MEMORANDUM OF UNDERSTANDING

between

The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Unit 042A, 4th Floor, Coco Building, 14 Thuy Khue, Tay Ho District, Hanoi, 100000, Viet Nam

And

ENVELOPS CO. LTD.

806 Heyground Seoul Forest, 115, Wangsimni-ro, Seongdong-gu, Seoul, 04768, Republic of Korea

And

Da Lat University

1 Phu Dong Thien Vuong, Ward 8, Da Lat City, 66106, Lam Dong, Viet Nam

And

Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. | Hansastraße 27c, 80686 München, Federal Republic of Germany

as legal entity for its

Fraunhofer Institute for Solar Energy Systems ISE e.V.

And

Green Technology Center

17th FL. Namsan square bldg., 173, Toegye-ro, Jung-gu, Seoul, 04554, Republic of Korea

And

HAEZOOM Corp.

706, SKV1 GL A, 128, Beobwon-ro, Songpa-Gu, Seoul, 05854, Republic of Korea

And

Korea Leading Engineering System Inc.

271-23, Munji-ro, Yuseong-gu, Daejeon, 34050, Republic of Korea

regarding

Agrivoltaics pilot project in Viet Nam
(Da Lat, April 22nd 2022)

I. INTRODUCTION

1. The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH (hereinafter referred to as „GIZ“), ENVELOPS CO. LTD. (hereinafter referred to as “ENVELOPS”), Da Lat University (hereinafter referred to as “Da Lat University”), Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. | Hansastraße 27c, 80686 München, Federal Republic of Germany as legal entity for its Fraunhofer Institute for Solar Energy Systems [e.V.] (hereinafter referred to as “Fraunhofer ISE”), Green Technology Center (hereinafter referred to as “GTC”), HAEZOOM Corp. (hereinafter referred to as “HAEZOOM”), Korea Leading Engineering System Inc. (hereinafter referred to as “KLES”) (GIZ, ENVELOPS, Da Lat University, Fraunhofer ISE, GTC, HAEZOOM, and KLES shall hereinafter be collectively referred to as the

"Parties" and individually each as a "Party"), recognize the potential of agrivoltaics in Vietnam and affirm their desire to work together to pilot, research, and promote the technology together.

2. **GIZ** works to shape a future worth living around the world. GIZ provides tailor-made, cost-efficient, and effective services for sustainable development. As a federally owned, public-benefit enterprise, the purpose of GIZ is to promote international cooperation. GIZ supports the German Government in the achievement of its development policy objectives. In 2020, GIZ generated a business volume of around EUR 3.3 billion. GIZ's 23,614 employees work in around 120 countries.

3. **ENVELOPS** is a renewable energy project development company in Korea focusing on developing countries and social impacts. It is a private sector organization which was established in April 2018. Despite the short history of the company, each team member including the experts in climate technology has focused on developing renewable energy projects during their career which assists the reduction in greenhouse gas (GHG) emissions. ENVELOPS consists of specialists that are experienced in multiple sectors such as international development cooperation projects, renewable energy, civil engineering, and water management. In 2020, the company secured an approval on their first project "Fiji 4MWp Agrophotovoltaic Project in Ovalau" from Green Climate Fund.

4. **Da Lat University,** established in 1976, is a non-profit public multi-disciplinary university. The predecessor institution of DLU was a higher education institution established in 1958 called Dalat Institute of Higher Education (Viện Đại học Đà Lạt). Nowadays, DLU is the oldest and biggest higher-education institution located in the Central Highlands of Vietnam. DLU is currently hosting more than 11,000 domestic and international students, and offering 56 academic programs, including 06 Doctoral, 09 Master's and 41 Bachelor's programs. The fields of study spread from Science and Technology, Social Sciences and Humanities, Natural Sciences, Economics, Law, Tourism, to Foreign languages. Currently, DLU is constantly innovating and improving its quality in order to provide students with the best conditions to improve their knowledge, to comprehensively develop skills and qualities, attitudes, and to respond well to the needs of development and international integration.

