

LEED IN ACADEMIC ARCHITECTURAL EDUCATION

DOI: https://doi.org/10.18485/arh_pt.2024.8.ch56

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ABSTRACT

LEED (Leadership in Energy and Environmental Design) is a green building certification system that uses an elaborate set of tools and criteria for evaluation. It was introduced into the academic curricula of the Faculty of Architecture in Belgrade in early 2010's, thanks to successful collaboration with prominent consultants and educators directly involved in LEED development and application. What started as a single course designed to introduce basics of green building and preparatory lectures for LEED GA (LEED Green Associate) professional accreditation exam, has evolved in time and developed a range of methodologies for specific learning objectives and outcomes for various study programs and course structures. Like all major green building rating systems, LEED constantly evolves what makes its incorporation in academic curricula a challenging task. It is professionally oriented and the majority of the tools and criteria within the LEED system are developed and used by experts in the process of building certification. The paper presents methodologies that use LEED-based tools and criteria as an educational approach that goes beyond the introduction to basic principles of green building. The specific approach challenges the students to assess the environmental impact of their design decisions from the very initial design stages, introduces a wide range of design strategies that can improve the environmental features of their design and encourages them to communicate green features of their design in a variety of ways. The New Green Voice international design competition encompasses use of the LEED system, and the students can take part in it during some of the courses. In 2022, the students from the Faculty of Architecture in Belgrade won the first prize, which verified the relevance and quality potentials of stated methodologies.

KEYWORDS _ *LEED, green architecture, building certification, sustainable architecture, academic education*

INTRODUCTION

LEED (Leadership in Energy and Environmental Design) is green building certification system developed by the U.S. Green Building Council (USGBC; founded 1993) in the late 1990's. By the early 2000's it became rather visible internationally and is considered the most widely used green building rating system in the world. LEED uses elaborate set of tools and criteria for evaluation, aiming to provide a "framework for healthy, efficient, and cost-saving green buildings" (USGBC, 2023).

Green architecture is present in the curricula of Belgrade's Faculty of Architecture ever since 1990 (the specialization "Bioclimatic Design" in the 4th and 5th year of studies). When the collaboration with USAID started in 2010, the general topics of green and sustainable architecture were already well known to a number of lecturers and senior students (Cukovic Ignjatovic et al, 2011). The project of introducing LEED to Serbian professionals, therefore, also involved a "training of trainees" component that enabled the selected teaching staff to deliver verified LEED courses. What started as a single course designed to introduce basics of green building and preparatory lectures for LEED GA (LEED Green Associate) professional accreditation exam, has evolved in time and developed a range of methodologies for specific learning objectives and outcomes for various study programs and course structures. The paper presents the unique methodologies developed within Master and Specialized study programs, as well as key learning outcomes and internationally recognized results.

LEED system and course methodology

LEED rating system addresses goals (Figure 1a) by assessing buildings through a series of categories (Figure 1b). Within each category, a variety of criteria and respective indicators are defined in form of "credits" that earn the points that are counted into the final score and "prerequisites" that need to be met in order to pursue any certification level. LEED GA is basic professional accreditation that demonstrates general knowledge of green building practices and how to support others working on LEED projects. The content of LEED GA course was embedded in several academic courses at the Faculty of Architecture (Table 1), each time adjusting the methodology to the course's position within the curricula, relevant previous knowledge of green design principles and technologies and the possibility to refer to current or recent design studio. Students are encouraged to check (where possible) if their project meets LEED requirements for certain credits and explore design strategies that would help their project meet sustainable goals.

