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Ali Sayigh *Editor*

Sustainable Energy for all

**Selected Papers from the
World Renewable Energy
Congress WREC 2016**



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(Full Paper WILL BE RECEIVED LATER)

A University Master Course and training program for energy managers and expert in environmental design in Italy

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Topic: building construction management and environment

Abstract

This paper presents a higher learning course of the University of Florence, experiences related to an educational second level Master Course ABITA - Architecture Bioecology and Technological Innovation for the Environment - involving the training of energy experts in the field of energy efficiency.

The ABITA Master course training program is offered in Florence in Italy and covers nearly all the energy-relevant issues that can arise in public and private companies and sectors. The final output of the practical training is to achieve an elevated professionalism in the study of environmental design and Energy management in buildings.

The Master includes studies on low energy architecture and energy efficiency measures, integration of renewable energies in buildings, Building Information Modelling, dynamic software for Energy simulations, energetic diagnosis. The training Master Abita provides a solid basis for increasing the knowledge and skills of energy managers and is developed with an emphasis on practical experiences related to the knowledge through case studies, measurement, and verification of energy-efficient solutions in buildings, in the industry and in the cities.

Keywords: Energy experts, BIM, Energy Analysis and simulation, Green Building, Certification System, Sustainable Design.

Highlights

- Sustainable design and Energy analysis through BIM
- Training program for energy experts and managers in green buildings
- Topics and energy savings opportunities evaluated for young architects and engineers.
- Lessons learned and future challenges
- Future challenges

Introduction

The Master Degree programmes offered by the Department of Architecture of the University of Florence are post-graduate courses designed with the purpose of developing proficiency in terms of knowledge, skills and new approaches. The courses blend theoretical knowledge with practical applied activities, and respond to specific requirements of the labour market.

The courses are intended for students, but also for professionals wishing for further education and advanced training. Second level master courses are accessible only to students that have a Second Cycle Degree or equivalent.

The main purpose of the Master course is to design the energy consumption of building technologies, components, and structure at the conceptual design stage, so it could be very helpful for designers when making decisions related to the selection of the most suitable design alternative and for choice materials that will be used in an energy-efficient building. Building Information Modeling (BIM) has the capability to help users assess different design alternatives and select vital energy strategies and systems at the conceptual design stage of proposed projects. Furthermore, by using BIM tools, designers are able to select the right type of materials early during the design stage and to make energy-related decisions that have a great impact on the whole building life cycle.

The main objective of Master Abita is to propose an integrated methodology that links BIM and energy analysis tools with green building certification systems. This methodology will be applied at the early design stage of a project's life.

Around 70% of the Italian master Abita training participants confirmed that in addition to their energy concepts, they had also realized additional energy efficiency projects after they finished the training course. Based on the experience gained during the past 15 years of the Master training program's implementation, the energy experts graduated have really appreciated their practical education and training with on-the-job support from professional coaches.

The future challenges of the education and training program are related to follow-up activities, the development of interactive tools and the curriculum's customization to meet the constantly growing needs of energy experts from industry.

Objectives

The development of low-carbon, resource-efficient buildings and cities are becoming extremely important against the ever increasing consumption of natural resources. The ABITA, second level Master course provides students with opportunities to develop the advanced knowledge and skills required to find innovative solutions to these needs and become experts in energy management in buildings. The ABITA Master course training program is offered by the University of Florence and covers nearly all the energy-relevant issues that can arise in public and private companies and sectors. The final output of the practical training is to achieve an elevated professionalism in the study of environmental design and Energy management in buildings.

The Master includes studies on:

- low energy architecture and energy efficiency measures,
- integration of renewable energies in buildings,
- BIM - Building Information Modelling,
- dynamic software for Energy simulations,
- energetic audit and diagnosis – green audit,
- smart cities, green urban planning,
- water and waste reuse and economic evaluation management.

The training Master Abita provides a solid basis for increasing the:

- knowledge and skills of energy managers and expert in energy
- practical experiences through case studies, measurement, and verification of energy-efficient solutions in buildings, in the industry and in the cities.

The master course is divided in frontal lectures, e-learning activities, workshops, study trips and meeting with enterprises

- **FRONTAL LECTURES** are divided in 4 UNITS: Each Unit is articulated in many frontal lectures and hours of project work.
- **E.LEARNING ACTIVITIES:** The on line training materials, as well as online tutoring for project work will be implemented thanks to the MOODLE e-learning platform of the University of Florence.

