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Strengthening the Role of Sharia Banking in Financing Solar Power Plants to Support Sustainable Development in Indonesia

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Abstract. *The reluctance of Islamic banking to participate in financing solar power plants is primarily due to higher risk and lower economic value than fossil-based energy. This study proposes a risk management guidance and financing model to strengthen the role of Sharia Banking in financing solar power plants and support sustainable development in Indonesia. There is a significant gap in the study of risk management and the Syariah financing model for solar power plants. We used a qualitative method that involved expert consultations and literature studies to identify the risks of solar power plants. We also derived an equity-based Diminishing Musyarakah for the Sharia financing model. The study's result is a risk management framework and a Sharia financing scheme for solar power plants. By using this framework Sharia banks can increase their participation in supporting sustainable development.*

Keywords: *Solar Power Plant; Risk Management; Sharia Financing*

Abstrak. *Keengganan perbankan syariah untuk berpartisipasi dalam pembiayaan pembangkit listrik tenaga surya terutama disebabkan oleh risiko yang lebih tinggi dan nilai ekonomi yang lebih rendah daripada energi berbasis fosil. Studi ini mengusulkan sebuah panduan manajemen risiko dan model pembiayaan untuk memperkuat peran Perbankan Syariah dalam pembiayaan pembangkit listrik tenaga surya dan mendukung pembangunan berkelanjutan di Indonesia. Terdapat kesenjangan yang signifikan dalam studi manajemen risiko dan model pembiayaan Syariah untuk pembangkit listrik tenaga surya. Kami menggunakan metode kualitatif yang melibatkan konsultasi dengan para ahli dan studi literatur untuk mengidentifikasi risiko pembangkit listrik tenaga surya. Kami juga menurunkan Musyarakah yang semakin berkurang berbasis ekuitas untuk model pembiayaan Syariah. Hasil dari penelitian ini adalah sebuah kerangka kerja manajemen risiko dan skema pembiayaan Syariah untuk pembangkit listrik tenaga surya. Dengan menggunakan kerangka kerja ini, bank-bank Syariah dapat meningkatkan partisipasi mereka dalam mendukung pembangunan berkelanjutan.*

Kata kunci: *Pembangkit Listrik Tenaga Surya; Manajemen Risiko; Pembiayaan Syariah*

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Introduction

Indonesia has abundant renewable energy sources of 3,687 GW of renewable energy potential spread throughout the region (DEN, 2023). As a country with a Muslim majority population, the utilization of renewable energy should be maximized to support sustainable development in line with the spirit of the Islamic economy. Several studies have shown a positive correlation between the use of renewable energy and economic growth (Fotourehchi, 2017; Majeed et al., 2021; Nepal & Musibau, 2019). However, despite the positive effect, based on a study conducted by Wahyudi et al. (2023), the effect of renewable energy consumption is very low, only 0.18% on economic growth, while non-renewable energy is 7.14%. According to statistical data, Islamic financial institutions still contribute to a significant decline in environmental quality (Abduh et al., 2022). This condition is undoubtedly different from the Islamic economy and finance spirit, so radical and systematic efforts are needed (Kennedy, 2018).

According to Mukhtashor (2023), 90% of renewable energy funding in Indonesia is debt-based funding from conventional banks and 10% from other sources. This shows that Islamic banks' participation in renewable energy financing is still very low, which is contrary to the spirit of sustainable development. Factors that inhibit the implementation of renewable energy can generally be classified into four main factors: socio-economic, technical, management, and policy (Abdullahi et al., 2017; Florez & Ghazali, 2020; Hu et al., 2018; Lo et al., 2018; Mukhtasor et al., 2023). Factors related to economic aspects are high investment costs and long investment returns, which cause the economics of renewable energy to be considered unattractive. Meanwhile, technical aspects include technological risk, location limitations, low renewable energy literacy, expensive maintenance, and the lack of experts in the field of renewable. Low government support also inhibits the growth of the renewable energy (Abdullahi et al., 2017; Karakaya & Sriwannawit, 2015; Mukhtasor et al., 2023; Nuriyev et al., 2019).

Moreover, the absence of standard guidelines for assessing financing renewable energy projects in Sharia banks is a pressing issue. As highlighted by (Karim, 2022, 2023), Sharia banks urgently need to establish standard guidelines for assessing renewable energy's feasibility and financing contracts. The high complexity of work in the renewable energy sector further underscores the immediate need for these standards.The current Sharia infrastructure financing products are also not yet at par with conventional bank loans (Mahardika et al., 2016). This condition cause financing for renewable energy projects unattractive for Sharia banks.

