

Sustainable Development Based on the Tri Hita Karana Concept in the Development of Electric Power Plants in Bali

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ABSTRACT

This study discusses the application of the concept of Tri Hita Karana (THK) in the development of electric energy plants in Bali by PT Indonesian Power. The concept of THK which includes Parahyangan (human relationship with God), Pawongan (human relationship with others), and Palemahan (human relationship with the environment) is applied as an approach for sustainable development. The results of the study show that the implementation of THK has a positive impact on social, environmental, and economic aspects. Parahyangan is reflected in respect for cultural values and religious rituals in the operation of the plant. Pawongan can be seen from the increased community involvement in the planning and management of power plants, which reduces social conflicts. Meanwhile, Palemahan is realized through the use of renewable energy and environmental conservation programs. Several challenges are still being faced, such as limited infrastructure, lack of public understanding of renewable energy, and regulatory barriers. Therefore, a collaborative strategy is needed between companies, the community, and the government. The conclusion of this study shows that the Tri Hita Karana-based approach can be an effective model in supporting sustainable energy development in Bali by balancing spiritual, social, and environmental aspects

INTRODUCTION

Sustainable development is a concept that has become increasingly important in the modern era, particularly in efforts to maintain the balance between economic progress, environmental protection, and social welfare. This concept aims to meet current needs without compromising the ability of future generations to meet their own needs (Sesa, 2018). In the context of energy development, sustainable development requires an approach that considers environmental impact, resource efficiency, and community welfare. In energy generation development, it is crucial to integrate the local wisdom of Bali with sustainable development principles in the energy sector. Below are several key reasons why this research holds high significance:

1. **Supporting Sustainable Energy Transition**
Electricity is a key element in economic development and community welfare. With the Tri Hita Karana (THK) approach, which encompasses balance between humans and God (Parahyangan), humans with one another (Pawongan), and humans with the environment (Palemahan), the development of power plants can be carried out in a more holistic and sustainable manner.
2. **Application of Local Wisdom in Energy Development**
The THK concept has been the life philosophy of the Balinese people for centuries. By adopting these values in the development of electricity power plants, electricity infrastructure development can better align with local culture, thereby increasing community acceptance and participation in energy projects.
3. **Reducing Environmental and Social Impact**
Many energy projects have the potential to cause negative environmental and social impacts. Through the THK approach, power plants can be developed while maintaining ecological balance, enhancing community involvement, and respecting local spiritual and cultural values.
4. **Improving Effectiveness and Sustainability of Power Plant Operations**
By considering spiritual (Parahyangan), social (Pawongan), and environmental (Palemahan) aspects, the management of power plants can be more harmonious, reducing conflicts with local communities, and improving operational effectiveness in the long term.
5. **Encouraging Innovation in Clean Energy Development**
THK-based development can serve as an innovative model for clean energy development in Indonesia. By balancing modern technology with cultural and ecological values, this research can generate concrete recommendations to enhance the use of sustainable renewable energy.
6. **Aligning with Global Agenda and National Regulations**
Indonesia has committed to achieving Net Zero Emissions (NZE) by 2060 and meeting the targets of the Sustainable Development Goals (SDGs). The THK-based approach can be a relevant model for implementation to ensure that energy development remains aligned with global goals and national policies.

This research is expected to make a significant contribution in building an energy system that is not only reliable and efficient but also in harmony with the local culture, society, and ecology, thus fostering more sustainable and equitable development for the people of Bali and Indonesia at large. Tri Hita Karana, as a life philosophy originating from Bali, offers a holistic view in maintaining harmony between humans, nature, and God. This concept encompasses three main dimensions: the harmonious relationship between humans and God, humans with one another, and humans with nature (Yuniti, Wahyuni, and ... 2022). In the context of electricity power plant development, the Tri Hita Karana principle can serve as a highly relevant foundation to integrate social, economic, and environmental aspects in energy resource management. Electricity demand is a key variable due to its connection to economic activities and development. Electricity plays an important role in economic development and is a crucial factor supporting the welfare of the people (Damara and Yasa, 2019).

