

State-of-the-Art: Solar Energy in Urban Planning Education

Education and dissemination are important issues for SHC Task 51 on Solar Energy in Urban Planning. As part of this work, Subtask D experts are focusing on educational issues to strengthen the knowledge and competence in solar energy and urban planning of relevant stakeholders, including university students, planners and other professionals. The creation of a substantial link between research and education as well as between research and practice is the core of Subtask D. This subtask is working to determine where deficits currently exist and then will evaluate the reasons for these deficits and propose solutions and strategies to overcome these shortcomings.

Task's Education Work

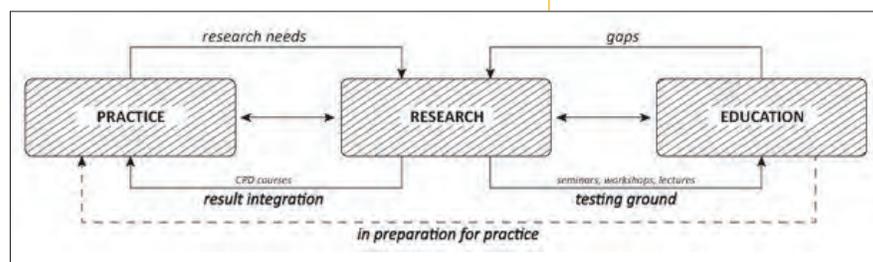
The goal of this work is to inform students as well as planners and professionals within the field of urban design and development on how to find relevant courses and to create a solar urban planning platform for dissemination and education. To do this, Task participants are integrating relevant methods for using digital and analogue tools and compiling experiences from case studies of completed projects and ongoing "action research/case stories."

The experts in Subtask D are clearly summarizing the shortcomings and barriers in existing courses, and the related teaching methods, in order to provide relevant seminars, lectures and tools for educating the next generation of architects, urban planners and specialist planners.

The Subtask's modus operandi on how to find and evaluate existing teaching material was based at first on general online research, followed by a survey of the relevant programs and courses in regards to teaching about solar energy at universities and colleges. After identifying and analyzing these programs, expert interviews with various educators at different levels of experience took place to investigate in more detail the individual approaches of the applied methods behind teaching solar energy in the urban context. The final results of the survey and its evaluation show that solar energy and its adaption to the urban fabric are typically not included in the academic teaching programs.

The matrix in Figure 2 describes the information and data generated for solar energy adaptation in higher education. Among other approaches used, specific questionnaires were emailed to educators at universities in the SHC Task 51 participating countries of Australia, Austria, Canada, France, Germany, Italy, Norway and Sweden. And, to ensure a wide range of detailed information about the existing courses on solar energy, in addition to the survey various experts were directly interviewed.

The survey demonstrates a concrete overview on the content and methodology of the seminars and lectures in the different countries. Most of the taught courses focus on technical specifications, such as material and system studies as well as construction of solar integration systems. These topics were typically part of engineering and architectural programs at the undergraduate and postgraduate levels. The survey also shows that courses on solar energy design integration and energy planning are mostly taught in architectural and urban planning faculties at the undergraduate level. In regards to the education of students at an earlier stage of their studies, the survey shows that various courses

