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Serdar **ULUBEYLI**

Serkan **KIVRAK**

YTÜ

YILDIZ TECHNICAL UNIVERSITY



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Leadership in Energy and Environmental Design (LEED) vs. National Green Certification System (YES – TR) in Building Materials Category Comparison

E. Deniz
Kocaeli University, Graduate School of Science and Technology, Architecture Program, Kocaeli, Turkiye
emibedeniz@gmail.com

R. Kömürlü
Kocaeli University, Architecture and Design Faculty, Department of Architecture, Kocaeli, Turkiye
ruveyda.komurlu@kocaeli.edu.tr, ruveydakomurlu@gmail.com

Abstract

The remarkable growth in advanced construction techniques has significantly increased the demand for sustainable buildings. Many countries have taken important steps in this field by introducing sustainability, green building assessment tools. Leadership in Energy and Environmental Design (LEED) is a programme initiated by the US Green Building Council. National Green Certification System (YeS-TR) is the certification system issued by the Ministry of Environment, Urbanisation and Climate Change in Turkiye. Building materials evolve with the advancement of technology and develop with the aim of having low emission, sustainable, recyclable, and aesthetic properties. The continuous development of materials has created an important context between design and cost concerns. In this study, the material category of LEED and YeS-TR green building assessment certification systems are compared with the help of tables and their common features and differences are given for the new buildings. In LEED and YeS-TR, the material category is ranked fourth in terms of points and ranking in both certification systems. Although both systems have common criteria such as sustainable material supply, waste management and use of low emission materials that encourage material selection, there are differences in scoring types. YeS-TR, which was developed by considering the conditions specific to Turkiye, includes more detailed Building Material and Life Cycle (BLC) Assessment Criteria than LEED. While both systems give high importance to the material category, it is foreseen that this category will further develop and specialise in the future.

Keywords: *green building, green building certification systems, LEED, YeS- TR, building materials.*

Introduction

The concept of green building refers to an approach that aims to consume zero energy and focuses on minimising negative impacts on the environment. The green building movement has

emerged with increasing interest in environmental issues and surprising statistics. This approach has led to sustainable construction being recognised as a major area of interest and included in official projects since the early 1990s. Green building, together with concerns about the number of available resources, triggered this movement. In this context, a green building is a building constructed or remodelled using environmentally friendly design techniques, advanced technologies and materials that minimise environmental impacts (Jerry, 2008).

Different programs have been developed around the world to assess the environmental and energy impacts of buildings and to make the green building concept sustainable. The first environmental certification system was introduced in the United Kingdom in 1990 (Jerry, 2008), "The Building Research Environmental Assessment Method (BREEAM)". In 1998, the Leadership in Energy and Environmental Design (LEED) Green Building Rating System was introduced in the United States, largely based on the BREEAM system. For the first time in Turkiye, a National B.E.S.T.-Housing Certificate was developed by TGBC - Turkish Green Building Council (in Turkish: ÇEDBİK) in February 2013. It was prepared for Turkiye by analysing BREEAM and LEED certificates (TGBC, 2019).

Following these certification systems, the 'Safe Green Building' Certification System was published by the Turkish Standards Institute (TSE). Finally, with the regulation on 'Procedures and Principles of Secure Green Building Certification' published by the 'Ministry of Environment, Urbanisation and Climate Change' in the Official Gazette on 12 June 2022, the Green Certificate system for Buildings and Settlements was implemented and the national 'Yes-TR Green Certificate' system was published (MoEUCC, 2022a and 2022b).

This study will first examine the requirements and processes of LEED and YeS-TR certification systems in detail. Then, by comparing the evaluation criteria of LEED and YeS-TR certification systems, the prominent features of the material category will be determined. In the next stage, the strengths and development areas of both certification systems will be identified. This study aims to identify the differences between LEED and YeS- TR in the material category and to gain a deeper insight into the applicability of the certification process.

Green Buildings and Certification Systems

Green buildings create an environmentally friendly building by reducing environmental impacts on the building, saving energy and water. Green building design has significant impacts not only on the environment but also on human health (Yudelson, 2008). The first critical level is that green buildings directly affect an individual's health by providing optimized indoor environments. These indoor environments increase productivity, reduce stress, and improve people's overall quality of life through clean air quality, use of natural lighting and ergonomic adjustments (Pope, 1993). The second critical level is that green building designs contribute to the reduction of health problems throughout society by reducing energy use and polluting air. As a result, green buildings adopt an approach that focuses not only on environmental sustainability but also on human health (Habre, 2014). There are different certification systems for the assessment of environmental and energy impacts of green buildings.