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Sharia banks urgently need a guideline to assess the risks of and to develop more innovative financing products for renewable energy projects. However, creating innovative financing products by Sharia banking necessitates a thorough understanding of the risk and financing model for renewable energy projects. There is a significant gap in the literature, particularly in Indonesia, regarding the study of risk management and the Sharia financing model for renewable energy projects. The proposed study is of utmost importance and crucial, as it will fill a significant gap in the literature, thereby guiding Sharia banking in supporting the development of renewable energy projects, enabling them to increase their participation to support sustainable development. This study focuses on the solar power plant financing framework, because it offers a promising future with their low technical and investment risk compared to other renewable energy resources (Eti et al., 2024; Tarigan, 2024).

Literature Review

Barriers to Solar Energy Implementation

The risks of implementing solar energy can be classified into four dimensions, namely socio-economic, technical, management and policy dimensions (Abdullahi et al., 2017; Florez & Ghazali, 2020; Hu et al., 2018; Lo et al., 2018; Mukhtasor et al., 2023). The socio-economic dimension is related to the social conditions of a society and their understanding of solar energy technology. Public perception of solar energy technology will affect the level of adoption of solar energy. Communities with a low level of understanding of solar technology will perceive that solar energy provides few benefits or consider that implementing solar energy for them is too complicated from a technical or administrative perspective and expensive. Others have too high expectations of solar energy, resulting in disappointment when the results obtained do not match what is perceived. The existence of this literacy gap has given rise to a pro and con debate regarding the implementation of solar energy, which ultimately has a negative impact on the growth of the renewable energy sector as a whole. From the economic perspective, the renewable energy sector is still perceived as having low economic value. Several studies show that the Payback Period of Solar Power Plants in Indonesia is between 9 and 18 years, depending on several conditions such as capacity, location, technology used, and interest rates (Putri et al., 2020; Syafii et al., 2018; Tarigan, 2020; Widyanto et al., 2023). Although public interest in solar power technology as an alternative source of electrical energy is relatively high, the low economic value is one of the main obstacles to implementing solar power plants (Kappagantu et al., 2015; Mukhtasor

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et al., 2023). Studies conducted in other asian countries such as Malaysia (Sarker et al., 2023), Hong Kong (Lo et al., 2018), Bangladesh, and China (Karakaya & Sriwannawit, 2015) also show the same phenomenon.

However, most of these studies only focus on the problem of low economic value that inhibits the implementation of renewable energy-based power plants. This perspective is not appropriate, as stated by Dhruba (2018). He mentioned that as clean energy projects are unique financial assets, it require a distinct approach to assessing economic feasibility. Because clean energy projects have implicit and long-term benefits, the same approach to valuing renewable energy as non-renewable energy is considered inappropriate. A study by Shasavari et al. (2024) shows that the external costs of coal-fired power plants, such as controlling environmental pollution, are several times higher than those of renewable energy plants. Meanwhile, Mousavi Reineh & Yousefi (2021) mentioned that these costs for renewable energy plants are negligible. This opinion is supported by Rokhmawati et al. (2023), who, in their study, showed that the calculation of the economic value of fossil power plants, especially coal, has ignored social costs. If these social costs are included in the calculation, according to them, it will extend the payback period of fossil power plants.

Some researchers are of the view that low economic value can be overcome if there is support from the government. The steps taken by governments in many countries are to provide support in the form of feed-in tariff (FiT) policies. A feed-in tariff (FiT) is a policy mechanism to accelerate investment in renewable energy technologies. This FiT policy is a subsidy policy so that investment in renewable energy development becomes more attractive and profitable for investors and developers. The subsidy is in the form of a long-term contract with a higher electricity selling price compared to the market price so that investment in renewable energy generation is more attractive attractive (Rahmanta et al., 2023; Rahmawati & Salam, 2021; Tarigan, 2020). The government's consistency in supporting the FIT policy affects a country's renewable energy adoption level (Abdullahi et al., 2017; Egli, 2020). In Indonesia, the policy regarding incentives for renewable energy-based power plants is regulated by Presidential Regulation No. 112 of 2022. This regulation regulates the FiT policy for all types of renewable energy available in Indonesia, which is expected to accelerate the realization of renewable energy in Indonesia to support the achievement of Net Zero Carbon Indonesia in 2060. Although it provides attractive incentives, several stakeholders hope the government consistently implements the policy. Since 2014, the FiT policy has changed several times, causing business actors and investors to be more careful in making renewable energy business decisions.

