Thermal conduction through opaque enclosures [%]	10.83	4.33	1.4	3
	Natural ventilation [%]	87.77	66.97	75.2	77.2
Thermal loss distribution	Thermal conduction through opaque enclosures [%]	12.22	21.53	24.8	22.8

## CONCLUSIONS

- Several countries have chosen to evaluate the energy performance of their buildings through indicators such as the annual thermal demand or the intensity of annual energy consumption.
- In countries with a tropical climate, the energy evaluation of their buildings tends to consider in greater depth the efficiency of the envelope and its systems.
- The energy evaluation of the building typologies object of the BELS supports the previous selection of indicators. The results of the simulations reveal the equipment and the lighting system as the uses with the greatest weight in the distribution of consumption.
- The results of frequent thermal discomfort in most of the categories analyzed suggest considering this parameter as part of a comprehensive evaluation of the building. This evaluation can be achieved by considering energy for comfort as an indicator.