Methodology

The course includes different teaching activities: theory classes, seminars, design workshops, speeches, construction labs, external construction lab and visits to case studies. The first module will be dedicated at introducing students to the basic skills of indoor comfort, sustainable architecture, and the basic skills of BIM modelling and principles of environmental strategies.

From the second module and through the next 11 months, students will work on a challenging thesis project that will be presented to a public audience at the end of the Master. During this phase, the master course will stimulate students on the topics of Green Energies Design Strategies, Smart Technologies for the Built Environment, Design Rating Systems and Certifications, renewable energy systems, installation, Italian regulation and smart Urban infrastructures. All the input coming from these activities will be embedded in the students design work to develop a compelling thesis project.

The core modules are four;

- **M1** Sustainable Architecture and buildings deep renovation
- **M2** Energy management and integrated Design for NZEB - Mass Modelling for Conceptual Design (BIM) - Energy performance valuations
- **M3** Integrated Design for NZEB-nearly zero energy building - Energy modeling and simulation of buildings

- **M4** Building the future: Green building and smart cities
- **ML** Project work Training - WORKSHOPS

MODULE 1

Core module 1 is on the teaching of Sustainable architecture and its principles with the main purpose to:

- analyse the energy consumption of building technologies, components, and structure at the conceptual design stage,
- help designers related to the selection of the most suitable design alternative and for choice materials.

Smart Buildings and Sustainable Design addresses the issue of sustainability in terms of design strategies that optimize environmental, energy and social behaviours of the urban environment. The course is aimed at embedding interactive and tools connected technology with architecture, in order to become aware of what is going on in the surrounding environment and acquire the capability of virtuous reactions. BIM tools help designers to develop Sustainable architecture

deals with the challenges and problems of post-industrial polluted cities by combining design and technical skills to outstanding theoretic, critical and cultural knowledge.

The Master Program aim is to learn the principles and methodology of environmental design and to develop critical thinking skills to challenge established practices, in order to improve technologies for:

- green building strategies,
- energy efficiency
- environmental conscious design;
- experimenting technologies
- procedures and tools
- Renewables
- climatic and environmental control
- reduction of the use of natural sources and energy consumption.
- Comfort behaviour
- Environmental and energy quality
- Envelope eco-efficiency
- Greenhouses: strategies and evaluation on energy efficiency
- Natural ventilation and cooling systems
- Automation, management systems
- Passive house, NZEB
- Green buildings efficiency

The students are continuously trained in interdisciplinary co-operation in order to implement the integrated design method in their professional practice.

Students will hold the knowledge and the practical tools to better understand existing buildings for retrofit and to design new ones – positively driving change in this field and moving towards a truly environmentally conscious architecture.

The Master course starts generally in November and ends in April or May. Lessons will take place three days a week and at the end of the course will follow an internship. The final thesis is expected within the next year in April.

MODULE 2

The main contents of the **core module 2** are:

- ☐ Integration of renewables in architecture
- ☐ EGE – Regulations
- ☐ Energy Audit
- ☐ Tools

EGE - EXPERT IN ENERGY MANAGEMENT

The MS2 provides knowledge and skills required of a professional energy manager for the qualification according to the standard UNI CEI 11339:2009 for the industrial and civil sector.

Students will be involved in practical workshops on the use of tools and on the development of analytical methods, which will be directly applied to a design studio project on the evaluation of case studies.

In this module, students will learn about climate and microclimate analysis and fieldwork methods for the measurement of environmental and energy parameters, thermal comfort surveys and post-occupancy evaluations.

The EGE qualification allows students to demonstrably achieve the highest level of competence in energy management.

At the end of the course, students will be able to attend the exam for certification according to EGE TUV e UNI EN ISO 50000.

The specialization of the Expert in energy is to be an independent energy consultant that offers a service to help to cut the energy costs, reduce carbon footprint and invest in renewable energy production.

The Expert in Energy can identify and help owners of productive buildings or offices toward prioritize actions to cut their consumption and advice on how best to invest in energy efficiency and renewable energy systems.

Businesses	Homeowners
Energy surveys Energy auditing Energy management Lighting surveys Sustainable build consultancy Training Project Support Renewables consultancy	Make homes more comfortable, cut bills and carbon footprint. Home energy survey Thermal imaging survey New-build consultancy

BIM AND DESIGN BUILDER TOOLS

Workshops and design application of parametric massive design, dynamic thermal modeling and day-lighting are the contents of the core module 2.

