MBA Building Sustainability

Management Methods for Energy Efficiency

A Three Semester Master's Degree Program
Taught in English
Berlin, Germany

Technische Universität Berlin

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Welcome to the Technische Universität Berlin

Dear students,

Welcome to the internationally renowned Technische Universität Berlin located in Germany's capital city at the heart of Europe. I am most delighted that you have chosen our institution for your master's degree.

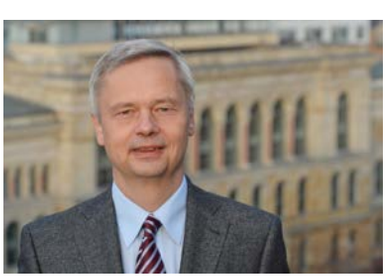
With over 30.000 students, TU Berlin is one of the largest universities of technology in Germany. One of our most important tasks is to prepare our students for the challenges they will face in the future.

The MBA program Building Sustainability – Management Methods for Energy Efficiency is a comprehensive, interdisciplinary course for those who plan a career in real-estate project management and planning with a focus on implementing sustainability. The program will provide you with basic knowledge and skills connecting theory, research and practice. For these educational objectives, the EUREF Campus of TU Berlin offers an inspiring atmosphere and a great number of outstanding scientific events.

With this brochure, we would like to help you in getting started at TU Berlin. You will find an introduction to the Master program as well as helpful links and contact details. For further information, please do not hesitate to contact our team of the Academic Advisory and Examination Office. They are here to assist you with all the necessary formalities.

I wish you a motivating and successful time at our university.

Prof. Dr. Christian Thomsen
President



Introduction

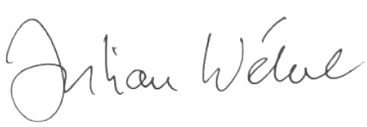
Dear prospective and active students,

The concept of the German "*Energiewende*" – literally, energy transition – has gained international attention. It includes a variety of measures that aim at making Europe's largest economy free of fossil fuels and nuclear energy. In order to attain this, all areas of energy production and consumption will have to go through a transition process. Beside mobility and production, buildings are therefore one of the key factors for a successful *Energiewende*. In the building sector, this means redirecting from a mainly fossil-fueled energy supply towards renewable energies and a much more energy-efficient use of energy in buildings and urban, as well as, regional areas. This is one of the largest and most urgent challenges of current urban development and other social disciplines.

Finding solutions to such a complex challenge means that a multitude of actors, from business, civil society, to public administration take part in the process and influence it with their differing and often conflicting interests. Resulting from this is the need for skilled workers who, based on a highly professional qualification, both understand all stakeholders and are able to work in a leading position with them.

The MBA program in Building Sustainability – Management Methods for Energy Efficiency will teach you exactly this: skills, methods, and concepts to consider different approaches, to understand them, and to align them for reaching sustainable solutions. Such proficiencies are not only important in the context of the Energiewende, but are indispensable in every building, construction and real estate project that takes energy efficiency and the other sustainability criteria like economical, ecological, social, and cultural balances into account.

In this regard, you will learn a lot from our experts, coming from research labs and science institutions as well as from the practical areas of planning and implementation. You will also learn from your classmates and hopefully enjoy the international, interdisciplinary teamwork as well as Berlin's urban and cosmopolitan atmosphere.



Prof. Julian Wékel
Academic Director

Studying management methods for energy efficiency with the experts

According to the German Advisory Council on Global Change, by 2050, the urban population alone will be larger than the current total world population. This will lead to considerable challenges for the planning and the construction sector, since roughly the same amount of infrastructure will be added in the next three decades as has been built since the beginning of industrialization. In addition, most of the existing infrastructure will have to be renewed in the same period. “For example, if the expansion of infrastructure has a CO2 footprint that is similar to that of the current infrastructure of cement, steel and aluminum in industrialized countries, the construction of new infrastructures in developing countries and emerging economies alone could lead to around a third of the total available CO2 budget if the temperature increase is to be limited to 1.5°C.”[1]

