

## Experience report

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Fist and last name: Arjun

Study program: Engineering and International Business

Bachelor or Master: Masters

Host institution, country: Ss Cyril and Methodius University, North Macedonia

Period: 01.10.2021

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## Declaration of consent to the publication of the report

- I agree that the present report will be linked on the website of the ERASMUS office, so that future prospective customers can get first-hand information about my experiences at the university location abroad.
- I agree that my e-mail address will be available to prospective students who would like to get first-hand information about my experience at the university abroad, upon request to the Erasmus office.
- I agree that my **full name** / only **my first name** can be found in the published report.

## Formalities:

Students from SRH Berlin had a zoom meeting with professors from FEIT, Skopje. Professors introduced their areas of expertise and topics they are planning to work on. That gave us opportunity to select specific mentor/ professor and the topic which relates to our area of interest.

## Motivation and preparation for mobility:

Interesting research topic (A Techno-Economical Analysis of Residential PV system) and offered international exposure were main attractions to participate in this internship programme.

Filling and signing learning agreement, applying for health insurance, and finding accommodation in Skopje were the main tasks in preparation for mobility.

## Start of mobility:

I moved to Skopje, Macedonia in the first week of October 2021. After arriving we had to register ourselves at local police station with residential address and submit one form signed by landlord. On first day at the FEIT comprised of an introductory section with all professors and tour to the different departments and labs of the university.

## **During the mobility: 3 months**

### **What have I learned and what am I taking with me from this time?**

#### **1. SELECTION OF THE TOPIC**

The starting stage of the internship was focused on the selection of a topic for my internship. Where my initial selected topic was “Trends in Electric Vehicle and Hybrid Electric Vehicle” but when I had my initial discussion with my professor, I had informed her that I would like to work on a topic which I can build for my thesis and with some practical applications in it as it would be easy for me to work on. She very well understood my need and then introduced me to her then PhD. student Mr. Vladimir Gjorgievski who was working on a residential PV system. My first session with him was to understand this inhouse system in the university. Which was very well explained to me by Mr. Vladimir and with further discussions with him I arrived at a topic titled in this report “Techno-Economical analysis of a residential PVsystem”

#### **2. UNDERSTANDING OF TECHNOLOGIES**

Understanding details in PV power generation technologies was the next step of my internship. Research papers, case studies and other reading materials suggested by professors and fellow students were helpful for the detailed understanding of technologies in PV. This helped me to get actual theoretical understanding. Referring past thesis materials of graduated students was also useful to obtain the required formulas and numerical calculations. Along with this I was also asked to learn and understand some energy management software’s like RET Screen and PVsyst. So, the following couple of weeks I had to devote to understanding of this two software’s and then I had to arrive at a conclusion that it would be best for me if I could carry on my work with PVsyst for this project. Then I enrolled myself to free online tutorials of this software and started learning in depth. Then I simulated the PV system that was present in the university in the PVsyst software and generated a report. Compared and analyzed the report generated by me to the preexisting report of the system done by experts. Which gave me a good sense of understanding and helped me in rectifying my errors.

The further research work for this internship was focused on calculating the Net Present Value (NPV) of a system which can be used for 20 years in our case.

#### **3. TECHNICAL ANALYSIS**

Initial process was to simulate the Energy generation of Photovoltaic system using Energy management software’s like PVsyst and some online platforms like PVGIS and Renewables Ninja. So, using the data from the system present in the university, I simulated it in the software to get the Electricity generation for 1 year. Then I obtained the Electricity

consumption of a household for a year which was given to me by Mr. Vladimir. All these values were tabulated in an excel sheet. Later, these values are projected for 20 years considering 1% degradation for every year of energy generation and thus a Net Present Value is Obtained.

Some of the system details used for the analysis:

Geographical Site is Karpos Dva- Macedonia with Latitude: 42.00 N and Longitude: 21.41 E

PV Field Orientation is fixed plane with Tilt: 30 and Azimuth: 10 degrees respectively.

Rest of the details can be found on the report attached with this document. This report gives a good understanding of the system and various input parameters.

The next step in the project was to tabulate all this in an excel sheet and present the understanding of NPV for different wattaged system.

## 5. ECONOMIC EVALUATION

The main factors analyzed in economical evaluation is Net Present Value (NPV). The NPV formula is a way of calculating the Net Present Value (NPV) of a series of cash flows based on a specified discount rate. The NPV formula can be very useful for financial analysis and financial modeling when determining the value of an investment (a company, a project, a cost-saving initiative, etc.).

### Net Present Value (NPV) Formula

$$NPV = \sum_{t=1}^n \frac{R_t}{(1+i)^t}$$

**where:**

$R_t$  = Net cash inflow-outflows during a single period  $t$

$i$  = Discount rate or return that could be earned in alternative investments

$t$  = Number of timer periods

If you are unfamiliar with summation notation—here is an easier way to remember the concept of NPV:

$$NPV = TVECF - TVIC$$

**where:**

TVECF = Today's value of the expected cash flows

TVIC = Today's value of invested cash

## 6. CONCLUSION/ LEARNING OUTCOMES

By this Internship we can conclude that this project is a profitable one as the NPV is greater than 0 as you can see from the excel sheet.

Through this internship program, I got introduced to different energy management software's like PVsyst and RET Screen. Through research papers and other reading materials suggested by my mentor, I received detailed understanding of specific concepts like NPV.

Other than the academic learning of this internship program, I got to know new places, new people and new culture which are most important outcomes for me.

### **Green ERASMUS – How is the topic of the environment treated at the host institution & in the host country?**

Faculty of Electrical Engineering and Information Technologies, Skopje has vision to utilize renewable energy as a main source of power and electricity. They have already started working towards it by installing PV panels on the roof of an institution building. Campus area is also clean, but they should provide different bins as per the type of waste, this could help for the on-sight segregation of waste. About Skopje city, on the ranking of air-pollution it lies on the 5th position in the world. The government should focus on this and implement the techniques applied by other developed countries from Europe like Germany, UK. North Macedonia has a huge potential to grow as a green energy producer and they are working on maximizing renewable energy utilization. I wish and believe that North Macedonia will be in the list of sustainable energy producing countries in near future.