The software used (BIM): climate data analysis to building form, day-lighting, and thermal modeling, in order to maximize the impact of shadows and solar control systems.

These will be directly applied to a design studio project running in parallel to the workshops. The energy analysis of the project will be run with the software Design-Builder.

Building Information Modelling (BIM)

- ▣ help users and select energy strategies and systems at the conceptual design stage of proposed projects.
- ▣ are able to select the right type of materials and make energy-related decisions that have a great impact on the whole building life cycle.
- ▣ integrated methodology that links BIM and energy analysis tools with green building certification systems. This methodology will be applied at the early design stage of a project's life.

GREEN BIM

In particular, Green BIM implements the process of green designs, sustainable design methods can be used to analyze the impacts of green buildings, including all aspects of lighting, energy efficiency, sustainability of materials and other building performances. The construction of green technology should be optimized with green buildings parameters and standards.

Green BIM can control all these aspects:

- The use of natural ventilation, natural lighting and shading effective measures.
- The use of solar energy.
- Rainwater recycling and waste recycling.
- The outdoor use of permeable ground.

- The use of green, sustainable and energy efficient materials.
- Focusing on ecological maintenance.
- The application software featuring of energy-efficient computing.
- The use of natural ventilation, and performance analysis.

BIM (Building Information Modelling) is an effective tool for the integration of natural and technical systems in architectural design.

Integrated multi-discipline building models Green BIM allows to develop integrated multi-discipline building models. The result is better performing buildings and infrastructure because complex information is combined to allow decisions to be made early in the design stage.

Energy model uses Green BIM to model a project's energy performance and helps to identify choices to optimize the building's life cycle energy efficiency during the early design phase when changes can be made without incurring high costs.

During the design phase, the project teams can ensure that relevant building codes or baselines are technically and cost effectively verified. The models can also be used, during the operation of maintenance of the building to validate its energy consumption.

High-quality information modeling is able to achieve cost-effective NZEB buildings and districts in the shortest time and managed all planning creating economic benefit for the investments.

