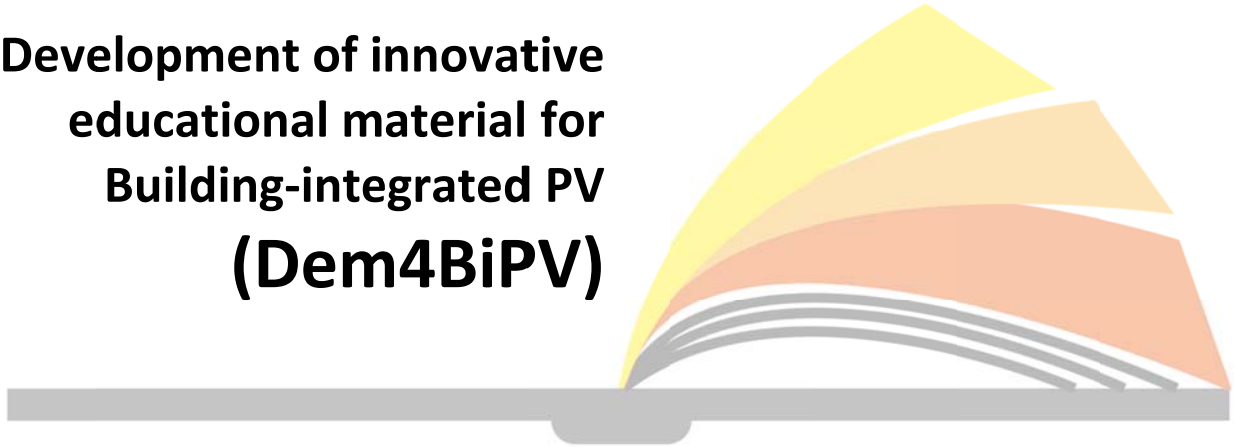
PV integration Assignment

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



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1 Introduction

This assignment is part of the Photovoltaics module of the Dem4BiPV program. In the assignment students are invited to implement their findings from general PV courses into building integrated situations, by means of building a website. This website exhibits and evaluates different BIPV projects. Besides building a website students are also challenged to show their analytical skills by evaluating the work of their peers.

This document describes the goals of this assignment, how it should be carried out, and how it could be graded.

1.1 Learning goals

The goal of this assignment is to integrate knowledge and skills gathered in the courses from the Photovoltaics module into a building integrated approach. In this assignment students are expected to apply their knowledge and skills about PV in situations where the PV is not added or applied to a building, but where integration into a building takes place. For every different application, this integration brings different (dis)advantages.

In this assignment the student demonstrates:

- Insight into different PV technologies used for different BIPV-applications
- Making well informed decisions on what PV technology to use for different applications
- Having an overall view on the (dis)advantages of different PV technologies
- An understanding of the manufacturing of BIPV elements
- Being able to publish findings in a web-based environment
- Having an analytical and critical view on published findings

1.2 Setup of the assignment

This assignment consists of desk research combined with review work of peer students. Both parts of the assignment are being graded.

The desk research consists of building a web page where details of different existing BIPV examples are being exhibited. Besides showing these examples, students are being asked to improve their examples with current technologies and to give a perspective of how the application could be in the future.

After finishing part 1 of the assignment, students will critically evaluate the work of their peers. This way they're being exposed to more different applications and insights on BIPV and learn to critically evaluate the work of their peers.

Finally the peer review will be the basis for a self-evaluation.

1.3 Study load

This assignment can be done solely or in groups with of maximum 4 students. With increasing group size the study load decreases. The table below provides an estimation of the study load per student for the whole assignment for different group sizes.[1]

	1 student, 3 examples	**2 students, 3 examples**	**4 students, 5 examples**
Part 1: Web page	50 hours	38 hours	28 hours
Part 2: Peer reviewing	8 hours	8 hours	8 hours
Part 3: Self-evaluation	4 hours	4 hours	4 hours
Total	62 hours (2,2 ECTs)	50 hours (1,8 ECTs)	40 hours (1,4 ECTs)

1.4 Grading

The final grade is based on all three parts of the assignment. Every part is weighted as described in the table below. Even though the instructor gives the final mark, findings from the peer reviewing and self-evaluation will be leading for this.

Part 1		
Website	**Weighting (%)**	**Grade (mark between 1 and 10)**
General appearance	10	Should be at least a 6 to pass
Referencing	10	Should be at least a 6 to pass
Description per project		The average mark of all projects together should be at least a 6 to pass
Past	20	
Present	20	
Future	20	
Part 2		
Peer reviewing	10	Should be at least a 6 to pass
Part 3		
Self-evaluation	10	Should be at least a 6 to pass
	100	

[1] The study load is indicative and could be varied with the amount of exhibited examples, amount of peer reviewed assignments and group size.

2 Part 1: Website

Build a website where 3 existing BIPV projects are being exhibited. Every project should at least have its own page, use subpages in such a way that the site remains viewable.