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Solar Power Plant Risks and Mitigations

Solar Power Plant risk can be divided into five risk category, namely construction risk, financial risk, operational risk, resource risk, regulation risk and force majeur risk (Abdullahi et al., 2017; Bouhal et al., 2018; Egli, 2020; Ioannou et al., 2017; Lei et al., 2020; Neto et al., 2018; Nuriyev et al., 2019; Petrova et al., 2019; Steggals et al., 2017). In the construction phase, the most significant potential risk is failure to complete the project or delays that cause additional costs Ioannout et al. (2017) classify construction risks as essential risks that must be considered before construction work begins. According to Steggals et al. (2017), construction risks are included in the medium risk category, and ignoring them can have severe consequences, potentially leading to project failure. This risk occurs mainly due to inadequate planning and technical factors caused by the contractor's inability to complete the work properly and in time. Minimizing risk in the construction phase is done through good planning and conducting a strict selection of contractors. Appointing a capable contractor with good financial capabilities and insurance support is the best risk mitigation at this stage.

Operational risk is the cessation or disruption of energy production, which causes a decrease in income, generally caused by problems with personnel, systems, and internal processes (Wing, 2015). The best mitigation is through routine monitoring and maintenance to ensure the entire production process works properly. Situations that often occur and cause production disruption are equipment damage or equipment that does not work according to specifications, which decreases energy production (Table 1). Equipment warranties and the provision of reliable technicians are obstacles to operational risk mitigation efforts.

Some researchers do not consider construction work a specific risk in renewable energy projects. Construction risks can also occur in non-renewable energy projects, so preparing for construction risk mitigation is relatively straightforward. However, (Wing, 2015) and Nuriyev (2019) stress the importance of selecting a good contractor, regardless of the type of energy project. They argue that this is a crucial factor for the successful implementation of renewable energy projects, providing a sense of security and confidence in the project's execution.

Meanwhile, (Bouhal et al., 2018), (Neto et al., 2018), and Salvo (2017) put resource risk as a determining factor for the success of renewable energy-based power plants. They do not classify resource risk as operational risk, but rather as a risk that should have been anticipated before work began. Resource risk can reduce the production in renewable energy-based power plants. Weather changes over time cause unstable production, in contrast to non-renewable energy,

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whose availability is relatively unaffected by weather and seasonal conditions. This supply instability causes a gap between projections and revenue realization in renewable energy. Overestimation in predicting revenue or production is a condition that often occurs, causing information asymmetry between power plant owners and banks that provide financing. To minimize information asymmetry between renewable energy project owners and financial institutions, Dhruba (2018) proposes that investors or financial institutions have experts in the field of renewable energy. Experts who help assess the feasibility of renewable energy projects will reduce liquidity risk due to over-expectations of the energy produced, resulting in a more extended payback period than predicted. Studies that raise issue of resource risk are few compared to other risks, even though, in our opinion, one of the main causes of low economic value is not only the high initiation costs but also supply instability, which has a major impact on economic value. However, most researchers agree that regulatory risk is one of the highest risks that can cause renewable energy development to fail. The facts on the ground show that many countries are still reluctant to provide full support for renewable energy development.

A summary of the risks of renewable energy-based power plants is shown in Table 1.

Tabel 1: Potential Risk in Renewable Energy Power Plan

Risk	Potential Events
Construction Risk	• Construction costs adjusment / overrun • Material delivery and construction time delay • Specification do not match the requirement • Transportation cost adjusment / overrun • Lack of qualified workers • Equipment damage during construction
Financial Risk	• Payment default. User cannot pay the credit • Interest rate swing
Operational Risk	• Low equipment performance • Uncertain energy yield due the weather condition • Low energy yield because of overestimation • Damage of the equipment that stop energy production • Equipment theft • Equipment do not match the required the specification
Regulation Risk	• Government revise the incentive • Changing in the National economy
Force Majeur Risk	Flood, eathquakes etc