In addition to the technical aspects regarding CO2 saving solutions, strategic concepts for communication and cooperation are crucial for success in large-scale and structural important projects. Whereas building a house has become a manageable task, things become much more complicated when considering the urban environment and wider interests such as energy efficiency and other relevant factors of climate protection. The master program Building Sustainability focusses therefore not only on technical and economic perspectives but also aims at imparting basic knowledge in other relevant disciplines. This means that the scope of the program is both broad and specific at the same time. The combination of technology, management, and sustainability-related topics is therefore, a unique opportunity for young professionals to extend their skills and prepare for important planning and construction related team functions in this huge challenge of the 21st century.

Whereas the Building Sustainability program is new, there is already plentiful experience in conducting practice-orientated master programs on the EUREF campus. The first program started in October 2012, was taught in German, and focused on energy-efficient construction and operation of buildings. As a Master of Science, it was an interdisciplinary program with a very specific focus. It turned out, however, that this subject matter needs a broader scope. Two other Master programs – European and International Energy Law (Master of Business Law) and Energy Management (MBA) – also showed high international demand in the field of energy and sustainability. Therefore, current, and former students, teachers, and professionals re-designed the program and created Building Sustainability (MBA) with a schedule that focusses not only on engineers and architects but also on urban planners, economists, and project managers.

[1] WBGU – German Advisory Counsil on Global Change (2016): Humanity on the move: Unlocking the transformative power of cities. Summary. Berlin: WBGU

The idea is that sustainable project results can only be achieved in extensive cooperation of all stakeholders, considering economic, ecological, social, and cultural aspects. Managing and moderating such a cooperation is one of the major challenges of implementing sustainability in planning and building projects of all scales. The program aims therefore on enabling students to understand the complexity of sustainable planning and management processes and to develop solutions accordingly. This will happen in modules with different approaches: some will teach facts and numbers, others will facilitate connections between different fields and the soft skills of mediating between them, and some are designed to apply these competences to practical projects.

Graduates will be able to moderate and manage complex projects in the construction, real estate, and planning sector. The program provides the knowledge and skills for assessing projects from technical, ecological, and economic perspectives and for creatively finding solutions to consider the varying stakeholders' interest, in teams or independently. Graduates will either be able to enter the labor market in both the private and public sectors or continue with postgraduate studies.

The course program and structure

This Master program in Building Sustainability is a comprehensive, interdisciplinary course for those who plan a career in real estate project planning and management with a focus on implementing sustainability.

In addition to their own engineering, planning, architecture or economic studies, participants will gain economic, technical and management skills tailored to the planning and building sector, and will be prepared for a management career in leadership positions across the boundaries of their own fields. In addition to sector-specific fundamentals, the program includes project and lifecycle management modules as well as a global perspective regarding different approaches to energy efficiency.

The MBA Building Sustainability is taught over a period of three semesters. The semesters include lectures, tutorials, practical projects as well as excursions. The program will be completed in the 3rd semester with a master thesis.

Modules

Module 01: Project Management
This course is intended to provide students with the understanding and practical skills required to utilize internationally recognized methodology and tools of project management through all stages of its life cycle.

The students will understand the difference between document based and product model based information management in construction projects and learn new ways to utilize product modelling technologies for design, quantity surveying, and cost estimating as well as for feasibility analysis, energy simulations and visualizations of three dimensional spaces. They will also learn to improve the product data management for a building's entire life cycle used in many ways to support the use and maintenance of buildings.

Module 02: Energy Performance of Buildings
This module will provide students with insights into the energy performance of different building types. Basic knowledge of energy production, distribution, use and storage will help students in the energy analysis of buildings. This unit will give a general overview of the energy consumption in buildings and provides students with the tools necessary to unlock potential energy savings. It will include parameter methods and weather-corrected reference values, especially for heating. The detailed analysis serves to reveal specific weaknesses with the help of measurements and to plan corresponding measures.