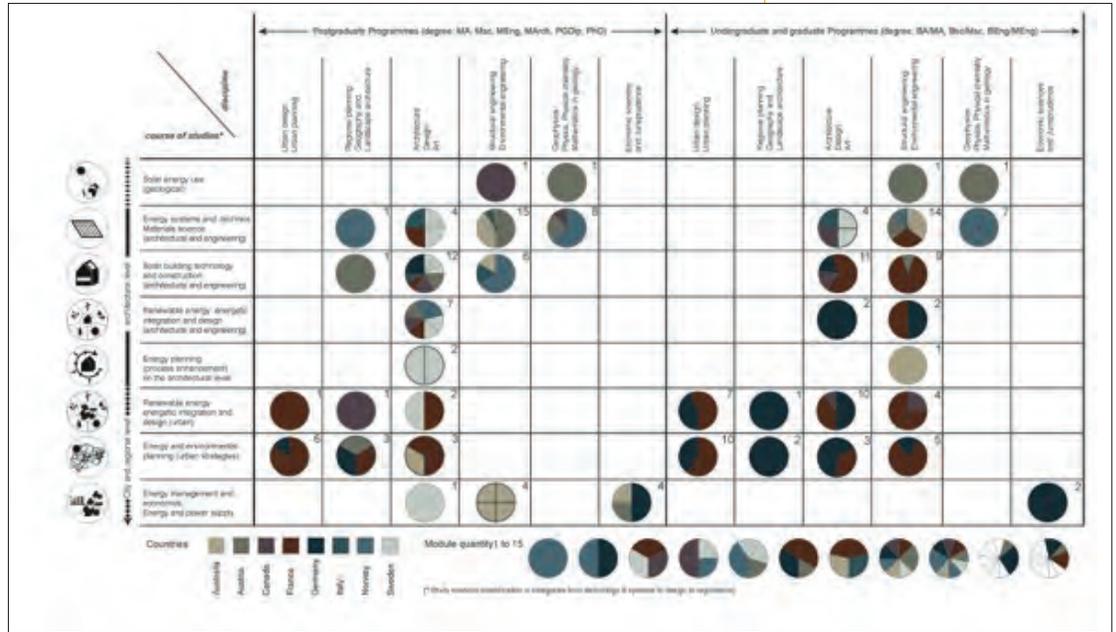


▲ **Figure 1. Diagram of inter-dependencies of practice, research and teaching.** (Source: Simon)

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► **Figure 2. Matrix on the study modules classification in categories. Each pie shows the number of identified and investigated courses in each country in relation to the educational program and course category.**

(Source: Siems, Simon).



exist at the undergraduate level for urban solar integration in design and planning in Germany and France.

The survey underlines our hypothesis that the importance of teaching solar energy as it relates to the urban context is necessary at an earlier stage of the educational training in universities to support the future practice. Currently, more specialized seminars and lectures on solar energy integration in the planning process are taught within postgraduate programs, which were chosen by the students after completing their first degree.

This comprehensive survey aimed to find modules on solar energy integration in construction and planning throughout a variety of disciplines. Within the field of urban and architectural design, in addition to urban integration in planning, the design project courses also exist that are integrating solar energy topics in the early stage of the design process. The survey reveals that various courses on solar energy also exist in the field of urban and regional planning and economic science and in jurisprudence. In the following matrix (Figure 2) the described information is displayed in a comparable overview.