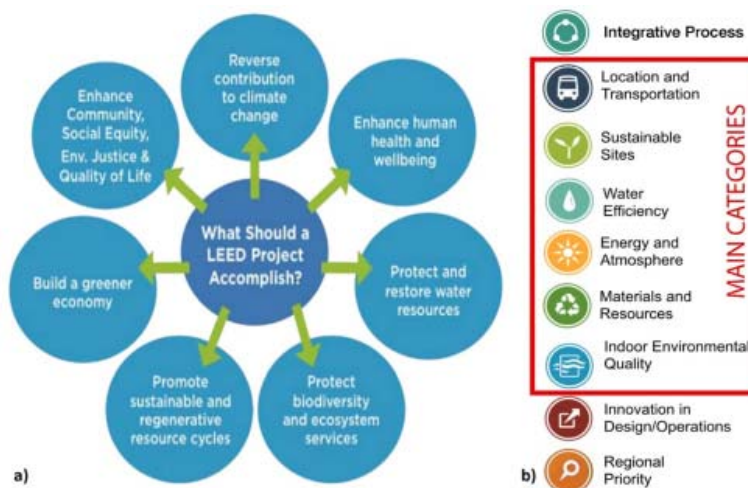


Figure 1: a) LEED system goals (Benjamin, 2017) b) LEED credit categories (per LEED credit library, LEED v4.1)

Table 1: Courses with LEED-related content

Course title	Study program	Course duration	Student activities	Final work
Green building certification systems	Specialized academic studies "Energy efficient and green architecture"	7 weeks / 28 hours in class	Homework and in-class activities: research and assessments	Technical essay (5-6000 words)
LEED and WELL systems in design process	Master academic studies in Architecture	14 weeks / 28 hours in class	Oral presentations, infographic	Technical essay (3-5000 words)
LEED and WELL systems and architectural design	Master academic studies in Architecture - Architectural Technologies	14 weeks / 28 hours in class	Oral presentations, handouts	Poster presentation

SPECIALISED STUDIES COURSE

Within specialised studies course "Green building certification" (mandatory course, 2nd module of Specialised academic studies "Energy efficient and green architecture") LEED is thought with complete LEED GA related content, extended with certain elements relevant for LEED AP (LEED Associate Professional) professional accreditation. While the course was in the same study module with design studio (2012-2018), LEED concepts, design strategies and assessments were tested parallel to design process. Currently, students use a project (preferably from their professional work) and assess it as accurately as possible. For the credits that require specific expertise and/or complex calculations and simulations, students provide a critical overview. Since the complete study program is focused on green building and energy efficiency, students are already acquainted with general concepts and certain tools. The course emphasises the logic behind the green building certification systems, challenges of implementation, "greenwashing" and "LEED brain" (Schendler, 2010). Final work is done in form of an extensive essay (Figure 2), going through all LEED categories and relevant credits.



Figure 2: Sample pages from final work: Specialised studies course "Green building certification", student Bojana Čanković, prof. Nataša Čuković Ignjatović

MASTER STUDIES COURSE

“LEED and WELL systems in design process” (“LEED and environmental aspects of architectural design” 2012-2021) is an elective course in 3rd semester of Master studies in Architecture and 9th semester of Integrated single-cycle-5-year studies in architecture. The main goal of the course is to acquaint students with systems for environmental certification of buildings and trends in contemporary architectural practice that are related to them. During the course, students, through theoretical and practical work, become familiar with the basic principles and strategies of LEED and WELL certification systems, as well as with the possibilities for implementing the acquired knowledge in the design process. The emphasis is, however, on LEED where the complete LEED GA content is included, while WELL is introduced in general, highlighting the equivalences and analogies with some LEED credits, as well as selected preconditions and optimizations that refer directly to architectural design. Direct application and verification of acquired knowledge can also be achieved through work at the international architectural competition NEWH Green Voice Design Competition (Figure 3). In 2022, team from Faculty of Architecture in Belgrade won the first prize, which verified the relevance and quality potentials of stated methodologies.