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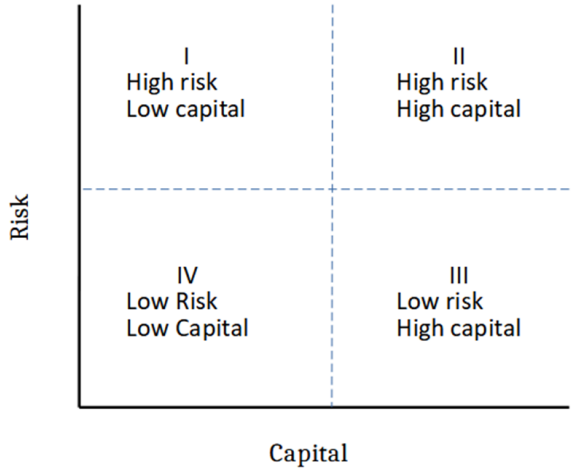
The Role of Sharia Banks in Supporting Renewable Energy Development

There is a scarcity of studies on the role of Sharia banks in driving the growth of renewable energy, which may be attributed to the low contribution of Sharia banking to the renewable energy sector. The perception of high risk and low economic value of renewable energy is a significant obstacle for Sharia banking to participate. Kunhibava et al. (2018) suggest that Sharia banking should take a more proactive stance and support the development of the renewable energy sector. Being proactive means introducing innovative financial products without waiting for conventional banks to take the first steps. This proposal aligns with the spirit of Islamic economics, focusing on maximizing benefits rather than profits (Aljifri & Khandelwal, 2013). The added value or benefits should be achieved without excessively exploiting natural resources, to support sustainable development and environmental sustainability. Sharia banking can play a more significant role by channeling financing for renewable energy generators with low risk and investment value. Mazzucato and Semieniuk (2018) classified renewable energy-based power plants into four risk and investment value categories, as depicted in Figure 1. They suggested that banks could participate in financing renewable energy projects with low technology and capital risk. Their findings are supported by Eti et al. (2024), which state that solar power plants have relatively low technical risk compared to other renewable energy generators. The maturity in technology, ease of installation, and maintenance are factors that reduce the investment risk of solar power plants.

Figure 1. Four type of renewable energy-based power plant



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The most significant risk for solar power plant is the inconsistency in the government's Fit-in-Tarif policy, making it difficult for solar power plant investors and developers to make long-term projections. Some researchers proposed the involvement of Islamic Social Financing in financing renewable energy plants to avoid depending on government incentives for developing renewable energy plants. This involvement has two main objectives: first, to increase the level of economic feasibility, and second, to provide more significant social benefits to the community. The potential for waqf funds to support sustainable and environmentally oriented development is enormous, as highlighted by Ari & Koc (Ari & Koc, 2021)endowment-, trust-, foundation-, and third sector-based. They proposed the establishment of a robust institution called the Waqf Owned Financial Intermediary, which plays a crucial role in collecting waqf funds from various sources. This intermediary ensures the smooth operation of the financing system, thereby enhancing the feasibility of the proposed model. The funds collected are used to build renewable energy plants. If the funds collected are not enough to fund the power plant project, banking financial institutions can be involved to cover some of the costs. Meanwhile, Mukhtasor et al. (2023) proposed that the ideal composition between bank financing and waqf funds is 70% and 30%. Although the portions between bank financing and waqf differ, both studies show that blended financing for renewable energy generation can encourage the successful implementation of renewable energy generation and maintain a fairer distribution of profits.

Methods

To formulate the investment risk framework for solar power plants, we use two methods, namely, literature study and structured interviews. A literature review can generally be described as a way to collect and synthesize previous research. It is very useful if the goal is to provide an overview of a particular research issue or problem. This literature review evaluates knowledge on a particular topic. According to Snyder (2019) there are four types of literature review: integrative literature review, narrative literature review, meta-analysis, and systematic literature review. In this study, a narrative literature review was used, which aims to describe the investment risk of solar power plants and, at the same time, conduct a subjective examination of the literature used as references. One of the objectives of a narrative literature review is to explore problems, weaknesses, contradictions, or controversies in a particular field of investigation.

The literature review results are in the form of a risk table, risk level, and mitigation of the construction of solar power plants. The results were then

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triangulated with a structured interviews. According to Sugiyono (2022), structured interviews are generally conducted in research if the researcher knows what information will be obtained. In our study, we conducted structured interviews with two key stakeholders, the National Energy Council and a renewable energy business actor. The aim of the interviews is to gain their insights and confirm the type and level of risk of solar power plants obtained from the literature review.