LEED (Leadership in Energy and Environmental Design)

LEED was developed by the United States Green Building Council (USGBC) in 1998. The LEED certification approach provides a certification process for designing sustainable plans and green construction.

LEED has been in use since 1998 and as of September 2022, more than 155,423 buildings in 165 countries have LEED certification (ElSorady, 2020). Today, this number covers a total of 197,000 buildings (USGBC, 2024). The latest version of LEED is v4.1. In LEED v4.1 certification, a building earns a Certified rating with 40-49 points, Silver with 50-59 points, Gold with 60-79 points and Platinum with 80-110 points. LEED v4.1 adopts the principle of sustainability throughout the entire life cycle of the building. It also measures these sustainable principles comprehensively. LEED v4.1 offers a broader perspective by including the interior spaces of the building in the evaluation process (ElSorady, 2020). LEED v4.1 offers four different types of certificates:

- Building Design and Construction (LEED BD+C)
- Building Operation and Maintenance (LEED O+M)
- Interior Design and Construction (LEED ID+C)
- Building for Neighborhood Development (LEED ND)

This study analyses the criteria of the LEED (BD+C) certification system, which consists of nine main topics or categories. The LEED certification approach provides a certification process for the design of sustainable plans and green construction. LEED v4.1 (BD+C) categories and their corresponding points are as follows: Integrative Solution 1 point, Location and Transportation 9 points, Sustainable Sites 9 points, Water Efficiency 11 points, Energy and Atmosphere 35 points, Materials and Resources 19 points, Indoor Environmental Quality 16 points, Innovation 6 points and Regional Priority 4 points for a total of 110 points (USGBC, 2024).

LEED v4.1 (BD+C)'s "New Building's Materials and Resources" Category

LEED v4.1 (BD+C) evaluates the buildings in the certification process in "New Buildings" and "Existing Buildings" headlines. There are building typologies evaluated in each category. Given building typologies: New Construction, Core and Shell, Schools, Retail, Data Centres, Warehouses and Distribution Centres, Hospitality, Health Services (USGBC, 2024). In this study "New Building" headline is analysed (Table 1). The assessments were made according to LEED's Building Design and Construction (LEED BD+C) New Construction guidelines.

Table 1. LEED v4.1 (BD+C)'s "New Building's Material and Resources" category points.

LEED v4.1 (BD+C)'s "Material and Resources" Category's Credit / Prerequisite	New Building Points
Recyclable Materials	Prerequisite
Construction Waste Management Planning	Prerequisite
PBT Reduction - Mercury	-
Building Life Cycle Impact Mitigation	5
EPD Optimization	2

Source of Raw Material Opt.	2
Material Content Optimization	2
PBT Reduction- Pb, Cd, Cu	-
Furniture and Medical Upholstery	-
Design for Flexibility	-
Construction Waste Management	2
Total	13

In the LEED v4.1 (BD+C)'s "New Building Materials and Resources" category, Recyclable Materials must be provided with the prerequisite of Construction Waste Management Planning. Building Life Cycle Impact Reduction 5 points, EPD Optimisation 2 points, Raw Material Source Optimisation 2 points, Material Content Optimisation 2 points, Construction Waste Management 2 points, total 13 points (Table 1). The remaining items have no points. The ratio of the materials and resources category to other categories in LEED is 17% (USGBC, 2024).

YeS - TR (National Green Certification System)

YeS-TR has been contributed and its development has been supported by the Ministry of Environment, Urbanization and Climate Change, 32 academics from 11 different scientific working groups from 7 countries, universities, and many experts (Özçevik et al., 2018). It is a local assessment system for Turkiye. Its aim is to ensure that it competes with internationally recognized assessment systems all over the world. YeS-TR was announced on November 8, 2019, because of the joint work of the 'Ministry of Environment, Urbanization and Climate Change' and Istanbul Technical University (ITU).

In the first version published by YeS-TR, a guideline that can be applied in both residential areas and buildings has been prepared. There are building typologies that are evaluated in each module. The given building typologies: There are 7 types in total: Housing, Office Buildings, Education Buildings, Hotels, Health Buildings, Shopping and Trade Centres, Other. These two evaluation categories are given as 'New Building' and 'Existing Building'.

The equivalent of the main category expression in LEED is the main module in YeS-TR. YeS-TR consists of 6 main modules (MoEUCC, 2022a).