Students will be able to apply recognized calculation and estimation methods on practical

examples, which divide energy consumption into heating, hot water generation, ventilation, and miscellaneous consumption. An individual approach enables a meaningful evaluation and reasonable consumption data can be identified.

The aim of this module is to make students capable of optimizing the energy consumption of new as well as existing buildings. In the design and planning phase of a building the future energy consumption is heavily predetermined. The harmonization of the building envelope and its technologies is important for energy-efficient buildings. The distribution of energy and heating can be determined spatially, structurally, and temporally. Students will be able to calculate a building´s heat demand, heat transfer and ventilation requirements.

Module 03: Introduction Project

In this module, students will learn how to run a project and apply their accumulated expertise and experience from the modules Project Management and Energy Performance of Buildings. The independent knowledge and skills from the modules can be merged and applied in several areas throughout the practical project.

Students will consider a small project from the perspectives energy efficiency and project organization, i.e. technology and management. Specific learning objectives of this practical project are the necessary skills to survey and assess processes in their interdependencies.

Module 04: Lecture Series: Building, urban and regional area structures – Modifications for sustainability and energy management

Students will be able to follow experts' lectures covering technological, social, ecological, and cultural dimensions regarding challenges in strategic planning and implementing construction processes with a special focus on the economy of energy. The lectures will discuss aspects at both the micro and macro levels, specifically individual buildings, and whole urban districts and thereby, students will be able to identify central concepts.

Module 05: Energy-Efficient Societies

The aim of energy efficient buildings is embedded in specific socioeconomic discourses. In consequence, the idea of energy efficiency can be conceived differently in different social and cultural contexts.

This module explores different understandings of energy efficiency and their consequences for project managers (i.e. students of this master program), other building and energy experts, users, and society.

In addition, it will provide knowledge and skills in order to deal with diverse audiences and to reflect on student‘s own projects that have been developed in other courses or been presented in the practice-oriented lecture series.

Module 06: Real Estate Economics
The learning goal is the understanding and implementation of essential concepts of real estate financing and investment relevant to business problems and management decisions. The students will learn the basics of financial mathematics and will be able to calculate simple real estate development projects as a part of feasibility studies.

Module 07: Interdisciplinary Project
On a ready-planned and already existing building the students will apply the content learned to achieve qualitative and quantitative information.
There will be a special focus on the dependencies of various factors and the order of processing steps.
The students will be working on the project essentially independently, with little assistance.

Module 08: Lifecycle Management
Real Estate and Facility Management are significant in the global structural change from an industrial towards a service-orientated society. In this course, students will learn relevant working methods and their theoretical basis (e.g. life cycle concepts, life cycle information management, service, and facility management standards) together with an understanding of services and customer needs. Students will be able to apply those management concepts and make decisions in terms of implementing a FM organization and its business processes according to the needs of building owners and users.

Module 09A: Smart Buildings (compulsory elective)
This module will provide insight into the planning, implementation, and operation of technologies (software, communication, and hardware) in building monitoring, control and automation, with special emphasis on energy management. Currently available solutions will be regarded as well as current development and future expectations for so-called smart buildings.

Students will gain a basic understanding of the flexible and intelligent energy management of modern home environments. In view of a holistic energy balance, students develop detailed knowledge of the internal factors such as building configuration, users/usage, monitoring, control/automation, and distributed generation. On the other hand, they will understand from a smart building perspective the relation between external factors such as energy procurement, (regenerative) energy supply, legal and market framework for construction and operation.

Graduates will have the ability to determine and evaluate the effects of smart building design and implementation alternatives with respect to energy efficiency and compare them to other measures (e.g. intelligent automation of heating compared to modifications of building envelope).

In this respect, students will develop academic research skills in the area of telecommunications in smart homes and gain hands-on experience in realization and management of energy-efficient systems in the networked building.