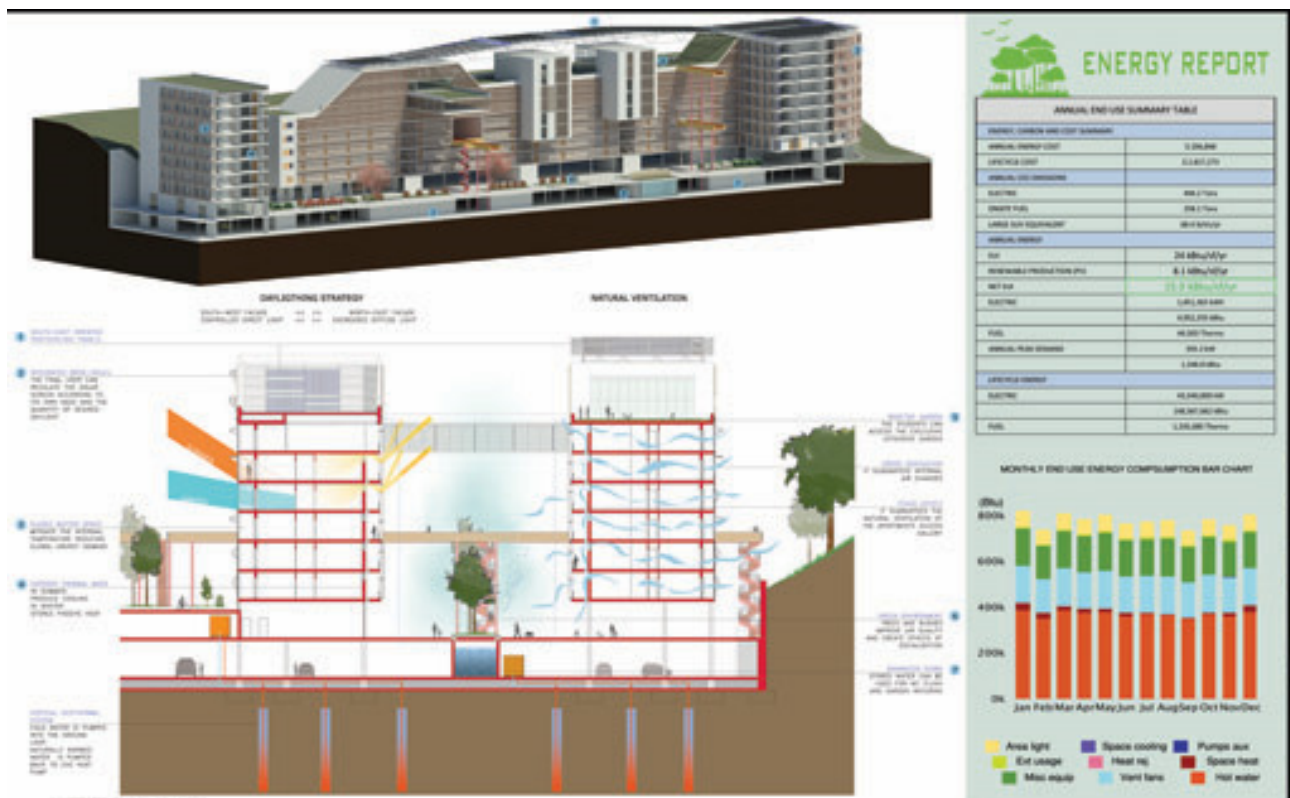


Fig. 1 Few Master students drawings realized with BIM programmes

Core module 3

- ▣ Energy modeling and buildings simulation
- ▣ Environmental and energy quality
- ▣ Integrated Design for NZEB nearly zero energy building

The TOOLS used generally during the master course are:

- REVIT (Autodesk BIM) ECOTECT
- DESIGN BUILDER (Dynamic simulation)
- ENERGY PLUS (Energy simulation)
- PV SYST (photovoltaic)
- TERMUS (energy certification ACCA)
- SOLARIUS PV (photovoltaic ACCA)
- DOCET (Energy certification ENEA)
- RELUX (lighting design)

- DAYLIGHT Visualizer (lighting design Velux)

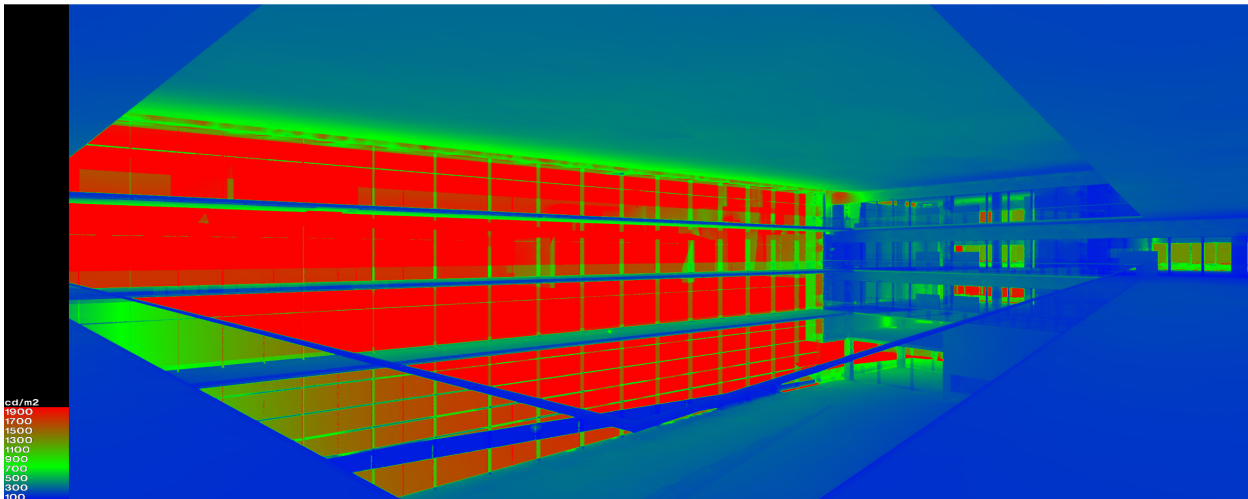


Fig. 2 Thermal analysis realized with thermal camera



Fig. 3 Smart city approach with BIM tools

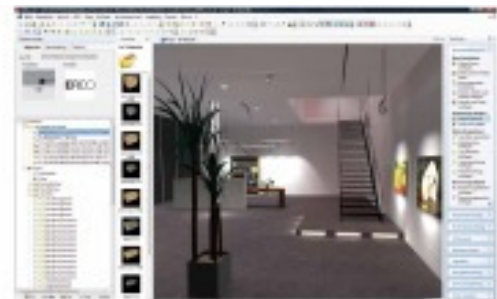


Fig.4 Velux tool for daylighting

Core module 4

By 2050, a great part of the population will live in new urban cities that do not exist yet. Those Smart Cities needs to create better lives conditions and to reinvent citizenship for every stakeholder: younger/elder, families/professionals, tourists/dwellers, and by giving meaning to the best technologies.