5. **Fraunhofer ISE**, founded in 1981, is the largest solar research institute in Europe with a staff of 1300. Fraunhofer ISE creates the technological foundations for supplying energy efficiently and on an environmentally sound basis in industrialized, threshold and developing countries. With its research focusing on energy conversion, energy efficiency, energy distribution and energy storage, it contributes to the broad application of new technology. Adolf Goetzberger, founder of the Fraunhofer Institute for Solar Energy Systems ISE, was the first to propose the concept of agrivoltaics as an integrated system for simultaneous food and PV power production in 1981. For more than 14 years, the APV team at Fraunhofer ISE has been pursuing solutions in the areas of dual land use, light management, radiation simulations for shading optimization, system optimization and the development of APV plants.

6. **GTC** is a government-funded research institute under the coordination of the Ministry of Science and ICT of the Republic of Korea, which has the task to promote green climate technologies that cope with climate change through research and development of (1) policy, (2) mitigation and adaptation platforms, and (3) international cooperation. GTC has established itself as a green and climate technology hub at home and abroad by supporting national strategies in the technology field of the UN Framework Convention on Climate Change and actively carrying out global cooperation projects to support domestic

institutions and small and medium-sized enterprises. Now, GTC is planning to re-emerge as a think tank for climate change response technology and policies that lead global inclusive and innovative growth in line with its mission of the times.

7. **HAEZOOM** is an award-winning solar energy startup focused on accelerating the solar energy business in South Korea. Our main focus is on maximizing solar energy efficiency through IT/data related technologies. Our main business includes the government-certified residential solar lease program, where we have installed the most in the nation for 3 years. We resolve the risks and problems associated with renewable energy through IT and data solutions such as “solar maps” and “virtual power plants”. “Solar maps” are web-based solar irradiation & PV energy yield estimation tools that utilize machine learning algorithm analysis based on meteorological information and satellite imagery to accurately forecast PV energy yield. More recently, Haezoom has been focusing on the localization of map-based solar power forecasting and analytic systems based on GIS and other analytic tools for data analysis, and meteorological information utilizing the latest Korean satellites. Through our unique software and data mining technologies, we have been expanding the pie of the solar energy market in South Korea.

8. **KLES** specializes in power generation equipment and services which provide total solutions to the energy industry. In particular, the company gets ahead in various technology developments with the goal of safe and secure operation & maintenance of power generation facilities. In the interest of helping the value of safety take deep root in the industry even under these sea-changing business ecologies, KLES has tried out countless challenges so long and will do the same down the road. Moreover, the company has in-depth experience with a number of agrivoltaic projects in Korea in terms of its EPC and O&M.

II. OBJECTIVES OF PARTNERSHIP

7. The objective of this Memorandum of Understanding (MoU) is to affirm the intention to establish a close partnership for promoting active cooperation between the parties in

a) piloting agrivoltaics in Vietnam as elaborated in Annex 1
b) researching the agrivoltaics pilot project as elaborated in Annex 1
c) promoting the results and the technology together as elaborated in Annex 1

This MoU sets forth the Parties’ intentions to collaborate on future projects and the Parties acknowledge that this MoU is not intended to set up already any kind of project in a legally binding form. All terms and conditions relating to specific projects following this MoU shall be agreed upon separately in individual written project agreements.

Although the Parties wish to cooperate in future projects, this MoU does neither impose any duty on one of the Parties to disclose any information to the other Party nor does it force the Parties to enter into any individual project agreement or other obligation.

III. CONSULTATION

8. The Parties consent to use multilateral meetings to plan, implement and steer the envisaged project as defined in Annex 1.

9. The Parties will consult at request of either party on all matters arising out of this MoU and on other matters of common interest. In order to promote a regular exchange of information, the Parties plan to hold multilateral consultation at least on a quarterly basis in the first year of implementation
10. The respective contact points responsible for making this MoU operational will be Thomas Krohn, Project Manager at GIZ; Sung Yoon, Chief Executive Officer at ENVELOPS; Dr. Trịnh Thị Tú Anh, Head of International Relations Department, Da Lat University; Max Trommsdorff, Group Leader Team Agrivoltaics at Fraunhofer ISE; Jaeryoung Song, Senior Researcher at GTC; Oh Hyun Kwon, Chief Executive Officer at HAEZOOM; Sunyoung Cho, Chief Executive Officer at KLES.

