TABLE OF CONTENTS

1. INTRODUCTION

This report gives an overall experience during my internship in Over Easy Solar. My focus during internship was on the analysis of solar panels and factors around their performance and integration into the real world.

Specific objectives of the internship were to

- Engage in hands-on work with the analysis of solar panels, focusing on the main factors affecting their performance.
- PVSOL: learn to use it for analysis of the energy yields, shading, module placement and overall performance assessment.
- Have enhanced knowledge of the certification processes and market requirements.

2. HOST ORGANIZATION OVERVIEW

Over Easy Solar AS was established in 2021 and is headquartered in Oslo, Norway. It is aimed at developing, manufacturing, and delivering pre-assembled vertical PV units, suitable for easy installation on green and flat roofs. Their inventive vertical bifacial solar panels have been developed to enable maximum energy capturing from both sides of a solar panel, creating an exceptional result considering the limitation of roof space, especially in urban areas.

The largest deal to date is providing the Norwegian National Football Stadium with a 248.4 kWp solar system in May 2024; it is a world record for rooftop-mounted, vertically placed solar panels.

Over Easy Solar was established to facilitate the transition toward adopting solar energy by providing maintenance-free and easy-install solar modules that coexist in harmony with a variety of existing building structures and form one part of a global movement toward renewable energy. With its focus on making solar easier to use, Over Easy Solar aims at enlarging the potential pool of consumers and businesses moving toward renewable energy and decreasing carbon emissions worldwide.

3. WEEKLY PROGRESS AND ACTIVITIES

Week 1: Getting to Know Vertical Solar Panels and DIBT Certification process

- learnt about vertical solar panels: what they are, how they work.
- Started the DIBT certification process for introducing solar panels into the German market.
- An overview of the requirements that will be needed for implementing it into the market.

Week 2: Learning PVSOL and VPV Planner

- Learned to use PVSOL and internal system planner VPV.
- Demo projects to get used to the tools.
- Panel orientation, shading impacts, energy yield calculation-related studies.

Week 3: Project Analysis - Feuerwehr Kassel

- Shading and Energy Yield Analysis for a Kassel, Germany project of ~19 MW/Year of production capacity.
- Pinpoint the most determining factors that will affect energy production: shading patterns and panel positioning.

Week 4: Friction Analysis for Vertical PV Panels

- Analyze friction properties for various panel feet to ensure stability.
- Friction calculation methods that will suit the Over easy solar panel, which relies only on foot-to-surface friction, serves as the main motive to avoid installation time and easy maintenance.

Week 5: France Certification Process for Solar Panels

- France's certification process and necessary tests to enter the market has be researched.
- Worked towards requirements for these certifications to establish panels in the French market.
- German vs. France differences in certification standard studies, & similarities.

Week 6: Advanced Shading Analysis Methods

- Perform shading analyses and study different methodologies for vertical solar panels using Rhino, Sketchup & other tools.
- Shading of the surroundings and environmental factors were dealt with in terms of deeper understanding.

Week 7: Project Analysis - Loren Skole

- Estimated shading and energy yields for the Loren Skole solar panel project of about 35 MW/year production capacity using PVSOL.
- Identified key factors impacting energy generation, including seasonal variations.

Week 8: Shading Analysis Using Rhino 3D and Grasshopper

- Continued shading analysis for vertical panels using Rhino 3D and Grasshopper.
- Improved modeling techniques to enhance analysis accuracy.

Week 9: Developing Vertical Panels Calculation Method

- In this week, a specific method of calculation of vertical panels has been developed.
- The inclusion of parameters such as panel height, angle, roof type etc.

Week 10: Rhino 3D modelling of Panels

- Rhino 3D was utilized in order to make the analysis manageable.
- A framework for this project was developed by keeping repeatability and efficiency in mind

Week 11: Green Roofs Effects on Solar Panel

- Research on the effects of green roof on solar panel compared to black conventional roofs.
- Studied factors such as temperature regulation, albedo (reflection), and shading from vegetation.

Week 12: Attending Solar Solution Fair

- Attended the Solar Solution fair to learn about projects and promote Over easy solar panels.
- Product features and technical data presented to potential clients.
- Recognition of industry trends and market demand

Week 13: Energy and Shading Estimation for Aker Solutions

- Worked on a new project estimating energy and shading for Aker Solutions of 120 MW/Year of production capacity using Rhino 3D.
- Applied advanced analysis techniques to optimize energy yield predictions.

4. SKILLS ACQUIRED

- Proficiency in PVSOL, Rhino 3D for energy yield and shading analysis.
- Enhanced understanding of solar panel analysis, including factors to consider such as shading, orientation, and environmental influences.
- Improved problem-solving and project management skills.
- Practical knowledge of certification processes for different markets.

5. CONCLUSION AND FUTURE OUTLOOK

This internship has been a transformative learning process that has provided me with hands-on exposure to the solar energy sector and the details of solar panel analysis. To be able to work with innovative technologies such as vertical bifacial solar panels and advanced tools such as PVSOL and Rhino 3D, the internship has immensely broadened my technical and analytical abilities. From shading analysis and energy yield estimation to certification processes and market needs, I developed a holistic view of solar energy solutions. Most especially working with Over Easy Solar had a role to play in deepening my understanding of sustainable energy systems and their practical implementations in various environments.

I look forward to advanced research, particularly my thesis, on the shading analysis of vertical bifacial solar panels; these learnings shall be applied. Committed I am to contribute toward innovative engineering in sustainable energy; thus, I am confident this experience will make me impactful in the transition of our world toward renewable energy.