As for the financing model for solar power plants, we present an innovative approach using diminishing Musyarakah. Our proposed model based on the concept initiated by Jaffar et al. (2017), that offers a new perspective on financing solar power plants. They formulated a financing proposal called equity-based diminishing Musharakah, which is considered a compromise for the debate on murabahah financing and diminishing musyarakah. By using some mathematical equations we derived an equity-based diminishing Musharakah that can be used by Sharia banks as reference to make a decision in financing solar power plants. We do also a comparative analysis between Murabahah and equity-based diminishing Musharakah

Results and Discussion

The results of this study consist of two parts: Risk management framework and financing model using equity-based diminishing Musyarakah for solar power plants. The risk management framework, designed for practical use, can be a reliable guide for Sharia banks to assess the risk of solar power plant financing and the mitigation steps that must be taken to minimize the risk. Meanwhile, the equity-based diminishing Musyarakah financing model can be a fairer financing alternative for Sharia banks and entrepreneurs.

Risk Management Framework for Solar Power Plants

To develop this Risk Management Framework, we followed a qualitative method. This involved expert consultations and comprehensive literature studies on the risks associated with renewable energy power plants. The risk assessment, as depicted in Table 2, is based on the severity of the impact, which is categorized into three levels: low, medium, and high. This framework is designed to serve as a reliable tool for Islamic financial institutions to evaluate the risk profile of solar power plants.

During the construction stage, which commands the largest financing allocation, Islamic financial institutions have an influential role in risk mitigation.

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They can do this by transferring risk to the EPC Contractor and insurance. At this stage, the risk with the most significant impact is the delay or failure to complete construction work, which can lead to losses for all parties, including the financing of Islamic financial institutions. Therefore, Islamic financial institutions should request a guarantee from the EPC contractor as a mitigation step if a delay results in losses in the form of fines from electricity buyers.

Financial risks in solar power plants during the construction period generally occur due to inflation and changes in foreign exchange rates, which cause an increase in construction costs so that the investment return period is longer. Financial risks after construction can occur due to payment defaults from electricity buyers. For contracts that the government guarantees, the probability of this risk occurring is small unless a radical policy change causes the cancellation of the electricity purchase contract. This risk can only be mitigated with insurance guarantees or dispute resolution through arbitration.

Operational risks arise from issues with systems, equipment, personnel, or inadequate pre-construction studies. Inaccurate analysis of energy potential or overly optimistic projections causes differences between projections and revenue realization. Although it does not result in the cessation of power plant operations, lower revenue realization than projections results in a longer investment return period. Islamic financial institutions need to be careful in making financing decisions and need to involve experts in assessing financing feasibility. As stated by Dhruba (2018), information asymmetry between developers or power plant owners and investors or financial institutions often occurs due to investors' inability to assess pre-construction studies properly.

The risk that has the highest impact on solar power plant failure is regulatory or policy risk, especially those related to incentives (Nuriyev et al., 2019; Petrova et al., 2019; Wing, 2015). Generally, renewable energy-based power plants' economic value is worse than non-renewable energy, so government support is needed through incentives. Petrova (2019) even classifies regulatory risk as a high probability of occurrence with a high impact. There is no standard mitigation method to handle policy risk except for a country's good political and economic stability. For Islamic financial institutions, studying economic and political stability is a primary requirement before assessing the techno-economic feasibility of developing a solar power plant.

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Table 2. Risk Management for Solar Power Plant

Risk	Effect of the Risk	Severity	Mitigation
Construction Risk			
Construction costs overrun	Lack of funds	Medium	1. Intensive Monitoring 2. Penalty clauses to EPC Contractor 3. Contigency funds 4. Guarantees from EPC Contractor
Material delivery delays	Project finishing delay, Penalty from buyer	Medium	1. Intensive Monitoring 2. Penalty clauses to EPC Contractor 3. Guarantees from EPC Contractor
Contruction finishing delays	Penalty from buyer, Project stops	High	1. Intensive Monitoring 2. Penalty clauses to EPC Contractor 3. Guarantees from EPC Contractor 4. Insurance
Specifications do not match the requirement	Lower Performance	Low	1. Penalty clauses to EPC Contractor 2. Guarantees from EPC Contractor
Sub contractor problems	Under standard work, Lower Performance	Low	1. Intensive Monitoring 2. Penalty clauses to EPC Contractor 3. Guarantees from EPC Contractor
Financial Risk			
Inflation	Inflation during construction can increase the construction cost	Medium	Fixed EPC contract
Risk	Effect of the Risk	Severity	Mitigation
Exchange Rate Swing	Construction cost increase	Low	1. Fixed EPC contract 2. Islamic Foreign Exchage Swap
Payment Default	Operation stops	High	1. Insurance 2. Arbitrage
Operational Risk			
Variability of Solar Irradiation	Uncertainty energy yield	Medium	1. Use expert to perform feasibility Study 2. Use different irradiation data
Severe Weather condition	Equipment damage, Lower Energy Production	Medium	1. Insurance 2. Routine Equipment Checking