Module 09B: Innovation and Technology Management (compulsory elective)
The module Innovation and Technology Management is an interdisciplinary project, which awards 12 ECTS for two semesters. Students will learn about innovation and technology management in theory and practice. First, the course provides theoretical input sessions about innovation management, technology management, IP management, project management, team building and more. Second, the students will apply this knowledge to a real project and work together with industrial partners. They will develop a prototype in interdisciplinary teams based on a given problem. Finally, the teams hand in a written project report and give an oral presentation on their prototype.

Module 09C: Integration of Renewable Energies (compulsory elective)
This module will provide insight into various ways to supply energy - heat, cold, and electricity - to buildings as well as districts based on renewable sources. The planning, implementation, and operation of these technologies in such an environment with special emphasis on energy management is presented. Currently available solutions as well as current development and future expectations for so-called smart buildings will be regarded.

Students will gain a basic understanding of the applicability and limitation of renewable energy sources in a building environment.

In this respect, students will develop academic research skills in the area of the design of building- and district-related energy-supply systems based on renewable energy sources and their interplay with conventional/fossil sources.

Schedule

Semester I

Module	Themes
01 Project Management	Project Management • Target, goals, and standards • Scope of Services • Programming and organization • Contracts and procurement • Time schedule and cost estimation • Quality definition and control Building Information Modeling • Theory and practice of product model based construction process • Modelling and coding systems, Information structures and standards • Possibilities to utilize product models in design and construction process and in real estate management Soft Skills • Methods of scientific research • Techniques of mental working and writing • The final examination: colloquium • The time after graduation
02 Energy Performance of Buildings	• Assessment criteria for the energy performance of buildings • European and international standards • Electrical building services • Key energy figures / benchmarking • Sources of energy • Physics of the building envelope and its thermal conductivities • Impact of ventilation and air conditioning on the indoor climate • Energy balance of buildings • Calculation methods for energy procurement, energy consumption and heat demand • Reasonable measures to improve the energy balance of buildings • Implementation of building automation (smart buildings) • Profitability and effectiveness of new building technologies and insulation measures
03 Introduction project	• Based on an existing building project • Retracing and simulating the project steps

04 Lecture Series – Sustainable Energy-Efficient Reconstruction of Buildings and Urban Districts	• Technological, social, and ecological dimensions regarding challenges in planning and building/ construction processes • Special focus on the energy economy and climate protection on all levels of national, regional and urban levels planning and implementation • Experts from science and practice consider both building and area dimension

Semester II

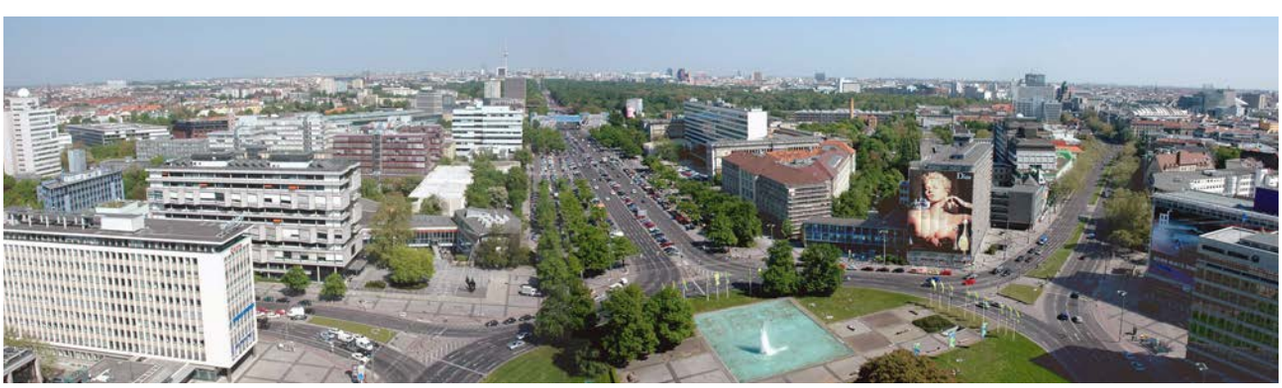
Module	Themes
05 Energy-Efficient Societies	• Conceptions of energy efficiency in a global context • Societal consequences of energy efficiency • Roles and job profiles for students of this program • Good and bad practices of project management • Dealing with complex and diverse audiences Conflict management: communication, participation, and cooperation
06 Real Estate Economics	• Feasibility study • Market and site analysis • Basic financial mathematics (e.g. calculation of present value, bonds, annuities, payback period, rate of return etc.) • Investment appraisal • Developer calculation • Sensitivity analysis
07 Interdisciplinary Project	• Building conceptualization: information gathering, problem structuring, analyses, synthesis • Consideration of the two perspectives: energy efficiency and profitability, i.e. technology and management
09 A Elective: Smart Buildings	• Current and future development of smart building technologies • Insight into the planning, implementation and operation of software and communication technologies in building monitoring, control and automation, with special emphasis on energy management • Field trips to and case studies of existing best practice smart energy buildings
09 B Elective: Innovation and Technology Management I	• Innovation management • Technology management • IP management • Team building

