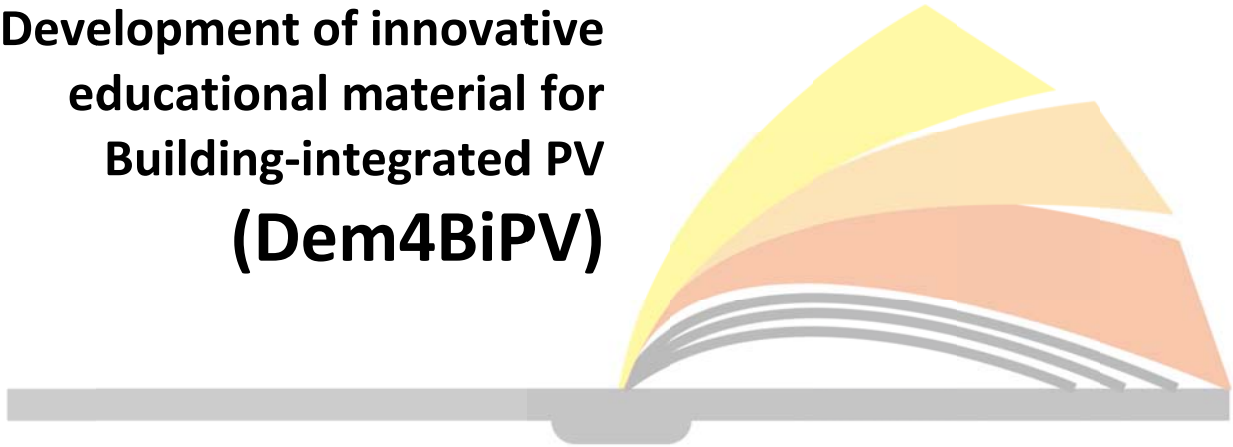
Syllabus: Architectural Aspects

Development of innovative educational material for Building-integrated PV (Dem4BiPV)



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1 Introduction

This module consists of different courses in which different fields of architecture are being treated. At the end of the module you have an understanding about how architects see and shape the world. You'll learn how BIPV could serve the architect's needs, but also where the application of BIPV might jeopardize its views.

The study material in this module is covers a wide range of the field of Architecture. It is up to the student, instructor and / or the university to decide what elements to choose from this module. This is also dependent on the entry level and study background of the participant. To follow this module a master level is recommended.

2 Teaching Methods

The teaching methods for this module are dependent on the chosen courses. The online courses are recommended to be followed on their online platforms. These courses contain short lectures, assignments, forums and exams and are mainly student centered In case online course material is not available (anymore), lecture material is available for download. Besides these courses an assignment is available where the connection between the general course material and BIPV is made.

3 Learning Objectives / goals

After successfully completing this module the student

- Knows how to read, analyze, and understand different forms of architectural representations
- Understands the social and historical contexts behind architecture
- Has an understanding of how architects see and shape the built environment
- Understands the interdisciplinary context of sustainability and architecture
- Understands how cities are formed and how to maintain livability in future cities
- Understands where BIPV meets and where it jeopardizes the views of the architect
- Understands what is required from and by the field of architecture to implement BIPV on a larger scale

4 Study load

The study load for this module is dependent on the chosen courses. The table below shows possible options for doing this module with their respective study load:

Courses	**Study load (hours)**	**ECTS (1 = 28 hours)**	**Total ECTS**
The Architectural Imagination	50	1,9	1,9
Sustainability in Architecture	16	0,6	0,6

Future Cities Quality of Life: Livability in Future Cities	30 33	1,1 1,2	2,3
Architecture integration assignment	28-56	1-2	1-2

4.1 Recommended structure / schedule per week

The MOOCs can be followed online and studied on demand. Therefore a weekly schedule to study these courses can be adapted to other courses in the curriculum, and to the time frame in which the curriculum is given. There's no recommended sequence for the courses except for the Architecture Integration Assignment. This assignment combines the course material and should be performed last.

5 Content of the module

This module consists of 4 MOOCS and one assignment. The following paragraphs describe the content of the respective MOOCS and their learning goals.