The scores for the residential building module of YeS-TR are given as follows: Integrated Building Design, Construction and Management (BBT) 15 points, Indoor Environmental Quality (IOK) 20 points, Building Material and Life Cycle Assessment (LCA - YMD in Turkish) 16 points, Energy Use and Efficiency (EKV) 25 points, Water and Waste Management (SAY) 24 points and Innovation_Bina (INO) 10 points, totalling 110 points (MoEUCC, 2022a). The YeS-TR rating system is certified as 'Pass, Good, Very Good and National Outstanding'. YeS-TR certification grades are based on the following minimum and maximum scores: 'Pass' requires 32 to less than 40 points, 'Good' requires 40 to less than 55 points, 'Very Good' requires 55 to less than 75 points, and 'National Distinguished' requires 75 or more points.

YeS - TR Crediting System

YeS-TR promotes more sustainable urban development by lending from different perspectives. At the same time, measurable criteria as well as mandatory criteria provide a flexible framework

for projects to achieve their sustainability goals. YeS-TR placement grades are determined by the 'total weighted credit' points earned. Each module is assessed out of 100 credits, with a maximum of 100 credits. The credit points earned in modules are multiplied by the module's own 'weighting coefficient' to obtain the weights in the green placement. The basic grading system is based on a 'total weighted credit amount' obtained by summing the weighted credit amounts obtained for the categories (MoEUCC, 2022a).

YeS -TR's Housing Type, Building Module's "New Building Material and Life Cycle Assessment (YMD)" Criteria

The 'Building Material and Life Cycle Assessment' category, which is considered in the creation processes of the Green Building Guide, aims to determine the criteria that will minimise the environmental impacts of the materials used in the construction phase of sustainable buildings. These criteria generally aim to reduce the use of depleted and non-renewable natural resources, to reduce solid, liquid, and gaseous wastes resulting from technological and industrial production processes, to minimise wastes mixing with air, soil, and water, and to prevent the negative effects of the materials selected in the formation process of the building on human health. In this way, it is aimed to minimise environmental impacts and contribute positively to human health through the selection and application of materials used in sustainable building projects (MoEUCC, 2022a). YeS-TR "Building Material and Life Cycle Assessment (LCA-Turkish LCA)" is evaluated with 7 categories that are given in Table 2 below with their points.

Table 2. YeS-TR's housing type, building module's "New Building Material and Life Cycle Assessment (LCA- in Turkish YMD)" criteria points.

YeS-TR's Housing Type, Building Module's "New Building Material and Life Cycle Assessment (YMD)" Criteria	Points
YMD 01Building Material Life Cycle Assessment (CUB) and Environmental Product Declaration	25
YMD 02 Healthy Product Declaration (SUB)	21
YMD 03 Radiation Release	5
YMD 04 Responsible Sourcing	8
YMD 05 Local Sourcing	6
YMD 06 Use of Reused, Reclaimed or Recyclable Materials	26
YMD 07 Use of Durable Materials	9
Total	100

Comparison of LEED and YeS-TR's Material Categories

The LEED and YeS-TR systems are green building certification systems with different schemes for various building typologies. The LEED certification system was established in 1998 in the United States by the U.S. Green Building Council (U.S. Green Building Council (USGBC). YeS-TR was published by the Ministry of Environment, Urbanization and Climate Change in 2021 in Turkiye (MoEUCC, 2022a).

Both systems are divided into environmental categories and sub-categories, with a specific number of points or credits for each, and the total points of both categories is 110.

LEED v4.1 offers a category with 9 main headings which are called categories. These main headings have different subheadings within themselves. Each different main heading has its own credit score (Ahankoob, 2013). The sum of the credit score given is 110. YeS-TR has 6 different main modules in the building module. Since LEED v4.1 is an international green building certification system, the points given to each country are equal, but the conditions of each country are not equal (Karademir, 2021). Since YeS-TR is a national green certification system, the points are given in accordance with the conditions of the country. LEED, on the other hand, was scored according to the American region.

According to Gultekin and Bulut (2015), while the protection of water resources is a higher priority in some countries, land use is more important for others. Since such priorities vary according to each country, the application of weighting coefficient is important. In this way, national and regional priorities can be prioritised according to each country and contribute to the elimination of the problems there. Since YeS-TR has this weight coefficient, each country can point according to its own priority.

