

## Track 3: Advancing SBE Assessments

### Session 1.5 SBE Assessments - Green Neighbourhoods (1)

## LEED Certification and the New Standard of Sustainable Construction in Colombia

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### ABSTRACT

The Decree 1285 of 2015 is the new standard for sustainable construction in Colombia, with technical parameters and design guidelines adopted by Resolution 0549. This normative has increased public and private interest in the subject, in order to develop a sustainable construction industry. However, there is a lack of technical and practical knowledge in architects and builders, and the recent process of training on sustainability guidelines and its relation to the standard are insufficient to shape a critical mass for its application in architectural process. This situation constitutes a commercial opportunity for the promotion of LEED certification in Colombia and their representatives. They having publicity stated in academic events and media, that compliance with a LEED certification is enough to fulfil the guidelines of the Sustainable Construction standard. However, this statement lacks technical support, turning a model of visual, media and distorted sustainability. This paper evaluates the real water and energy consumption of an office building with LEED Gold certification in Medellín and its relation to the sustainable construction standard, with the aim to determine if a building with LEED certification can reach the goals established by the Colombian standard. The results show differences of 172% in energy consumption and 81% in water consumption between the real and the expected consumption. This suggests that there is no guarantee to meet the standard through a payment of a foreign system, but it threatens the expectation of sustainable construction in Colombia.

**Keywords:** *sustainable design education, sustainable construction, LEED certification*

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### 1. INTRODUCTION

The Decree 1285 of 2015 is a new standard in Colombia that proposes sustainable construction guidelines for buildings, aimed to improving the quality of life of inhabitants and to promote the implementation of actions with environmental and social responsibility from the construction industry (Ministerio de Vivienda Ciudad y Territorio Republica de Colombia 2015a)

In order to apply the Decree 1285, technical parameters and design guidelines were adopted by Resolution 0549 of July 10th, 2015 (Ministerio de Vivienda Ciudad y Territorio Republica de Colombia 2015b). This resolution is intended to establish minimum percentages of consumption and saving strategies of water and energy in buildings, through the adoption of the Sustainable Construction Guide (Annex 1 of Resolution 0549), with the intention to project an efficient operational life of buildings.

While these situations occur, either a positive application of the rule from the updating and training of professionals or a critical rejection against to implementation of a regulation that can be weakly promoted by the State, it is also expected a model of commercial opportunism, associated with the sale and purchase of LEED certification in Colombia. In other words, the construction sector is in risk of continuing and increasing the practices of pseudo-sustainability as Greenwash, in response to the standard of sustainable construction (González et al. 2012)

According to the previous statement, professional associations assigned to the United States Green Building Council (USGBC), are seeking the implementation of LEED certification system in the country without a critical review of it, from a technical and economic point of view. The process of analysis and marketing of LEED system, developed for seasonal weather conditions, is applied without any consideration of geographical and climatic conditions of the diverse regions of Colombia. In opposite to this condition is necessary to emphasise that

Resolution 0549, have as a starting point for the energy efficiency and saving water analysis, the incidence of four types of climate differentiated for major regions of the country.

However, after the publication of the Decree 1285 in 2015, academic events and public declarations took place, in which it was stated that 182 projects in Colombia, until July 2015, where LEED certifications were applied, which sums up to a total of 3.7 million m<sup>2</sup>, "... [They] come surpassing the minimum efficiency established by the guidelines for saving water and energy in buildings..." (Consejo Colombiano de Construcción Sostenible 2015).

Given this situation, it is necessary to establish from an objective point of view, if the application of the LEED system in Colombia is valid and a guarantee to fulfil the requirements of the Decree 1285, with its statutory Resolution 0549. This analysis is, therefore, the overall objective of this article, developed by professionals and researchers in the field of bioclimatic design, energy efficiency and sustainable construction in the Colombian context, with more than 15 years of experience.

## 2. METHODOLOGY

To perform this research, an office in Colombia, was taken as a study case. This building has a LEED Gold certificate, under the application of the system LEED O + M: Existing Buildings v3 - LEED 2009 (U.S. Green Building Council 2009), which focuses on existing buildings and certifies the operations and maintenance activities, has implemented. The study case is localised in Medellín, Colombia, city with a mild weather according to the Resolution 0549 (Annex 2). The building has a built office area of 50,000 m<sup>2</sup>, and an average population of 4,000 people.