IV. GENERAL PROVISIONS

11. Any costs or expenses relating to, or arising from, activities undertaken pursuant to the MoU shall be borne by the respective Party undertaking the activity. For legal reasons, Fraunhofer and GIZ cannot invest their own funds into this project. Therefore, all Fraunhofer and GIZ commitment under this MoU shall be subject to financing at full cost coverage of Fraunhofer costs by the i4AG for innovation in agriculture and respectively GIZ costs by the project Agri-Photovoltaics for rural areas in Vietnam, financed by the German Ministry for Economic Development and Cooperation. Should the financing agreement not come into place or should it cease later, Fraunhofer and GIZ shall have the right to quit at no cost and no liability towards the other Parties.
12. This MoU enters into effect at the date of the last signature and will be in effect until June 30th, 2025, or when the Parties mutually decide to terminate the MoU on three (3) months' notice in writing.
13. This MoU does not create any rights or obligations.
14. This MoU may be modified in writing with the consent of the Parties.
15. The interpretation or application of this MoU will be pursued in an amicable manner solely through consultation between the Parties. Any disputes arising over the interpretation or application of this MoU are not justiciable and will not be subject to adjudication or arbitration.
16. This MoU shall be governed by the law of the Federal Republic of Germany, without reference to its conflict of law provisions and excluding the provisions of the UN convention on the international sale of goods (CISG).
17. None of the Parties may assign this MoU or transfer individual rights or obligations under this MoU to a third party without the prior written consent of the other Party.
The Parties agree that the rights and duties under this MoU should also apply to legal successors of both Parties. The Contracting Parties are therefore obligated to impose the terms and conditions of this MoU upon their legal successors accordingly.
18. Should one or more provisions of these MoU be or become fully or partially void then the validity of the remaining provisions shall remain unaffected. In this case, each contracting party may demand that a valid provision is agreed to that most closely approximates the purpose of the void provision. The same shall apply in the event of a gap.

The signatories have signed this MoU in seven originals in the English language.

Da Lat, 04 August 2022

DocuSigned by:
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Sung Yoon
Chief Executive Officer
ENVELOPS

DocuSigned by:
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Thomas Krohn
Project Manager
GIZ

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Vice Associate -
Dr. Nguyễn Tất Thắng
Vice President
Da Lat University

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Jaeryoung Song
Senior Researcher
GTC

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Oh Hyun Kwon
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Oh Hyun Kwon
Chief Executive Officer
HAEZOOM

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Sunyoung Cho
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Sunyoung Cho
Chief Executive Officer
KLES

DocuSigned by:
Lisa Ferner
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Lisa Ferner
Legal Advisor
Fraunhofer-Gesellschaft

DocuSigned by:
Marianne Bösl
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Marianne Bösl
Head of Team "Production and Materials"
Fraunhofer-Gesellschaft

Annexes

Annex 1: Project Description

PROJECT DESCRIPTION

Agrivoltaics pilot project in Vietnam

Contents

Short description

With a vast potential for solar power and a dynamic agricultural economy, agrivoltaics is a promising solution to contribute to Vietnam's net-zero 2050 pledge and social ambitions. However, the application of this concept under specific conditions in the country requires further research regarding various aspects (energy, agriculture, and economics). GIZ, ENVELOPS, HAEZOOM, Da Lat University, GTC, KLES, and Fraunhofer ISE have come together and contributed their expertise to an agrivoltaics pilot project in Vietnam. The project will facilitate the research through the construction of a pilot plant of 100 kWp in Da Lat. The main research output comprises an agricultural evaluation of different crops and farming practices under the PV system, an analysis of its performance, and an economical analysis with foreseen implications on the central highlands and the country as a whole. The joint project is set to run until June 2025.

1. Project background

Over the last 30 years, Vietnam has managed a remarkable development of its agricultural and its energy sector. In the context of climate change and the ambitions to reach Vietnam's Net-Zero 2050 pledge, new sustainable technologies and business models need to be studied, developed, and multiplied to further reduce GHG emissions. To foster the development of the agriculture sector and maintain the growth momentum of renewable energy, agrivoltaics has shown to be a promising solution.

Agrivoltaics is a concept combining solar power generation with agricultural production. Developed in the early 1980s in Germany, the concept has been piloted (Germany, Chile, India and more) and implemented in large scale (China, Japan & more). This concept aims to resolve the land-use conflict between renewable energy and agriculture production. Besides a higher land use efficiency, the technology potentially brings about other benefits including energy cost savings, additional income for farmers, enabling technology application in agriculture with higher energy consumption, a reduction of CO_2 emissions and an overall more competitive and sustainable agricultural sector.