The assessment of construction materials determined by YMD 01 K1 targets environmentally, economically, and socially beneficial products. Total points are 25. YMD 02 Health Product Declaration (SUB) under K1, K2 prioritises indoor air quality with 21 points. Radiation Emission (YMD 03) aims at user safety with 5 points. Responsible Sourcing (RES 04) provides efficient, sustainable use of materials with 8 points. Local Sourcing (YMD 05) minimises environmental impact and is assessed with 6 points. YMD 06 promotes the use of Recycled Materials with 26 points and YMD 07 focuses on Durable Materials with 7 points. Total module value 100 (Table 3).

Table 3. Comparison of LEED v4.1 (BD+C)'s "New Building's Material and Resources" category and YeS-TR's housing type, building module's "New Building Material and Life Cycle Assessment (LCA- in Turkish YMD)" criteria category.

LEED v4.1 (BD+C)'s "New Building's Material and Resources" Credit / Prerequisite	New Building - Points	YeS-TR "Building Material and Life Cycle Assessment (LCA- in Turkish YMD)" Credit / Prerequisite	New Building - Points
Recyclable Materials	Prerequisite	YMD 06 Use of Reused, Recycled or Recyclable Materials	26
Construction Waste Management Planning	Prerequisite	-	-
PBT Reduction - Mercury	-	-	-
Building Life Cycle Impact Mitigation	5	YMD 01Building Material Life Cycle Assessment (YDD) and Environmental Product Declaration	25
EPD Optimisation	2	-	-
Source of Raw Material Optimization	2	YMD 04 Responsible Sourcing	8
Material Content Optimisation	2	YMD 02 Healthy Product Declaration (SUB)	21
PBT Reduction- Pb, Cd, Cu	-	-	-
Furniture and Medical Upholstery		-	-
Design for Flexibility	-	-	-
Construction Waste Management	2	-	-
-	-	YMD 03 Radiation Release	5
-	-	YMD 05 Local Sourcing	6
-	-	YMD 07 Use of Durable Materials	9
Total	13	Total	100

LEED Material Category points total 13, while YeS-TR offers 16. YeS-TR references TS, ISO, and EN standards, favoring local materials and avoiding international procurement, thus reducing carbon footprint. LEED requires materials within 500 miles, challenging in Turkey, while YeS-TR's local sourcing criterion is 200 km. While LEED emphasises recyclable materials as a prerequisite, YeS-TR requires the use of 5% recycled materials from different sources (MoEUCC, 2022b). YeS-TR's construction and waste management planning requires documentation of 20% of material costs, exceeding LEED's recycled materials criterion (USGBC, 2019; MoEUCC, 2022b). YeS-TR's "Healthy Product Declaration" module offers a more detailed approach with 21 points, replacing LEED's PBT Mitigation categories (MoEUCC, 2022b). In terms of building life cycle impact mitigation, the criteria of YeS-TR are more comprehensive, giving 25 points compared to the 5 points given in LEED (MoEUCC, 2022b). While LEED's criteria are based on American conditions, YeS-TR considers local factors and potentially produces better results (Erten, 2009; Erdede et al., 2014; Kurnaz, 2021).

Results

The use of building materials evolves with technology, aiming for low emissions, sustainability, recyclability, and aesthetics. Both LEED and YeS-TR prioritise material criteria, reflecting the importance of material selection in design and cost concerns. Although they share common criteria such as material reuse and sustainable sourcing, YeS-TR's Building Material and Life Cycle Assessment Criteria provide more detail than LEED's Materials and Resources category. Despite their differences, both certification systems have common features and aim to meet country-specific needs. While LEED has been applied internationally since 1998, YeS-TR, which was introduced in 2022, aims to develop internationally by adapting to Turkey's construction sector and local conditions.

Conclusion

While LEED and YeS-TR certification systems both prioritise the material category, LEED v4.1 is becoming more detailed over time. YeS-TR offers a more comprehensive approach compared to LEED's 13-point system with a total of 100 points and 7 sub-criteria. However, YeS-TR lacks the modules for location and transport and sustainable sites found in LEED, indicating some shortcomings in urban context scoring and environmental impact mitigation. Nevertheless, YeS-TR surpasses LEED in this respect by encouraging recycling in water and waste management.

The widespread use of LEED globally enables regional adaptation, reconsiders limits such as 500 mile radius for material sourcing, and contributes to its ongoing development. In contrast, YeS-TR's focus on local materials within 200 km encourages regional sustainability.

As the number of LEED certified projects in Turkey increases, supporting YeS-TR is vital to promote environmentally friendly building practices. Improvements to YeS-TR, particularly in areas such as location and transport, are expected to increase compliance with international standards and promote sustainability in construction projects.

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