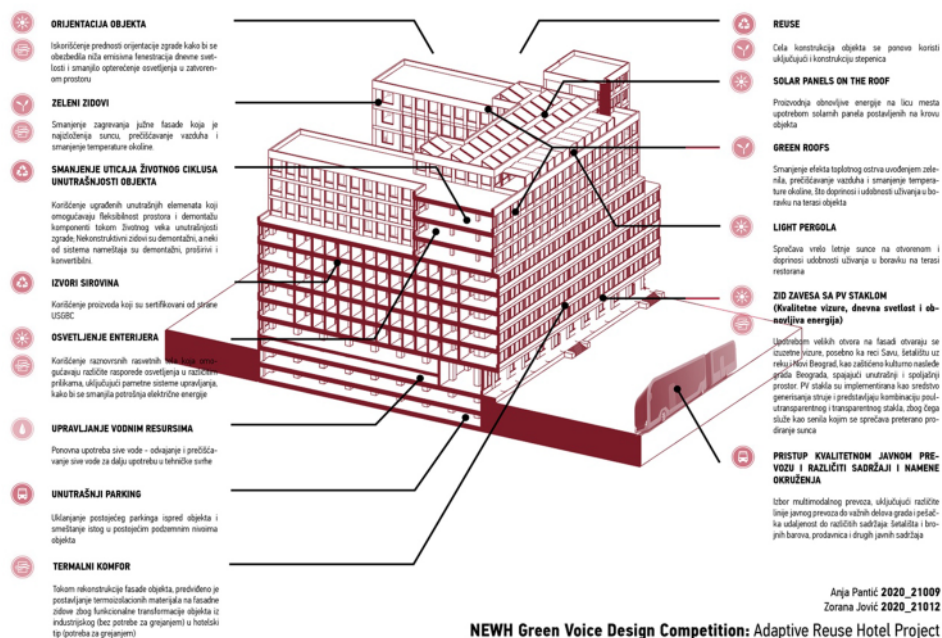


Figure 3: Sample page from NEWH Green Voice Design Competition work (Master studies course “LEED and WELL systems in design process”, students Zorana Jović and Anja Pantić, prof. Nataša Čuković Ignjatović

MASTER STUDIES SEMINAR

“LEED and WELL systems and architectural design” (“LEED system and architectural design” 2012-2018) was a seminar complementing the design studio in 3rd semester of Master studies in Architecture. Through theoretical and practical work, students become familiar with the principles of LEED certification system and WELL standard. From the complex structure of certification systems, elements that can be successfully checked during work on a studio project have been singled out. The emphasis of the work is on the adoption and practical application of design strategies and technical solutions that achieve high-value ecological qualities of the building. The first part of the

course is dedicated to LEED, mainly categories LT (Location and Transportation) and SS (Sustainable Sites) while the second part introduces the elements of WELL standard, the overlaps and differences in relation to LEED as well as the features that are overlooked by LEED. The final work is in presented as board, explaining the key green/sustainable features of the studio project (Figure 4).



Figure 4: Master studies seminar “LEED and WELL systems and architectural design”, presentation boards. Students (from left to the right): Ilija Nikolić, Marko Stevanović, Bojan Stojiljković, Katarina Pejić; prof. Nataša Čuković Ignjatović, design studio M03AT, prof. Dušan Ignjatović

THE ROLE OF DESIGN PROJECT IN LEARNING PROCESS

The common denominator of all three courses is establishing active relation to an actual design project in the process of learning. The similar approach is used in LEED Lab, where student's understanding of sustainable design is developed by evaluating existing buildings through green assessment (Andrasik, 2022). While LEED Lab uses LEED O+M (Operations and Maintenance) rating system, the courses developed in Belgrade follow LEED for Building Design and Construction (BD+C) rating system. The main difference is that LEED O+M assesses existing buildings while LEED BD+C assesses new construction and major renovation during design and construction phases. This is crucial for establishing high level of relevance as all abovementioned study courses are focused on design rather than on facility management.