5.1 GSD1x: The Architectural Imagination: Introduction to the History & Theory of Architecture

Cited from the course website (Hays et al., 2018)

> *"Architecture engages a culture's deepest social values and expresses them in material, aesthetic form. In this course, you will learn how to "read" architecture as a cultural expression as well as a technical achievement. Vivid analyses of exemplary buildings from a wide range of historical contexts, coupled with hands-on exercises in drawing and modeling, bring you close to the work of an actual architect or historian.*
>
> *Architecture is one of the most complexly negotiated and globally recognized cultural practices, both as an academic subject and a professional career. Its production involves all of the technical, aesthetic, political, and economic issues at play within a given society. Over the course of ten modules, we'll examine some of history's most important examples that show how architecture engages, mediates, and expresses a culture's complex aspirations.*
>
> *What You Will Learn:*
>
> - *How to read, analyze, and understand different forms of architectural representation*
> - *Social and historical contexts behind major works of architecture*
> - *Basic principles to produce your own architectural drawings and models*
> - *Pertinent content for academic study or a professional career as an architect"*

5.2 ISA201x: Sustainability in Architecture: An Interdisciplinary Introduction

Cited from the course website (Orozco-Messana et al., 2018)

"This course offers an interdisciplinary approach to sustainability in Architecture. Learners will be introduced to the basic elements of sustainability assessments (first model layer), as well as trends informing the space today.

The coursework enables students to develop a conceptual neighborhood model for assessing performance and urban policies.

In the first week, participants will learn to develop a conceptual model from the architectural elements of buildings; the basic building block of which will be the performance of materials. The second week explores methods of optimizing performance. Coursework will detail the needs and constraints inherent in selecting materials and neighborhood urban elements (the second model layer for green, blue and grey infrastructure).

In the third week, learners will develop the basic tools for introducing energy and measuring the potential impact on climate change (CO2). A new layer (third) on our neighborhood stainability model, this will be approached from a global perspective. In the fourth and final week, the course will explore techniques for a joint assessment directly connected to policy issues.

WHAT I WILL LEARN

- *How to evaluate the sustainability performance of buildings from materials*
- *Ways to assess energy use*
- *How to account for use of urban infrastructure*
- *How to create a neighborhood model adequate for analysis and urban policy assessment"*

5.3 FC-01x: Future Cities

Cited from the course website (Schmitt et al., 2018)

"With the successful completion of the course, you will be able to better understand the city by going beyond the physical appearance and by focusing on different representations, properties and impact factors of the urban system. On the one hand, we will explore the city as the most complex human-made organism with a metabolism that can be modelled in terms of stocks and flows. On the other hand, we will investigate data-driven approaches for the development of the future city, based on crowd sourcing, sensing, and citizen science.

More specifically, by the end of the Future Cities course you will be able to:

- *Understand how to use the information to design architecture in the future*

- *Make the invisible-visible, by understanding the interaction between the components of the city. You will also be able to recognize data as the raw material of future architecture and learn how to organize them in meaningful ways*
- *Understand the construction process as a system*
- *Understand how a good model can describe the interaction between important features of the real object, as well as the importance of simulation for decision making and planning*
- *Understand the importance of energy and exergy as key concepts in the interaction with the environmental system and the value of the impact a building causes in it*
- *Apply the principle of stocks and flows to architecture at different scales, where statics and dynamics are represented by people, water, material, capital etc.*
- *Understand the importance of the knowledge of the territory, and how crucial it is regarding planning or developing a city*
- *Understand that the boundaries between cities and their surroundings are dynamic and constantly changing.*
- *Finally, you will learn the importance of transforming existing cities in order to become more sustainable and how to plan future cities for resilience."*

5.4 ETHx: FC-02x: Quality of Life: Livability in Future Cities

Cited from the course website (Schmitt et al., 2018a)

"Cities are becoming the predominant living and working environment of humanity, and for this reason, livability or quality of life in the city has become crucial.

This urban planning course will focus on four areas that directly affect livability in a city: Urban energy, urban climate, urban ecology and urban mobility. The course begins by presenting measurable criteria for the assessment of livability, and how to positively influence the design of cities towards greater livability. We will focus on this basic topic of the human habitat in a holistic way, and introduce possibilities of participatory urban design by citizens, leading towards the development of a citizen design science.