Based on the consumption data on energy and water obtained from an internal source of the analysed building (Alis Restrepo 2014), correlations between aspects of LEED certification and Decree 1285 were made, with analytical work performed in two stages:

### 2.1 Analysis of LEED O + M and the respective results of the case study

The scope of the first stage corresponds to the study of the chapters of the LEED certification, with the purpose of identifying the requirements to obtain it. The information is reviewed from the certification guide in the web page of LEED System (U.S. Green Building Council 2009). In this process, the points of energy efficiency and water efficiency are checked to determine the level of sustainability that compliance with these factors represent for the classification.

Finally, public information recorded in the study case "scorecard" is reviewed to determine its particular level of performance in energy and water, connecting their level of certification as a sustainable building. This information is available online in the LEED system, from where it was taken (USGBC 2016).

### 2.2 Theoretical exercise of application of resolution 0549 on the building

In a second stage, verification of energy and water performance of the study case building were made. Real consumption of energy and water were analysed, regarding energy consumption and water from the guideline of resolution 0549. It was calculated the level of savings required in the study case, according to the percentages of mandatory reduction in water and energy consumption, according to their use and the climate zone where the project is located.

The analysis conditions for the study case correspond to an office building located in mild weather. The baseline type indicated by the resolution 0549 is presented in Table 1. The table shows the values for all the weathers and it is highlighted the mild weather, where the building is located.

Office Building Baseline	Cold	Mild	Warm dry	Warm humid
Energy Consumption (kWh/m <sup>2</sup> /year)	81,2	132,3	318,2	221,3
Water Consumption (l/per/day)	45,0	45,0	52,0	45,8

Table 2: Baseline of energy and water consumption for an office building according to resolution 0549. Adapted of Ministerio de Vivienda Ciudad y Territorio (2015b)

Starting from the consumption per m<sup>2</sup> benchmark, the expected water and energy consumptions were projected, considering the building area and its population. It is important to emphasize that the estimated data will correspond to a building that does not include sustainability criteria. Afterwards, the savings percentages established by the Resolution were applied, considering those percentages that will be required at a national level from 2017. The percentages of water and energy savings are presented in Table 2.

Saving percentages relative to baseline of office buildings (%)	Cold	Mild	Warm dry	Warm humid
Energy	30	30	40	30
Water	30	35	45	20

Table 3: Percentages of savings for office buildings in the second year of implementation of the resolution. Adapted of Ministerio de Vivienda Ciudad y Territorio (2015b)

With the projections of the buildings consumption and the reductions needed according to the parameters of the Resolution, the case should ensure savings of 30% in energy and 35% in water, regarding the benchmark defined for the weather of Medellin. Therefore, it will be expected that a building with energy efficiency and water saving criteria should reach the consumptions calculated. Regarding the objective of this paper, especially a building with LEED certification, as the study case, should have a consumption with the savings calculated, according to the affirmations of the Consejo Colombiano de Construcción Sostenible (2015).

### 3. RESULTS

#### 3.6 LEED certification O+M and score of study case

According to the checklist of the LEED v4 for Operations & Maintenance: Existing Buildings, there are 110 potential points. Figure 1 shows the range to different certificates depending on the obtained points.



Figure 34: LEED certification rating system. Based of online checklist (USGBC 2014)

The points are classified into 7 categories: Sustainable sites (26 points), water efficiency (14 points), energy & atmosphere (35 points), material & resources (10 points), indoor environmental quality (15 points), innovation (6 points) and regional priority (4 points). Figure 2 shows the seven categories and its respective points.

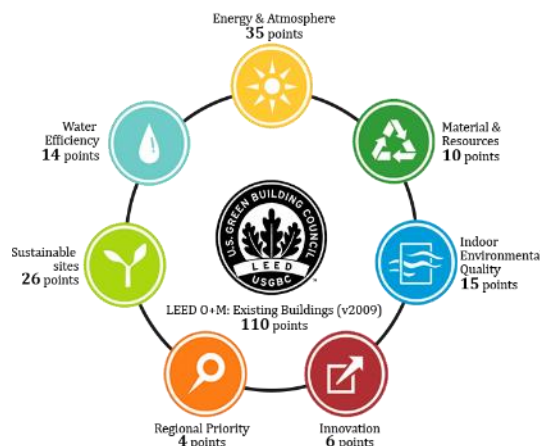


Figure 35: Categories LEED O+M and assigned points. Based of online checklist (USGBC 2014)

With this information, it is possible to deduce that, even if no significant scores are reached in energy and water, whose values added are equivalent to 49 points, it could be obtained from a Certified to a Gold certification level, with the 61 points remaining in the other categories.