Semester III

Module	Themes
08 Life Cycle Analysis	• Strategic Facility Management • FM Standards (e.g. DIN 15221, GEFMA-100) • FM Business Processes during Building Life Cycle • Sustainability and Building Certification Systems • Service Level Agreements and Key Performance Indicators in FM • Building Information Management and Computer Aided Facility Management • Case Studies
09 B Elective: Innovation and Technology Management II Can only be elected if “Innovation and Technology Management I” was taken in 2nd semester	• Application of the knowledge from the course in 2nd semester to a real project • Working together with industrial partners • Developing a prototype in interdisciplinary teams based on a given problem
09 C Elective: Integration of Renewable Energies Can only be elected if “Smart Buildings” was taken in 2nd semester	• Basics of various renewable sources for heating, cooling, and electricity • Integration of renewable sources into existing and new buildings • Combination of different systems, hybrid systems of renewable and conventional energy sources • Design processes of energy-efficient building projects • Integration of urban and rural areas • Application areas, limits and alternative system configuration • Concepts for measurement and control
10 Master Thesis	• Topic is chosen and written individually • May be worked on together with a company

Lecturers

Zsuzsa Besenyöi	Hochschule für Technik und Wirtschaft Berlin
Dr. Maren Borkert	Centre for Entrepreneurship, Technische Universität Berlin
Prof. Dr.-Ing. Manfred Norbert Fisch	Institut für Gebäude- und Solartechnik, Technische Universität Braunschweig
Daniel Freund	Distributed Artificial Intelligence Labor, Technische Universität Berlin
Jan Herzberg	Messe Berlin GmbH
Prof. Dr.-Ing. Andreas Holm	Forschungsinstitut für Wärmeschutz e.V., München
Prof. Dr. Markus Krämer	Hochschule für Technik und Wirtschaft Berlin
Luise Kranich	Forschungszentrum Informatik, Berlin
Prof. Dr. Jan Kratzer	Centre for Entrepreneurship, Technische Universität Berlin
Olga Levina	Forschungszentrum Informatik, Berlin
Dr. Hamid Doost Mohammadian	Doost International
Prof. Dr.-Ing. Nicole Riediger	University of Applied Sciences Berlin
Emily Schneider	
Dr.-Ing. Carolin Schröder	Zentrum Technik und Gesellschaft, Technische Universität Berlin
Christoph Vornhusen	Bencon Energies
Prof. em. Julian Wékel	Institut für Städtebau und Wohnungswesen, München



Application for the master program

You can find more information about the application procedure online on our website:

www.master-in-energy.com

The number of students is limited to 30 per year. An admissions committee will make determinations based on the results of former studies, the academic profile, and further relevant qualifications, which were attained outside of the university.
You can send your application via the website, via email, or via postal service.



Academic direction and master program team

Academic directors:
Prof. Dr. Frank Behrendt
Prof. Julian Wékel

Administration:
Laura Lehmann

Course Coordinator:
Phillip Hebert

Imprint

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