You will be able to share your experiences with the other participants in the course and also with the experts from the teaching team. In completing this course, you will better understand how to make a city more livable by going beyond the physical appearance and by focusing on different properties and impact factors of the urban system.

Livability in Future Cities is the second course in a series of MOOCs under the title "Future Cities." This series aims to bring the latest research on planning, managing and transforming cities to places where this knowledge has the highest benefit for its citizens. "Future Cities" provided an overview, and this course will focus on livability in existing and new cities.

Learning objectives

This course focuses on four areas that directly affect livability in a city: urban energy, urban climate, urban ecology and urban mobility. With the completion of the Livable Future Cities course you will be able to:

- *Understand the importance of livability in cities*
- *Recognize the existing measurable criteria of livable cities*
- *Learn about how different aspects of urban climate, energy, mobility, water and ecology affect the livability in cities*
- *Understand what citizen design science is and how important it is for the planning of future cities*
- *Recognize the different measurable criteria for the assessment of livability, and how to influence the design of livable cities."*

Even though it is recommended to follow the MOOCS on the online platform. The module-folder contains downloads and prints of the course content of the MOOCS, in case the online course is not available (anymore).

5.5 Architecture integration assignment

The Architecture integration assignment links the content of the various MOOCS with BIPV, more information on this assignment can be found in chapter 8.

6 Connection with BIPV

Even though BIPV is a topic that plays a role in most of the MOOCS, a large part of the content of this module is about architecture and urban planning in general. For this reason the connection between the knowledge and skills gathered in this module and BIPV is made in the Architecture integration assignment.

7 Excursions and other activities

7.1 Excursions

Examples of possible excursions for this module are:

- Visiting a building where BIPV is applied, have a guided tour and receive background information about the project. Best to organize with a local project developer.
- Visiting other architectural works and analyze where BIPV could have been applied
- Visiting other architectural works together with an architect and receive a presentation of the architects ideas about the building
- Visiting the urban planning department of a municipality

7.2 Optional extra involvement architects

For the Architecture Integration Assignment a panel of architects is required. The assignment describes the possibility of more involvement of this panel. Even when this assignment won't be

implemented as part of the module, this could be of great value for the students. Examples of extra involvement of architects are:

- Guest lectures on topics chosen by the architects
- Guest lectures on topics requested by the students
- Organizing a forum with students and architects (could also be an online forum)

8 Assignments and exercises

Besides the assignments given in the MOOCS, the architecture integration assignment is an important part of this module. The main goal of this assignment is to make the connection between the Architectural aspects module and BIPV. Students learn:

- Where BIPV meets and where it jeopardizes the views of the architect
- What is required for the architect to make use of BIPV on a larger scale
- What technological requirements are necessary for BIPV to be used by architects on a larger scale
- To translate technological possibilities to other requirements such as aesthetics, societal needs, 'Zeitgeist', financial etc.
- How BIPV can play a role in the design and planning of livable cities
- To present their knowledge and findings in an attractive way

In this assignment the students make a product that persuades architects into making BIPV an integral part of the construction's design. At the end of this project this product will be presented to a panel of architects and there's time for feedback and discussion.

The deliverables for this assignment are

- 20 minute presentation of your product and your product itself[1]
- Short report that describes the decisions that were made to come to the work
- Evaluation of the work with the input of the panel and lessons learned

[1] The product could also be part of the presentation or the presentation alone

9 Readings and other materials

Title	Year	Authors	Subjects
Photovoltaics and zero energy buildings: a new opportunity and challenge for design	2012	Scognamiglio and Rostvik	ZEB, BIPV, Architectural perspective
Aesthetics of Sustainable Architecture	2011	Lee et al	Aesthetics, sustainable development, design
More to be added			

10 References and acknowledgements

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More to be added

11 Contacts

Project coordinator

Wilfried Van Sark, Associate Professor, Copernicus Institute of Sustainable Development, Utrecht University
Princetonlaan 8a, Utrecht, The Netherlands
Email: W.G.J.H.M.vanSark@uu.nl
Phone: +31-30 2537 611

Work Package Leader

WIP Renewable Energies
Sylvensteinstrasse 2 , D-81369 Munich, Germany
Email: sofia.arancon@wip-munich.de
Phone: +49-89-720 12 722