The LEED certification process requires the fulfilment of three conditions related to energy and atmosphere: Monitoring the consumption of the building, not using cooling gases with high impact on the greenhouse effects and to be subjected to an assessment of energy performance, executed under Energy Star system's parameters. The report on that last condition will only determine the points to be certified for energy, without conditioning the level of certification for a minimum range of compliance. The water efficiency category only has one prerequisite, a minimum indoor plumbing fixture and fitting efficiency. Is worth noting that the use of efficient fittings, is part of the national normative about hydraulic performance of buildings since 1998.

Figure 3 shows the case study scorecard summary. The study case reached a total of 73 points of 110 possible. Only 33 of those are related to the performance of the project on water and energy use, out of a total amount of 49 achievable points on these topics in the LEED system.

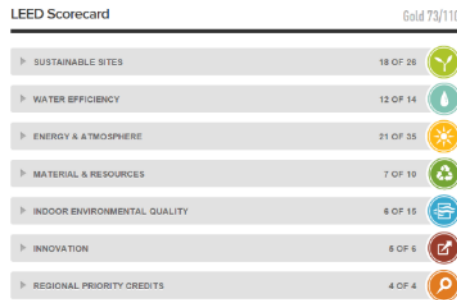


Figure 36: Study case scorecard. Source: USGBC (2016)

The energy and water points obtained by the case study, only represent 45% of the possible certification points. A detailed view of the points in water and energy categories does not find a direct relation to the requirements associated to Resolution 0549 (Figure 4), although energy certification points are developed under a model of analysis Energy Star that may be used in the methodology for the Colombian standard. However, this analysis is developed with a database of buildings in climate, economic and cultural contexts different to the Colombian context.

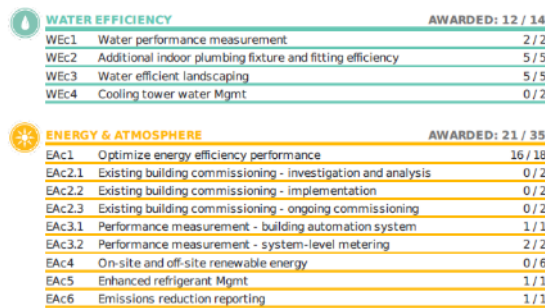


Figure 37: Detailed points for water and energy categories. Score obtained by the study case

### 3.7 The study case expected performance according to resolution 0549 and real consumption of the building

If is considered that a LEED certified building can exceed the minimum ranges of energy and water efficiency established by Resolution, a LEED Gold certification should be near or above to the maximum level range to reach the application of the regulation in its full implementation. In order to determine this aspect, it is necessary to know the real consumption of the building and its relation with the expected performance according to Resolution 0549.

The data of annual energy consumption of the study case over the past six years, are presented in Figure 5. It is important to highlight that since the entry into operation of the building in 2010, it has reduced its energy consumption by 23% by 2015, passing from a consumption of 16,640,867 kWh in 2010 to 12,762,052 kWh in 2015, thanks to the internal management.

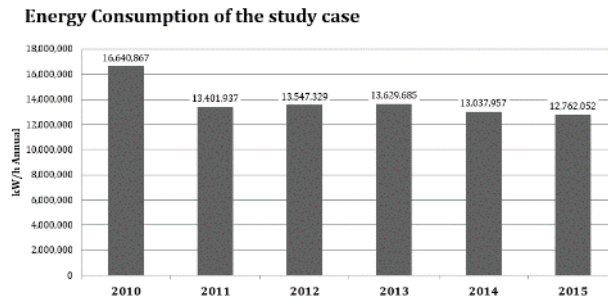


Figure 38: Annual energy consumption of study case 2010 to 2015. Source: Building operator, 2015

The energy consumption includes spaces for a different use from offices, which are responsible for 3% of annual energy consumption of the building, equivalent to 7623 kWh of the 12,762,052 kWh consumed in 2015. Consequently, the analysis will be performed with a value of 12,634,428 kWh annual, corresponding only to the office consumption.

The results of the energy consumption projection and energy consumption goal according to the baseline in the Resolution 0549 are presented in Table 3. The energy consumption projection is calculated based on the built office area of the building, excluding parking lots and areas with different uses, equivalent to 50,000 m<sup>2</sup>.