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Risk	Effect of the Risk	Severity	Mitigation
Lower Energy yield due overestimation	Revenues lower than expected	Medium	1. Use expert to perform feasibility Study 2. Use different irradiation data
Low equipment performance	Revenues lower than expected, Higher maintenance cost	Medium	1. Guarantees from EPC Contractor 2. Intensive Monitoring 3. Insurance
Equipment Theft	Production stops	Medium	1. Insurance 2. Better security system
Equipment Damage	Production stops	Medium	1. Guarantees from EPC Contractor 2. Intensive Monitoring 3. Insurance
Refusal from local community	Production hampered	Low	1. Social Activities 2. Worker from community
Regulation Risk			
Changing in Energy Policy	Incentive revised, Economically become not feasible	High	Political Guarantee

Financing Model for Solar Power Plant using Diminishing Musyarakah Contract

Several Sharia financing schemes can be used to finance infrastructure projects. However, literature examining financing for renewable energy-based power plants in Islamic financial institutions still needs to be available. We propose a financing scheme for solar power plant using equity-based Diminishing Musyarakah. Diminishing Musyarakah is currently widely used for financing with a long repayment period or tenor for financing housing or residences. Diminishing Musyarakah financing can solve problems in Murabahah financing, such as prohibiting increasing the installment costs of financing objects. The prohibition on increasing installments is considered detrimental to Sharia banks because, during the installment repayment period, the object's price can increase (Asyiqin & Alfurqon, 2024; Muhamad et al., 2013). Diminishing Musyarakah can be a fairer financing alternative for Islamic Financial Institutions because the installments that must be paid are replaced with rental fees whose amount is not fixed based on an agreement taking into account economic conditions (Muhamad et al., 2013; Zaaba & Hassan, 2019).

Although it is prioritized for long-term financing, several issues surrounding Diminishing Musyarakah financing are still being debated among academics. Among

these issues are the issue of ownership during the installment period and the rental fee paid using the interest rate as a reference, which is similar to conventional bank credit (Nor et al., 2019; Zaaba & Hassan, 2019). To overcome these problems, Jaffar et al. (2017)it is believed that Islamic banking is a financial model based on equity or musyarakah which emphasis on the sharing of risks, profit and loss in the investment between the investor and entrepreneur. The focus of this paper is to introduce the mathematical model that internalizes diminishing musyarakah, the sharing of profit and equity between entrepreneur and investor. The entrepreneur pays monthly-differed payment to buy out the equity that belongs to the investor (bank proposed equity-based Diminishing Musyarakah financing. In the proposed model, the Sharia bank and the entrepreneur jointly own an asset with a mutually agreed-upon composition. Part of the profit the entrepreneur obtains is used to buy back the shares owned by the Sharia bank until the ownership of the Sharia bank is worth zero. Following is our proposed solar power plant financing model using equity-based Diminishing Musyarakah.

It is assumed that the amount of investment required for the construction of the power plant is I, with each contribution from the Sharia bank and the entrepreneur being I_B and I_E, so that $I = I_B + I_E$. The projected income from the sale of electricity produced by the power plant per month is Y, where the income is divided between the Sharia bank and the entrepreneur by k and $1\text{-}k$, respectively. The amount of income shared is determined based on the following calculation.

$$Q_1 = \frac{I_B}{I} Y \tag{1}$$

$$Q_2 = \left(\frac{I_B}{I} - \frac{M}{I}\right) Y = Q_1 - \frac{M}{I} Y$$

$$Q_3 = \left(\frac{I_B}{I} - \frac{2M}{I}\right) Y = Q_2 - \frac{M}{I} Y$$

$$Q_t = \left(\frac{I_B}{I} - \frac{(t-1)M}{I}\right) Y = Q_{t-1} - \frac{M}{I} Y \tag{2}$$