Agrivoltaics is a new concept in Vietnam and has neither been thoroughly studied nor integrated into an established value chain. However, Vietnam bears a vast potential of solar energy and simultaneously has an extensive size of active agricultural land, which enables unfolding the full potential of this concept. Realizing this potential and the need for research, GIZ, ENVELOPS, HAEZOOM, GTC, KLES, Da Lat University and Fraunhofer ISE aim to jointly develop a research project on agrivoltaics in Da Lat. This research will be conducted with a pilot plant at Da Lat University. The project consortium gathers expertise from an international cooperation and development agency, two renewable project developers with expertise in agrivoltaics development, a power equipment and service provider, and a climate tech hub, one of Vietnam's leading agricultural universities as well as a globally renowned institute in solar photovoltaics. This joint project aims to provide the roll-out of APV in Vietnam with a scientifically proven foundation to develop a business model tailored around this technology.

2. Pilot plant

The core concept of agrivoltaics systems is to combine electricity generation and agricultural production simultaneously on the same land unit. An agrivoltaics system includes an elevated mounting structure that carries solar PV modules above cultivating land. The elevation of these solar dual-use systems that aim at an equal focus on agricultural production and solar energy generation can be 3-5 meters high to allow extensive or intensive, mechanized farming methods (including e.g. machine harvesters/tractors) underneath the solar modules. This dual-use application requires a lower degree of area coverage compared to roof mounted or conventional ground mounted PV systems to allow a higher ratio of irradiation to reach the ground. The space between differs from project to project and depends largely on the shading tolerance of the crops planted underneath. This is the key parameter of this dual-use set up.

The studies of the technology under Vietnam's conditions will be facilitated through the construction of the pilot plant in Da Lat. The pilot plant will cover an area of around 1000 m^2 for a free standing APV system and 1400 m^2 of greenhouse area for an integrated APV system on the premises of Da Lat University. The PV modules will be mounted 3-5 meters above the crops on the open fields and on top of greenhouses. Part of the testing site will be used as a baseline comparison without solar panels. The nominal power of the whole system is set to be around 100 kWp.

This APV plant serves the research objectives of project stakeholders, and hence, its exact layout will be planned according to the research design.

The generated electricity from this system is expected to be primarily used for self-consumption by the operation of the agricultural systems itself and for other adjacent facilities of Da Lat University. However, if a remunerated grid feed-in is achieved with the respective authorities, a partial feed-in of the electricity should be economically evaluated and possibly implemented.

All project partners will cooperate on the pilot plant from the day of signing the MoU until the project ends in the latest June 2025. GIZ is bound to hand over their part of the pilot plant to the Vietnam Ministry of Industry and Trade by June 2025 as stated in their bilateral implementation agreement.

3. Key research objectives

The overall research objective of the pilot plant is to explore and demonstrate the technical and economic feasibility of Agri-photovoltaics for Vietnam. Four types of study are expected to be published and disseminated as the results of this pilot plant: An agricultural evaluation of different crops and farming practices under the PV system, an analysis of the PV-system's performance, an economical analysis of the whole system and a study on policy framework for international cooperation for APV in Vietnam.

3.1. Agriculture research

From the agricultural perspective the most important research activities aim at understanding the impacts of APV on agriculture and discovering proper farming methods. Criteria for suitable crops could be shade tolerance, average yield per hectare compared to a reference area, the dimensions of the required machinery employment, and further possible synergies between the agricultural and PV layer. The layout of the PV modules will consider creating several zones within the same system with different lighting intensities. This setting will be tested with a range of various crops underneath to find out the appropriate crops and the optimal combination of crops and shading intensity. The effects the system has on agricultural production, growth, yield and quality of crops will be closely monitored.

Under these different shading intensities, microclimatic indicators (temperature, humidity, precipitation, wind, air pressure, pH value, oxygen and CO2, soil water tension) will be monitored and factored into the analysis. The needs for pesticide and fertilizer, changes in irrigation settings or in the application of agricultural machinery should also be taken into account. The agricultural performance under the APV system will be compared with performance on the reference site with the same crop types and farming practices. The research will be implemented in different phases.