The smart city is supported by information and communication technology (ICT) for learning, adaptation, and innovation. ICT means the enhancing of competitiveness of cities through the development of the digital economy and this means to understand the various challenges and opportunities with which cities are faced.

1. The evolution of cities: social, political and spatial planning models.
2. City services: utilities (water, energy and communications), public street lighting, roadways and traffic, public transport, signage, environmental quality, cleaning of public spaces, waste and sewage management, maintenance, security, civil protection, government, education, public health, social services, town planning, public housing, planning of economic and tourist activities, user and consumer protection, cemeteries.
3. Interactions: housing, education, work, culture, religious services, sport, trade, industry (processing/digital / cultural industries etc.), professional services, tourism, mobility, logistics, associative and civic activity, crime etc.
4. Quality of life in the city.
5. Migration flows and their impact on cities.
6. Human diversity in cities.
7. Physical and social virtual networks.
8. Efficiencies and inefficiencies in cities; challenges and opportunities.
9. The impact of ICT on the social fabric, on the management of cities and their innovation potential.
10. City resilience.
11. Green infrastructures aim to ensure that the protection, restoration and creation and enhancement to become an integral part of the spatial planning and territorial development whenever it offers a better alternative or is complementary, to standard grey choices. Green infrastructure reduces and treats stormwater at its source while delivering environmental, social, and economic benefits.



Core module ML - Project work Training

Professional opportunities for graduates that can progress or start a career in national and international architecture and engineering studios as Designers or Specialists in sustainable strategies and innovative technologies. The highly technological profile of the Master course, including the use of BIM and dynamic building technologies and tools, opens the doors to public or private research centers, experimental labs, and institutions related to product design and technology innovation.

This module includes lectures based on:

- Personal presentation
- Personal impact
- CV writing lesson plan
- Finding employment
- Interview tips and skills lesson plan
- Creativity and idea generation

Study tours

Tours form a central part of the Master Abita experience, the travel consists of a *Week-Long Study Tour* in Europe, in countries such as Denmark, Germany, England, Spain, Austria or others or in a neighboring country, combined with a seminar in Florence. While on tour, theories learned in the classroom come to life by meeting with professionals and experts in the green building and NZEB field which contribute to furthering student understanding of course topics. Study tours are hands-on and experiential, combining theory with practice, and expose students to additional cultural perspectives. They can have the opportunity to visit sites and experts in their field of interest that they may not otherwise have access to. Study tours are integrated into specific core courses, generally toward April.

Internship

Internship will be locally conducted in relative institutions such as universities' specialization departments, state institutions, international organizations, design companies, etc

The Master ABITA Internship is an initiative that helps students in making connections between their study of architecture and the real world of practice by undertaking supervised work placements in architectural firms. The internship exposes students to the work environment and gaining work experience in the industry. It provides opportunities for students to be involved in the conceptual stages of real architectural projects; and put into practice what they have learned in their architectural studies. Internships offer students exposure to actual working life, an experiential, an overview on career choices, and the chance to build valuable business networks. Students can serve as a valuable resource for organizations as a bridge to understand employment needs and fill immediate needs for labor sources. During the internship stint, master course students have the opportunity to develop their technical competence for possible employment after graduation.

Thesis

Upon attending 5 Modules and 2 Workshops and passing them successfully, students are allowed to submit their thesis plan to the Master Coordinator.

During summer time, the thesis topics will be approved and a tutor will be assigned to each student. This policy will allow the students to start writing their thesis in advance and hence their graduation can be achieved successfully by the end of December (2018) or by the end of the third semester (April 2019).

Conclusion

Based on the experience gained during the past 15 years of the Master training program's implementation, the energy experts graduated have really appreciated their practical education and training with on-the-job support from professional coaches.

The future challenges of the education and training program are related to follow-up activities, the development of interactive tools and the curriculum's customization to meet the constantly growing needs of energy experts from industry.

Career opportunities are the real result of our master course, the professional application of the knowledge and skills acquired during this Master's programme can be used within two main areas:

- Professionals already working as local council officers or elected members, or as specialists or managers in businesses which supply services to cities.
- Professionals who wish to use the project element to launch their own entrepreneurial or economic venture or community activities.

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