Energy	
Built area Case of Study (m <sup>2</sup> )	50,000
Baseline (kWh/m <sup>2</sup> annual)	132.3
Average annual energy consumption of study case (kWh)	6,615,000
Mandatory percentage reduction (%)	30%
Annual energy consumption goal of study case (kWh)	4,630,500

Table 4: Energy consumption projection and energy consumption goal. Based in Ministerio de Vivienda Ciudad y Territorio (2015b)

The data in Table 3 show that in the study case, an office building located in a mild weather, with 50,000 m<sup>2</sup>, would have a baseline annual consumption of 6,615,000 kWh. Applying the 30% mandatory reduction is determined that the annual energy consumption, should be 4,630,500 kWh. Faced this benchmark, the consumption of the last year of the building, estimated at 12,634,428 kWh, exceeds the baseline in 8,003,928 kWh annual, i.e. 172%.

Regarding water sub-item, Figure 6 shows the values of global consumption the years 2014 and 2015, only data available from the building operator.

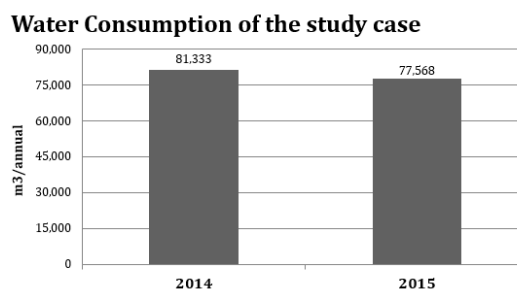


Figure 39: Annual water consumption of study case 2014 and 2015. Source: Building operator, 2015

The results of the water consumption projection and water consumption goal according to the baseline in the Resolution 0549 are presented in Table 4. The water consumption is calculated based on 4000 people, average population in the building.

Water	
<i>Total of people in the building</i>	4000
Baseline (l/person/day)	45
Average annual water consumption of study case (m <sup>3</sup> )	65,700
Mandatory percentage reduction (%)	35%
Annual water consumption goal of study case (m <sup>3</sup> )	42,705

Table 5: Water consumption projection and energy consumption goal. Based in Ministerio de Vivienda Ciudad y Territorio (2015b)

In relation to the baseline of the Resolution, the study case with 4000 people using the building, would have an annual base water consumption of 65,700 m<sup>3</sup> as shows Table 5. Applying the mandatory percentage of reduction corresponding to 35%, a total of 42,705 m<sup>3</sup>/ year of water is obtained as consumption goal. Therefore, it is established that the current consumption, corresponding to 77.568 m<sup>3</sup>/ year of water in 2015, is 81% above the limit of savings defined by the Resolution.

#### 4. CONCLUSION

The analysis carried out in the study case as a benchmark of a certificated LEED Gold building and its comparison with Resolution 0549, allows to identify the level of complexity that must be anticipated by architects and builders to face the immediate implementation of the new standard for sustainable construction in Colombia, the Decree 1285, from several aspects. The first one refers to a necessary criticism approach, to the analysis process of baseline and savings percentages defined by Resolution 0549.

However, this theoretical exercise was made with an existing building and it is possible that the differences found in this research may be produced because they were not originally designed under efficiency parameters and recommendations of the guide attached to the Resolution, even when it is a sustainable building with a LEED certification. Remains then the possibility that only new buildings, designed under efficiency parameters and according to the Design Guide, have the option of reaching the level of demand required by the Decree. This affirmation should be the subject of an investigation, after this work and in an urgent way, because the imminent entry into effect of the Decree 1285 and its Resolution 0549.

The results of the study case, a building with a LEED Gold certification, facing the efficiency ranges of Resolution 0549, show differences in performance of 172% in energy consumption and 81% in water consumption. This suggests that the guarantee to achieve the requirements of the Resolution, through a payment of a foreign seal, distorted in its own origin, is not only naive but an ethical irresponsibility against the expectation of sustainable construction.

Furthermore, a review of the LEED system allows identifying that according to its operation, the certification can be obtained without significant scores on energy and water items. Although it is necessary to fulfil some prerequisites, the level of energy efficiency and water consumption that these can mean for a building in a context like the Colombian, and its relationship to the new standard of sustainable construction in this country, is still a topic under review.

However, this highlights the need for local responses to achieve a real systemic sustainability, through public policies that are already being implemented in some cities, and the real commitment of the building sector to reach goals beyond a certification or standard compliance. The paper should finish with a conclusion which provides the major points of your paper.

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