3.2. PV system research

The research on the PV-system will study the impacts of agricultural activities on the system, especially the yield of the system, the soiling effect and degradation on PV panels, impacts of extreme weather conditions on the PV panels, and special maintenance needs. The overarching goal of this research component is an optimal design of the PV system to ensure highest performance of all components within the integrated system. In order to do so, several factors will be monitored including: soiling, wind/rain thresholds, module conditions and PV yield.

3.3. Economic research

The economic study will result in a cost-benefit analysis of the whole APV with different types of crops. This analysis should take into account the costs and revenue of the APV system, as well as costs and revenue for agricultural activities. For the PV system, potentially increased CAPEX & OPEX through higher costs for transparent and/or double sided panels, a taller and relatively larger mounting structure, higher maintenance costs and a lower yield through soiling and faster degradation will be studied. On the agricultural side the focus will be on potential negative impacts on crop revenue, as well as increasing or decreasing operational costs for farming practices.

The PV system research, the agriculture research and the economic research will be incorporated into a larger research set to conceptualize profitable business models using this technology in Vietnam and technical guidelines. Furthermore, the results of this research can be disseminated and further studied internationally, contributing to the larger existing knowledge body about APV and to the implementation of other projects abroad.

4. Implementing partners

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Da Lat University, established in 1976, is a non-profit public multidisciplinary university. The predecessor institution of DLU was a higher education institution established in 1958 called Da Lat Institute of Higher Education (Viện Đại học Đà Lạt). Nowadays, DLU is the oldest and biggest higher-education institution located in the Central Highlands of Vietnam. DLU is currently hosting more than 11,000 domestic and international students, and offering 56 academic programs, including 06 Doctoral, 09 Master's and 41 Bachelor's programs. The fields of study spread from Science and Technology, Social Sciences and Humanities, Natural Sciences, Economics, Law, Tourism, to Foreign languages. Currently, DLU is constantly innovating and improving its quality in order to provide students with the best conditions to improve their knowledge, to comprehensively develop skills and qualities, attitudes, and to respond well to the needs of development and international integration.

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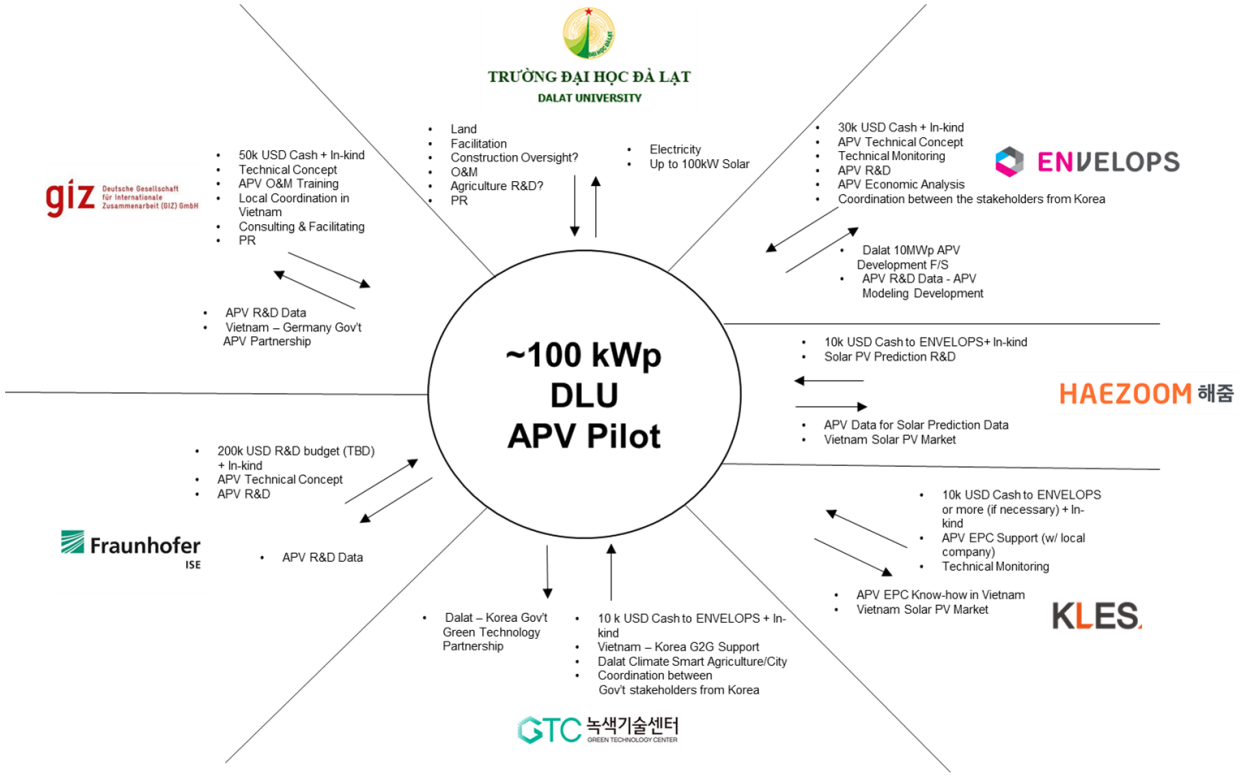
5. Cooperation structure



