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Implementation of The *Tri Hita Karana* Concept in Environmentally Friendly Resource Management: A Study of Solar Power Plants in Nusa Penida

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Abstract

The increase in electricity consumption in Bali, which is still dependent on fossil energy, presents environmental sustainability challenges. This study examines the implementation of *the Tri Hita Karana* concept in the management of the Suana Solar Power Plant (PLTS) in Nusa Penida as an environmentally friendly energy solution based on local wisdom. With a descriptive qualitative research method through literature study and field observation, this study explores how *Tri Hita Karana*. which includes *Parahyangan* (spiritual harmony), *Pawongan* (social relations), and *Palemahan* (harmony with nature) can be integrated in energy management. The results of the study show that Suana Solar Power Plant not only contributes to reducing carbon emissions, but also strengthens the involvement of local communities through cultural preservation programs, economic empowerment, and clean energy education. This cultural values-based approach increases public acceptance of the green energy transition and creates a more sustainable resource management model. This study emphasizes that the integration of renewable energy technology with local wisdom can be an effective strategy in sustainable development, while maintaining harmony between humans, nature, and spirituality.

Keywords: ***Tri Hita Karana*; Renewable Energy; Environmentally Friendly Resource Management**

Introduction

Referring to information from the Antara news channel on Wednesday, October 16, 2024, PT PLN (Persero) recorded an increase in electricity consumption in Bali with a peak load reaching a record 1,157.6 MW in early October 2024. This figure shows an upward trend in annual electricity consumption, where in 2020 the highest peak load was recorded at 980 MW, in 2021 it was 771 MW, in 2022 it was 915 MW, and in 2023 it reached 1,075 MW. Thus, in the range of 2020 to 2023, PLN recorded an average increase in electricity consumption per year of 3.55 percent. Cumulatively until early October 2024, electricity consumption in Bali has reached 5,353.63 GWh, experiencing a growth of 16.80 percent compared to the same month in 2023 (Damara & Yasa, 2019). This increase in consumption reflects rapid economic growth, especially in the tourism sector and related industries that are the main pillars of Bali's economy (Ula & Affandi, 2019).

Most of Bali's electricity is still sourced from coal-fired Steam Power Plants (PLTU), which leads to high carbon emissions and a dependence on fuel supplies from outside the island (Amalina, Wahyudi, & Ciptawaty, 2023). This poses a big challenge for Bali in realizing a more sustainable energy system. Meanwhile, the potential of renewable energy in Bali, such as solar, wind, and biomass, has not been fully utilized optimally because it still faces various obstacles, including technical factors, regulations, and investment limitations (Arsyad et al. 2023). This increase in electricity consumption is inseparable from the rapid growth of the tourism sector and related industries that are

the backbone of Bali's economy (Arsyad et al., 2023). However, on the other hand, dependence on fossil-based energy sources poses its own challenges, both in terms of environmental sustainability and energy security. Bali Province has targeted the utilization of solar energy of 108 MWP or 8.62% of its total potential, which is 1,254 MW, and the development of the total installed solar power plant capacity in Bali Province has reached 3.71 MWp or 3.44% of what has been targeted by RUEN (Ridwan et al. 2021). The most solar PV systems today are on-grid systems with a capacity of 3,225kWp, followed by hybrid systems with a capacity of 224kWp (Kossi, 2018).

As an international tourist destination that has a commitment to the concept of sustainable tourism, Bali needs to develop more environmentally friendly energy sources to maintain ecological balance and support carbon emission reduction(Yazid 2021). In this context, Solar Power Plants (PLTS) are one of the potential solutions to support the provision of clean energy in Bali (Kumara et al., 2020). One of the projects that has been implemented is the Suana Nusa Penida Solar Power Plant, which adopts an approach based on *the Tri Hita Karana* concept in energy resource management. *Tri Hita Karana*, as a philosophy of Balinese local wisdom, emphasizes the balance between the relationship between humans and God (*Parhyangan*), humans and others (*Pawongan*), and humans and the environment (*Palemahan*) (Siswadi & Puspadewi, 2020). The implementation of this concept in the management of sustainable energy resources is an important foundation in efforts to realize harmonization between development and environmental sustainability. This study aims to examine how the implementation of *the Tri Hita Karana concept* in the management of the Suana Nusa Penida Solar Power Plant can be a model for more environmentally friendly and sustainable management of energy resources in Bali (Sukasri, 2024). This study is expected to contribute to strengthening the green energy paradigm which is in line with the cultural values and local wisdom of the Balinese people.