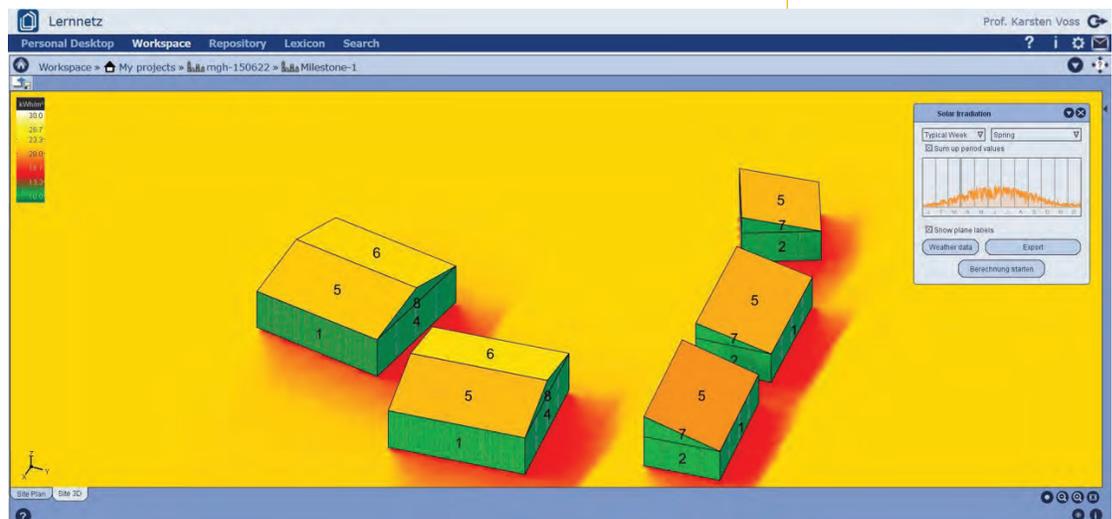
Development of Online Tools

This study identified that one of the core problems is the accessibility of relevant teaching material. We therefore will develop a web-based lifelong learning platform that will allow shared open source access to the constantly evolving research field. This platform will include a knowledge base of available digital and analogue tools and teaching methodologies as well as examples of best practices of integrating solar energy in an early phase of the planning process. During the development of this lifelong learning platform an evaluation in real-time of participating online users, students and educators will be taken into account in order to reflect existing educational material and possible deficits in its usability and accessibility.

Another activity within Subtask D is the development of the “EnOB Lernnetz,” which will be an exemplary tool to demonstrate how digital software tools can be integrated into the education process. The prototype web platform “EnOB Lernnetz” aims to let students acquire self-organized fundamental knowledge about energy-optimized design and building physics [Abromeit 2011]. A platform integrated basic CAAD module allows modeling of free-formed buildings within a web browser. The model data are stored on the server allowing shared work. As part of the German

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contribution to SHC Task 51, funded by the Federal Ministry of Economy, the basic functionality of the platform was improved and enhanced to handle shading and solar radiation analysis on the urban scale. Simulation modules for solar radiation, shadowing and sunlight hours are now fully functional. Results can be displayed as false color pictures and exported graphically as well as numerically. The degree of detail has been limited in favor of fast modeling and visual feedback in the early design phase (master plan). The calculation model only takes shadowing of direct sunlight into account. Building details, vegetation, shaded horizons as well as uneven site plans have not yet been implemented. After an initial application of the platform in a seminar at Wuppertal University in 2014, a second test phase starts in late 2015 when SHC Task 51 members will test and evaluate the functionality.



▲ Figure 3. The user interface of the “EnOB Lernnetz” (Source: Voss).

Supporting the Task’s Overall Goals

The main objective of SHC Task 51 is to provide a framework of support for urban planners, authorities and architects to achieve urban areas, and eventually entire cities, with integrated solar energy solutions thus achieving a substantial level of renewable energy in the total energy supply of cities and urban areas in the future. This includes the goal of develop processes, methods and tools capable of assisting cities in developing a long-term urban energy strategy. The scope of the Task includes solar energy issues related to new and existing urban area development and sensitive/protected landscapes (solar fields).

Institutions and universities in higher education are educating and forming the next generation of architects, urban planners and experts in this field. It is therefore of utmost importance that students gain in-depth and comprehensive knowledge in all relevant areas of the profession during their studies so that they can later apply this advanced knowledge in practice. Within this framework, the aim is to strengthen education at universities on the topic of solar energy in urban planning, by testing relevant software tools, generating an e-learning platform called “EnOB Lernnetz,” and developing teaching materials in form of a web-based platform for lifelong learning. These materials will be useful also for tertiary educational courses and continuing professional development (CPD).

In addition to educational institutions, SHC Task 51 targets municipalities. This requires a direct dialogue and close collaboration with the various municipalities in each participating country. On this basis, good communication between different key actors provides a possibility to develop and test the important tools that allow logging exemplary work with different method approaches within the urban planning process. Also, it demonstrates ‘best practice’ examples of solar energy integration in urban planning.

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Reference

Abromeit, A., Wagner, A.: Web based building modeling and simulation, CISBAT, Lausanne, 2011.