5.1. Research component

The pilot plant should facilitate research objectives of the consortium. Thus, input and needs for research content will be provided by all partners. Da Lat University, Fraunhofer ISE and ENVELOPS will oversee the research component and lead all research-related activities including:

- Research design and planning
- Implementation of research activities
- Monitoring the research activities
- Reporting research results to other partners
- Publishing research results

Da Lat University will be in the lead for agricultural research.

Fraunhofer ISE will be in the lead for PV system research.

ENVELOPS will be in the lead for technical concept and economic research.

HAEZOOM will be in the lead for solar energy prediction.

GTC will be in the lead for Vietnam - Korea government G2G support and APV based smart agriculture / city study.

The required equipment for the research activities will be determined based on the research plan. Da Lat University and Fraunhofer ISE will contribute available equipment to the research activities. Other equipment shall be purchased by Fraunhofer ISE.

5.2. Development of the pilot plant

GIZ, ENVELOPS, KLES, GTC and HAEZOOM will be responsible for the technological concept and the construction of the pilot plant. Fraunhofer ISE will also contribute to the development of the technological concept. GIZ will be responsible to finance and procure 50% of the whole system (approximately 50 kWp), ENVELOPS (30.000 USD cash + In-kind), HAEZOOM (10.000 USD cash + In-kind), KLES (10.000 USD cash + in-kind), and will be responsible for the other 50% of the system (approximately 50 kWp). GTC (10.000 USD cash + in-kind) will also contribute to the project. ENVELOPS will collect the cash from the Korea partners and select the EPC contractor and conduct other activities of which the plant engineering design will be supported by KLES. However, the procurement process from the GIZ budget will be in full separation from other Korean partners.

Despite separation in the procurement process, the overall layout of the whole pilot plant shall be designed together and developed into a technological concept to ensure the success of research activities. This layout must be approved by all project partners prior to construction.

Da Lat University will be informed about the construction plan and all activities happening on their premise. Da Lat University will reserve all rights attached to their premise and is invited to provide additional oversight of the construction on-site.

Da Lat University will be responsible for Operation and Maintenance (O&M) over the course of the system's lifetime after the first two years. During the first two years, O&M will be carried out by the contractors of the system with on-site supervision by Da Lat University. After two years, O&M will be performed by Da Lat University.

GIZ is responsible for organizing and financing the O&M training for Da Lat University, so that their staff will be able to operate and maintain the system independently, for the rest of its lifetime.

5.3. Research results dissemination and public relations

Focusing on generating knowledge for the general public, the research results gained from this pilot plant will be communicated publicly. Different groups of stakeholders in the energy and agriculture sector and related governmental agencies should be informed about the findings, and especially the possibilities of replication of the APV model. In order to do this, the pilot plant and the research will be accompanied by a series of information dissemination events and public relations activities.

Important milestones in this component include:

- Opening ceremony
- Research results publication
- Workshops and training for stakeholders
- Closing and handover ceremony

GIZ and Da Lat University will be responsible for and cover the costs of the activities regarding research results dissemination and PR in Vietnam. All media products will be approved by and made available to all project partners.