On this website, you will not only show the project as it was built, but you will also make an estimation of the project how it would be made with today's technology. Finally you'll give a future projection for this similar building.

2.1 Different project sizes

The projects you exhibit must vary in size, therefore you choose[2]:

- 1 dwelling/ house for at least 1 family (< 10 kWp for whole project)
- 1 office building/ congress center/ exhibition area (> 300 kWp for whole project)
- 1 project of your choice

2.2 Different BIPV applications

Every project you exhibit must fulfill a different application of BIPV, choose your 3 different applications from the list below[3]:

- Warm facade
- Cold façade
- Shading system
- Roofing
- (semi)transparent glazing

Make sure to have examples with enough data available to answer the questions in the following paragraphs.

2.3 Past

The BIPV project that you're describing has been built already, which means that the design phase of your example lies in the past.

Give a description of the project as it was built. Beside a general description of the project, describe:

- What PV technology is used
  - Why this technology? Give some determining factors for choosing this technology
  - Give some advantages of the used PV technology for the given application
  - Give some disadvantages of the used PV technology for the given application
- How are the PV modules connected to the grid?
  - Type, amount and sizing of inverters
  - String arrangement (how many and which modules are connected in series
  - Use of optimizers? DC system in building? Energy storage?
- What is the Peak power of the PV system in Watt / m^2
- What are the costs per Wp of installed PV

[2] In case of larger group sizes and more examples, the amount of obligatory project size could be varied. (for example with 5 projects it could be 2 <10 kWp, 2>300kWp and 1 free choice)
[3] In case you want to exhibit an application not listed, discuss this with your tutor/ teacher in advance

- What is the expected annual energy yield of the PV system?
- How are the BIPV elements manufactured
- How does the application of PV influence the esthetics of the building? Does it compromise or strengthen its esthetics?
- Define if and how the energy exchange with the grid is arranged. Analyze the reasons for this arrangement. Look at the more economic, regulatory or societal aspects such as subsidies, self-consumption, electricity rates etc.

In case certain data is not available for your project, give an estimation based on general data or similar projects from the time when the project was delivered.

2.4 Present

Imagine that the project is currently being developed and you're the designer of the PV part. Look back at the questions of the former paragraph and answer them for your new design.

2.5 Future

Now give a future prospect of how this same project would be built in 10 years from now. What technologies will be available then? At what cost? Etcetera. Again try to answer the same questions as in 2.3.

2.6 Platform

You're free to make use of any (free)web platform you like to build your site on. Google Sites (https://sites.google.com/) has an easy interface and has the advantage of using files from your Google Drive on your site. But there are many other options available online. Don't spend too much time on finding the best solution for you, just start with something that works. You're not expected to write html language or to claim a special domain name etc. Keep it simple, especially when you collaborate with other students.

Make sure your website is easy to read. Don't use too long text blocks and make smart use of pictures and subpages. Further on, when referring to online resources, make use of links, so the reader can easily follow where your data comes from.

2.7 References

In all the work you present, make sure that you have proper (scientific) references that support your findings and make references to the owner of the pictures you use. Decide for yourself where to put the list of references and how to link those with your text. An example of how you could work with references on websites is Wikipedia

3 Part 2: Review your peers

Every website can be reviewed by grading the following subjects. As reviewer, you're not expected to just give a mark. Every mark should be accompanied by a clear description of how this mark is defined. This will be done by answering two question on every subject:

- What is good about the work?
- How could it be improved?

The grades of the peer review are a clear guidance for the tutor to grade the final work.

As assistance in how to review the work of your peers, and even better, how to do this assignment in the best way in the start, the review subjects are a bit more explained in the paragraphs below.

3.1 General review questions

General appearance of the website: Think of matters as: Professional appearance? Balance between photos and text? Are the pictures of an acceptable quality? Do subpages and links facilitate browsing the website? Readability

Referencing: Are claims made on the website based on scientific sources? Are references to these sources visible? Are references reliable and up to date?

3.2 Review questions per project example

For every example the following questions can be answered:

Past: Are **all** questions described in 2.3 answered? Are there clear references to the data? When there was no data available, was there proper reasoning behind the estimations made?

Present: Are **all** questions described in 2.3 answered for this present situation? Is there proper reasoning behind the decisions for the chosen technologies? Does it show an understanding of the opportunities of current PV technology?

Future: Are **all** questions described in 2.3 answered for this future projection? Is there proper reasoning behind the decisions for the chosen technologies? Does it show an understanding of the opportunities of future PV technology?

4 Part 3: Self-evaluation

After you work has been reviewed, read carefully how your page has been graded and how your marks have been defined. Now make another page on your website where you publish the findings of the peer review and where you evaluate your own work by means of this review. Describe for every subject how much you agree with the findings of the reviewer. Would you give yourself the same mark? Don't only be critical on yourself, but be also critical on your reviewer. In case your work has been assessed as inadequate and you agree on this, define what could be done to improve your work to receive an adequate mark.

Finally write a small paragraph where you grade your peer reviewer. Define what was good about the review and how the review could be improved.