Where:

Q_t : revenue to be shared of month t

M : monthly installment to buy back bank's share

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The amount of revenue of Sharia banks and entrepreneurs each month is:

$$\Pi_B = kYQ_t \quad (3)$$

$$\Pi_E = (1-k)YQ_t \quad (4)$$

Meanwhile, the total Sharia bank's monthly income is:

$$\Pi_B = kYQ_t + M \quad (5)$$

At the beginning of the power plant 's operation, the Sharia bank's ownership is $\frac{I_B}{I}$, which decreased by $\frac{M}{I}$ every month. After t+1 months, when the value of $\frac{I_B}{I}$ is equal to $\frac{(t-1)M}{I}$, the asset is fully owned by the entrepreneur, and the Sharia bank is not entitled to the income obtained from the sale of electricity.

In the model above, asset ownership during the agreement period is divided between the Sharia bank and the entrepreneur, with the composition of I_B and I_E, respectively. The amount of payment to buy the share owned by the Sharia bank M is determined between the bank and the entrepreneur. The parties can mutually agree upon the composition of ownership between the Sharia bank and the entrepreneur, namely I_B and I_E. However, for a good cooperation, Mukhtashor (2023) proposed that the portion of the Sharia bank be no more than 70% so that the ideal I_B value is between 0.5 and 0.7 and the I_E value is between 0.3 and 0.5.

In our proposed model, two issues in diminishing Musyarakah financing are resolved. First, there is no rental fee to be paid, so there is no issue regarding using rental costs when adopting the interest rate for Diminishing Musyarakah. Second, because it is equity-based, the proposed financing model has no ownership problem. This model is also better compared to Murabahah financing because the revenue obtained comes entirely from the sale of electricity. The income of Sharia banks and entrepreneurs is determined by the production of electricity purchased by end users. In Murabahah financing, especially for long-term contracts, Murabahah is considered detrimental to Sharia banks because the installments received by Sharia banks are fixed in value.

Conclusion

In Islamic economics, humans as economic actors are Khalifah fil Ardh ordered to prosper the earth by not causing damage and maintaining environmental sustainability. Considering the sustainability aspect, the earth and its contents are only to be exploited as much as needed so that the next generation can use it.

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One of the resources available in limited quantities is fossil energy, such as oil, gas, and coal. There are two implications of the continuous use of fossil energy without strong control. First, availability will decrease; second, there will be an increase in carbon emissions in the air, increasing the greenhouse effect. The 2015 Paris Climate Agreement agreed that the World is committed to achieving net zero carbon by 2050. As a country with a Muslim majority population, it is fitting for Indonesia to pioneer the role of Islamic financial institutions in supporting the development of renewable energy plants. For this reason, a framework is needed to assess the risks of renewable energy-based power plants, which can be used as a reference for Islamic financial institutions to finance solar power plant projects.

The role of Sharia banking in supporting renewable energy development in Indonesia is not just important, it's crucial. Upholding environmental sustainability by utilizing renewable energy is not only in line with the spirit of Islamic economics but can also support sustainable development. The current role of Sharia banking is not significant enough. Based on statistical data, Sharia banking still contributes to activities that reduce the quality of the environment. This situation demands immediate attention and action. The main problem faced in utilizing renewable energy is the perception of high risk and lower economic value compared to fossil-based energy. However, comparing the economic value of renewable energy with non-renewable energy is not appropriate. Renewable energy projects must be seen as different financial assets. There are implicit and long-term benefits from using renewable energy that do not exist in fossil energy.

One of the essential principles in Islamic economics is to maximize benefits, not just profits. Sharia banking has the potential to benefit the environment and future generations by supporting renewable energy development. To minimize the risk of renewable energy projects, Sharia banking can propose innovative financing products for renewable energy types with relatively low technological risk, such as solar power plants. Creating these innovative financing products necessitates a thorough understanding of the risk and financing model. The proposed study aims to fill this gap in the literature by providing risk management guidance and a Sharia financing model for developing solar power plants in Indonesia. It enables Sharia banks to increase their participation in solar energy development, thereby supporting sustainable development and reaping the long-term benefits of renewable energy.

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