Method

The research method uses a descriptive qualitative method. According to explained that this method is used to provide an in-depth description of a phenomenon without manipulating the variables being studied (Adiwijaya et al., 2024). Descriptive qualitative research aims to describe or explain phenomena based on the participant's perspective and the context surrounding it. In this case, the researcher plays the role of the main instrument in collecting and analyzing data, so the validity of the findings is highly dependent on the sharpness of the analysis and the interpretive skills of the researcher. In addition, this researcher uses a literature study approach that examines the analysis of the teachings of *Tri Hita Karana*. The literature search process is carried out through online searches in various journal databases and websites. In addition, offline searches were also carried out for various books, printed journals, and policy documents. The research technique in this writing is carried out through Field Studies, which include direct observation of the research site as well as in-depth interviews with relevant sources (Wildan, 2024).

Results and Discussion

1. *Parahyangan* (Spiritual Harmony)

Parahyangan or spiritual harmony is an important aspect in maintaining harmony between humans, nature, and religious values in Bali (Yanti, 2024). In this context, PLN Indonesia Power UBP Bali has implemented a corporate social responsibility (CSR) program by supporting cultural sustainability and spirituality around the Suana Solar Power Plant (PLTS), Nusa Penida. One tangible form of this program is the donation for

the maintenance of temples around the solar power plant area, which not only aims to preserve places of worship, but also strengthen the relationship between the company and the local community. In addition, as an effort to maintain local cultural values, PLN Indonesia Power also builds places of worship in the solar power plant environment, so that the balance between technological and spiritual aspects can be maintained. This program reflects the synergy between the development of renewable energy infrastructure and the preservation of religious traditions, which is in line with *the principle of Tri Hita Karana* in Balinese culture, which is to maintain a balance between the relationship between humans and God (*Parahyangan*)

Figure 1. Place of Worship (Pelisat)
Source of Research Document

Figure 1. Showing the activities of *Perbekel* and Suana Village Apparatus and Staff, Yowana Village Companion Gema Santi Suana Village, Bhabinsa Suana Village worshipped together at *Rahiana Purnama Kedasa* at the PLTS place. To ask for solar power to become a stable and sustainable source of electrical energy

The implementation of this social responsibility program reflects a holistic approach to sustainable development where social and cultural aspects receive attention. The existence of the Suana Nusa Penida Solar Power Plant as part of the clean energy transition in Indonesia not only provides ecological benefits through reducing carbon emissions, but also pays attention to the spiritual aspects that are an integral part of the lives of the Balinese people (Berlianto & Wijaya, 2022). The construction of places of worship in the solar power plant environment shows that modernization does not have to sacrifice the values of local wisdom, but can go hand in hand with local culture (Terbarukan 2023). In addition, the active involvement of PLN Indonesia Power UBP Bali in maintaining temples and building places of worship also strengthens social relations between the company and the surrounding community. From a socio-religious perspective, this step strengthens solidarity and a sense of belonging to the existing infrastructure, so that the community not only sees solar power plants as technical facilities, but also as part of the community's cultural and spiritual ecosystem (Kristiantoro, 2021). This is in line with the concept of kala patra village, which teaches that adaptation to change must be carried out as a form of synergy in maintaining a solid relationship between the local community and the management.

From a sustainability perspective, this approach also has the potential to be a model for the development of other infrastructure projects, especially in areas with strong cultural and spiritual traditions. The integration of technology and local values can increase public acceptance of clean energy projects, thereby accelerating a more inclusive

and sustainable energy transition. Thus, the CSR program implemented by PLN Indonesia Power UBP Bali is not only a form of corporate social responsibility, but also a manifestation of sustainability based on the cultural and spiritual values of the local community (Ma'arif, 2023).

2. *Pawongan* (Social Harmony)

PLN Indonesia Power UBP Bali is committed to supporting the economic development of local communities through priority policies for local workers. This step not only creates jobs, but also improves the technical skills of the surrounding community, so that the community can adapt to the demands of the ever-evolving energy industry (Berlianto & Wijaya, 2022). As a form of social and environmental responsibility, the company implements the Indonesia Power–Community Assistance, Relations and Empowerment (INPOWER-CARE) program, which is designed to strengthen community engagement and sustainable development. The program includes a range of initiatives ranging from capacity building or skills training to assistance in product marketing strategies, to ensure a sustainable improvement in community welfare.

In its implementation, this program focuses on developing businesses based on local potential, including food and beverage products, as well as typical Nusa Penida handicraft products. Some of the superior products produced by the fostered partners include Cepuk Rangrang Woven Fabric, Rangrang Woven Fabric, and various seaweed-based preparations that have high economic value (Amir, 2018). The sustainability of this program not only rests on improving production skills, but is also strengthened through adaptive marketing support to the development of the 4.0 technology era. In this case, PLN Indonesia Power encourages fostered partners to utilize *e-commerce* technology as a means of marketing, so that local products can reach a wider market, both at the national and international levels.