The publication of research results in scientific journals and other forms of dissemination in academia will be handled by Da Lat University, Fraunhofer ISE and ENVELOPS.

5.4. Budget planning

Cost type	**Amount**	**Responsible Party**
Agrivoltaics system	$100,000.00	**GIZ (50k) /ENVELOPS (30k), HAEZOOM (10k), KLES (10k)**
Research equipment and PV research	$200,000.00	**ISE**
Korea - Vietnam Technology Transfer & Policy Research	$10,000.00	**GTC**
Agricultural research (Yield, quality, etc.)		**DLU**
Economic Analysis		**ENVELOPS**
O&M training for Da Lat University staff		**GIZ**
O&M		**DLU**
Commissioning ceremony at DLU		**DLU / GIZ**
Communications (Website, content, research dissemination)		**GIZ**
Workshops & trainings for stakeholders		**GIZ**
Travel & overhead		**All**

Table 1: Budget plan

*All values in this table are a rough estimation based on standard material, component and research equipment cost. The accurate value will be defined according to the research plan and the system layout.

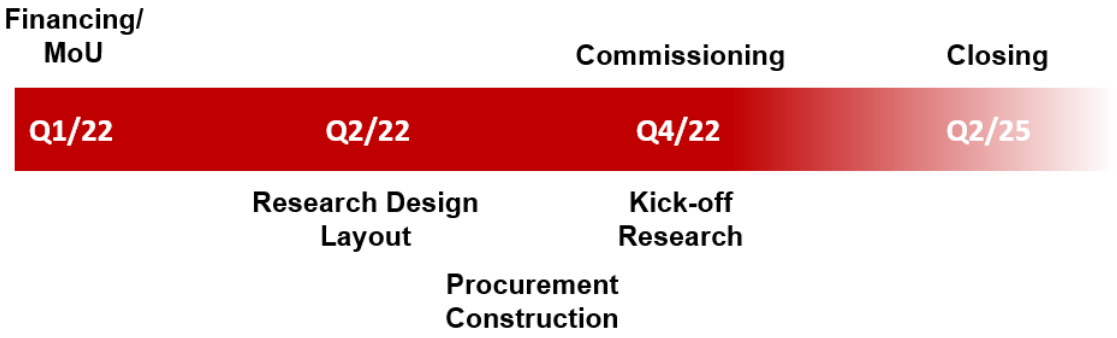
The costs for the EPC of the pilot plant will be financed 50% by GIZ and 50% by ENVELOPS, HAEZOOM, and KLES. Da Lat University will contribute their own research equipment for the research depending on their availability. Other required research equipment will be financed by Fraunhofer ISE.

The OPEX of the pilot plant includes:

- O&M for the first two years (to be discussed with EPC contractors)
- Costs for the re-arrangement and scientific maintenance of the system layout
- Costs for the dissemination of research results and other PR activities

6. Timeline

The timeline and the most important milestones of the research project are depicted below:



Milestone 1: Signing MoU and kick-off

This milestone serves for the official project start with the naming of the project team, the definition of the project goals and the termination criteria. After defining these goals, all project partners will sign the MoU. In addition, the milestone serves to determine project managers and sub-project managers and to clearly define and approve delivery and handover points in the plan.

Milestone 2: Research Design Agreement

Based on the input of all project partners, Da Lat University, Fraunhofer ISE and ENVELOPS will develop a research plan. This research plan will be commented on and approved by all partners. This research plan will serve the layout design of the pilot plant.

Milestone 3: Layout agreement and Procurement of EPC

This milestone serves to start the procurement process for the PV systems. Despite the procurement process being done separately by GIZ and by ENVELOPS, the layout design must be done in cooperation of two sides. The final layout must be approved by all project partners.

Milestone 4: Commissioning pilot plant and kick-off of research activities

This milestone completes the installation phase of the pilot plant and initiates the subsequent research and evaluation phase. At the same time, if the commissioning of the pilot plant is successfully completed, the project contents will be communicated to the public through an opening ceremony and other press and social media channels.

Milestone 5: Research results dissemination

This milestone marks the end of all research activities and serves the publication of the research results. The dissemination shall take place in the form of a workshop, scientific article in scientific journals and press articles.

Milestone 6: End of project

This milestone serves the official completion of the project and the hand-in of final reports.