When possible, assessments are made for an on-going project (design studio or professional commission) to simulate the non-linear process of design for sustainability. For each major LEED category (see Figure 1b), the basic process requires several steps:

1. Identification of potentials and limitations of the site and architectural program relevant to the building's performance in certain category
2. Identification of project's design features that have beneficial effects; comment on how they can

be quantified and/or verified in accordance with LEED system or national regulations

3. Identification of design features and strategies that are not applied in the project but would have beneficial effects; comment on how they can be successfully integrated into the final architectural design
4. Identification of design strategies that are not applicable to a given project (with proper argumentation)
5. Identification of strategies that are outside the student's professional domain; who are the stakeholders and/or specific professionals that should be involved?

The role of design project in the learning process is tailored in accordance with the specifics of each study program and course's position within study program structure. The specialised studies course is the most demanding in terms of in-depth analysis, accuracy, and technical presentation. Master studies course is more flexible, allowing students to combine their own design with relevant examples of good practice while the seminar includes mainly elements that can be related to their specific task on studio.

On specialised studies level, students mainly come from professional practice, aiming to broaden their expertise in the field of energy efficient and green architecture. Other courses within curriculum equip them with the tools and knowledge primarily related to energy efficiency, EPCs procedures, performance simulations and measurements. This means that they are capable of making rather accurate assessments themselves. At the same time, they are in contact with detailed design documentation, and they can gather and analyze plenty of relevant data. The more they are involved in professional practice, the more they are likely to gain knowledge relevant for LEED AP professional accreditation. The relevance of Integrative Process (IP) is easily communicated to the students, and the accent is on the means of effective moderation, active engagement of stakeholders, organizing design charrettes etc. Innovation (ID) category is explored as technical (i.e., "exemplary performance"), a connection to some WELL features, as well as the source for expanding a palette of green design features. Regional Priority (RP) is explored in the relation to national codes. NEWH Green Voice Design Competition would be a good alternative, but current schedule is rather unfortunate – classes start at the very final weeks of the competition and there is not enough time to complete a rather demanding task.

The course on 3rd semester of Master studies is open for students from various architecture study programs, meaning that their studio projects are usually focused on different research areas, often not dealing with green/sustainable approach. Some designs are very conceptual, but the students are always strongly encouraged to critically address their designs and to explore the paths of including green design principles in the process. The nature of design imposes variation in approach, but throughout the years it is evident that all 5 steps can be successfully completed regardless of the studio methodology. NEWH Green Voice Design Competition ends almost at the same time as the fall semester, so the students can include the competition work entirely in their curricular activities and submittals. The competition task is very demanding and extends beyond course's curriculum so therefore it is voluntary with an alternative way available for completing formal course obligations in case they do not finish the full competition submittals.

The seminar on 3rd semester of Master studies accompanies a design studio M03AT which is focused on green design principles and technologies. Lectures, assessments, and discussions are placed as complimentary material to studio and the learning process is strongly related to the design process. The focus is on effective communicating of green design features, using LEED system as a tool for assessing and presenting the qualitative aspects of the project. The five steps assessment process is applied, but calculations and quantitative assessments are limited to selected credits from LT (Location and Transportation) and SS (Sustainable Sites) categories. The credits that have equivalence or high compatibility with WELL optimizations are also highlighted during the lectures,

but students are free to choose their own path in improving and documenting the qualities of their studio project. Taking part in NEWH Green Voice Design Competition is also an option, but it turned out to be too demanding for seminar: the students who have entered the competition did not complete the whole submittals.

CONCLUSIONS

At the Faculty of Architecture, for more than a decade LEED is being embedded in various courses, both as a content that is being thought and as a tool for learning about green architecture, validating and communicating diverse design features. The methodology of relating to the student's design project throughout course has produced high quality results that were verified through international LEED-specific design competition. The 5-steps process has proven to work on diverse types of projects, from conceptual design studios to complex professional design tasks. Apart from obtaining the knowledge relevant for LEED GA professional accreditation, these courses develop specific skills that are beneficial for effective implementation of green design principles and communicating their values and expected benefits regardless of whether the building is going to be certified or not.

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