Figure 2. Nusa Penida Rang-rang Woven Fabric
Source: Bale Bengong

The INPOWER-CARE program also plays a role in strengthening the competitiveness of local products through various mentoring strategies based on innovation and sustainability. In the context of the development of the creative industry in Nusa Penida, the assistance provided includes aspects of production oriented to quality standards, product diversification, and more efficient supply chain management. By combining technological innovation and preservation of local traditions, this program is expected to be able to create an independent and competitive economic ecosystem, while maintaining the cultural identity of Nusa Penida (Sudipab et al., 2020).

The use of digital technology in marketing is also the main concern in this program. In the era of the digital economy, access to a wider market is highly dependent on optimizing e-commerce platforms, social media, and data-driven marketing strategies. PLN Indonesia Power UBP Bali encourages fostered partners to adapt to the digital ecosystem through online marketing training, online store management, and branding strategies based on local identity (Nazwa & Faradila, 2024). In addition to having a positive economic impact, the existence of this program also strengthens social cohesion and builds harmonious synergy between the business world and local communities in realizing inclusive and sustainable development.

Overall, PLN Indonesia Power UBP Bali's initiative in running the INPOWER-CARE program not only focuses on improving economic welfare, but also strengthens the social and cultural resilience of the local community. By integrating a community-based approach, technological innovation, and the preservation of local traditions, this program becomes a sustainability-oriented model of community empowerment. The success of this program is also a reflection of the synergy between the industrial sector and the community in creating an economic ecosystem that is inclusive, competitive, and rooted in local wisdom.

3. *Palemahan* (Environmental Harmony)

The concept of *Palemahan*, which emphasizes harmony between humans and the environment, is the basis for the design of the Solar Power Plant (PLTS) system in Suana, Nusa Penida by PLN Indonesia Power UBP Bali. The construction of this solar power plant is not just an energy infrastructure project, but also a manifestation of the commitment to implementing environmentally friendly and sustainable green energy. By carrying out the principle of zero-emission energy, this solar PV system not only contributes to reducing dependence on fossil fuels, but also becomes an initial milestone in building collective awareness of the importance of the clean energy transition (Rhamanda, 2020). This step reflects a receptive attitude towards renewable energy, which is in line with global efforts to reduce the impact of climate change and maintain the balance of ecosystems (Susilowati, Azzahra, & Nurcahyani, 2023).

Figure 3. Clean and Clean Activities in the Environment of Suana Village and PLTS
Source. Researcher Documents

Gotong royong activities are evidence of the aspect of community weakness in carrying out clean cleaning activities to maintain the sustainability and cleanliness of the environment and sauna and solar power plants. Solar Power Plant (PLTS) located in Suana Nusa Penida village, Klungkung regency which is one of the environmentally friendly plants.

Figure 4. Solar Power Plant in Suana Nusa Penida Village
Source: PLN Indonesia Website

The implementation of solar power plants in Suana also has significant ecological implications, especially in preserving the environment of Nusa Penida as an area with high biodiversity (Kemenuh, 2021). With minimal ecological impact compared to fossil fuel-based power plants, solar PV is able to be a solution to energy needs without sacrificing the balance of nature. In addition, the use of solar energy as the main resource shows a form of adaptation to the geographical conditions of Nusa Penida which has a high intensity of sunlight throughout the year. This local potential-based approach makes solar power plants an energy management model that is in accordance with the characteristics of the local environment. The existence of this solar power plant also has implications for the social and economic aspects of the surrounding community (Kumara et al., 2020). With the availability of access to clean energy, the people of Nusa Penida get benefits in the form of improving the quality of life, especially in the tourism-based economy and creative industries. The stable and sustainable supply of electricity supports the small and medium enterprises (SMEs) sector, which depends on the availability of energy in their operations. This creates a chain effect that contributes to improving people's welfare, while strengthening the concept of sustainable development that integrates environmental, social, and economic aspects (Suparmoko, 2020).

4. Ecological and Social Transformation Through the Implementation of *Tri Hita Karana*

The existence of the Suana Solar Power Plant in Nusa Penida not only provides benefits in the provision of renewable energy, but also encourages the formation of collective awareness and harmonious cooperation between the residents of Suana Village. As an educational impact, the solar PV system implemented has motivated the community to understand the urgency of green energy management as a solution in meeting electricity needs without causing emissions that are detrimental to the environment. This increase in awareness has implications for a change in the mindset and morality of residents towards the importance of environmental conservation and the application of environmentally friendly technology in life. This awareness is manifested in the establishment of the Bukit Keker Learning House in Nyuh Kukuh Village, which functions as an educational center based on local wisdom. This institution is a means for the community to explore various aspects of sustainability, including the development of solar panel-based energy systems as a more efficient and sustainable transformation of energy resources.

Figure 5. Bukit Keker Learning House Hall
Source: Bale Bengong

The Bukit Keker Learning House also serves as a forum to develop renewable energy-based innovations that are in line with *the principles of Tri Hita Karana.* In it, the community not only gains a theoretical understanding of green energy, but also has the opportunity to apply solar panel technology on a small scale, such as village lighting systems and electricity resource management for daily needs. In addition to the technical aspects, the program developed at the Bukit Keker Learning House also instills social and cultural values that strengthen solidarity between residents in maintaining environmental sustainability (Wanadjaja & Samputra, 2021). Through a participatory approach, residents are encouraged to share their experiences and knowledge about the application of renewable energy and its impact on the environment and the village economy. Thus, there is a process of social transformation that makes green energy part of people's lifestyles, not just as an alternative to technology.

From an ecological perspective, the existence of the Suana Solar Power Plant and the Bukit Keker Learning House has created a sustainable development model that takes into account the balance between energy needs and environmental sustainability. According to Suda, as a manager at the Limited Liability Company (PT) Indonesia Power UBP Bali and Suarta, as the Head of Suana Nusa Penida Village, revealed;

> I can say that we ensure the availability of stable, reliable electricity supply and provide green energy solutions (Environmentally Friendly) in accordance with our mission for customers, both in the industrial sector and the general public. In addition, we are also responsible for maintaining the operational efficiency of power plants, complying with environmental standards, and implementing corporate social responsibility (CSR) programs that benefit the surrounding community and maintain the sanctity of the place. stakeholders (interview with I Wayan Suda, 2022).
>
> As the Head of Suana Village, I see that the existence of the *Tri Hita Karana*-based Solar Power Plant (PLTS) has a big impact in supporting sustainable development in our village. From *Parahyangan's* side**,** this project is in line with the spiritual values of the community because it still respects local customs and culture, including through the implementation of religious ceremonies before development. From the *Pawongan* side, this solar power plant opens up job opportunities for local residents, improves the village economy, and provides more reliable electricity for the community and small businesses and schools can have better lighting, operate longer, and access to technology such as the internet

becomes easier. The use of renewable energy reduces dependence on fossil fuels and preserves the coastal environment and marine ecosystems in Nusa Penida. With this solar power plant, Suana Village continues to progress while maintaining local wisdom and environmental sustainability for future generations. If Suana Village is known as a village that uses renewable energy, this can attract tourists who care about the environment (interview, I Nyoman Suarta 2022).

The use of solar power as the main resource in the Suana Nusa Penida solar power plant not only contributes to reducing carbon emissions, but also plays a role in improving village energy security in a sustainable manner (Alfisyahri, Karimi, & Ridwan, 2020). By relying on abundant and environmentally friendly renewable energy sources, villages can reduce their dependence on fossil fuels, which have been the main cause of pollution and climate change. More than just a technical solution, the application of solar energy is integrated with the *Tri Hita Karana* principle, thus reflecting efforts to harmonize between humans, the environment, and spirituality in the use of natural resources (Wanadjaja & Samputra, 2021). This approach based on local wisdom is an effective solution, that energy development does not have to conflict with the cultural values and traditions of the local community (Terbarukan, 2023). On the contrary, green energy technology that is aligned with social systems and local beliefs can actually strengthen cultural identity, increase ecological awareness, and build a sustainability mindset in daily life. In the context of global energy challenges, models like this can be an effective example for other regions, especially in creating energy systems that are self-sufficient, inclusive, and oriented towards ecological balance.

Conclusion

The implementation of solar power plants in Suana Nusa Penida is a reflection of the synergy between technology and local wisdom in maintaining the balance of nature. Keeping in mind Balinese cultural values, such as the *Tri Hita Karana* principle, which emphasizes harmony between humans, nature, and spirituality, the project is not only a technical solution to meet energy needs, but also reflects a commitment to preserving ecological heritage for future generations. Therefore, the success of this solar power plant can be a model for the development of renewable energy in other regions, as well as strengthen Indonesia's role in the transition to sustainable green energy. In the context of energy development policies in Bali, cultural sustainability must be the main guideline in the planning and implementation of renewable energy projects. Therefore, stricter regulations are needed to ensure that every green energy project not only considers technical and economic aspects, but also accommodates cultural values and environmental sustainability principles that have been passed down from generation to generation. Local governments and stakeholders need to develop policies that integrate clean energy technology with a community-based approach, so that local communities are not only beneficiaries, but also actively involved in their management and development. Thus, Bali can be an example in the application of renewable energy that is not only oriented towards efficiency, but also in harmony with the local social and cultural ecosystem.

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