Currently, Bali requires an electricity generation capacity of 1200 MW. The production from power plants in Bali only contributes 980 MW, while the remaining 350 MW is sourced from the Paiton power plant in East Java, which still uses coal (Diwanda, Setiawan, and Setiawan, 2021). To meet this demand, PT Indonesia Power UBP Bali Power, a subsidiary of PLN that operates power plants, runs several power plant units, including gas and diesel-powered plants. There are also private power plants in Bali, such as the Celukan Bawang Gas Power Plant, which uses coal. Additionally, there are several solar-powered plants operated by the company. This article will discuss how the Tri Hita Karana concept can be applied in the development of electricity power plants. By understanding the connection between humans, nature, and spirituality in the energy system, it is hoped that solutions can be created that not only optimize energy use but also protect environmental sustainability and consider the social welfare of the surrounding communities.

This research aims to:

1. Analyze the Implementation of Tri Hita Karana
Examine how the Tri Hita Karana concept (the harmonious relationship between humans and God, humans with one another, and humans with the environment) is applied in the development of electricity power plants in Bali.
2. Identify the Impact of Sustainable Development
Investigate the social, economic, and environmental impacts of electricity power plant development in Bali based on sustainable development principles.
3. Evaluate Sustainable Energy Management Strategies
Assess the strategies and policies that have been implemented in the management of power plants to align with the values of Tri Hita Karana and support energy sustainability in Bali.

LITERATURE REVIEW

Sustainable development, which balances economic progress, environmental preservation, and social welfare, is critical in modern society. In the context of energy development, sustainable practices are necessary to ensure that energy production meets current needs without compromising future generations' ability to meet theirs. Bali, known for its rich cultural heritage and local wisdom, provides a unique framework for integrating sustainable development in energy projects through the concept of Tri Hita Karana (THK). This concept, emphasizing harmony between humans, nature, and spirituality, can offer valuable insights for the development of electric power plants in Bali. This literature review explores existing studies on sustainable development, the Tri Hita Karana concept, and their application in energy development.

1. Sustainable Development in Energy Sector

Sustainable development is defined as meeting present needs without compromising the ability of future generations to meet their own needs (Brundtland, 1987). The energy sector plays a pivotal role in achieving sustainable development, particularly through its impact on economic growth, environmental sustainability, and social welfare. Energy is fundamental to industrialization, economic development, and improved quality of life, yet its generation often leads to environmental degradation and social disruption.

In the past decade, the transition to renewable energy sources has gained significant attention, with research focusing on the development of green energy solutions (Susaeta et al., 2020). Energy projects are increasingly expected to reduce greenhouse gas emissions, promote energy efficiency, and minimize their environmental footprint (Yin et al., 2018). However, sustainable energy development goes beyond environmental concerns. It must also consider the social impacts, such as community displacement and job creation, and economic factors, such as the affordability and accessibility of energy.

2. Tri Hita Karana (THK): A Framework for Sustainable Development

The Tri Hita Karana concept, originating from Balinese Hinduism, offers a holistic approach to life and development. It emphasizes three fundamental. This philosophical concept has been central to Balinese culture for centuries and reflects an understanding of the interconnectedness of all elements in the universe. According to Pujawan (2009), the Tri Hita Karana philosophy is not only a cultural ideal but also a practical guide for sustainable living, which can be applied in various sectors, including energy. Recent studies have highlighted the potential of integrating THK into modern development practices. Gede et al. (2017) argue that THK could provide a framework for sustainable tourism development in Bali, emphasizing the importance of balancing cultural heritage, community welfare, and environmental conservation. Similarly, Tri Hita Karana has been suggested as a guiding principle for other sectors such as agriculture, fisheries, and even urban planning (Laksana, 2020).

This adaptability makes THK a promising approach for energy development in Bali.

3. Application of Tri Hita Karana in Energy Development

The integration of THK in energy development is relatively underexplored, but a few studies have made significant contributions. Energy development in Bali has historically been focused on economic growth, but there is a growing recognition of the need to incorporate local wisdom and sustainability into this development process (Diwanda et al., 2021).

1. Parahyangan (Human and God) : The spiritual dimension of THK can influence how energy projects are perceived and accepted by local communities. Bali's religious and cultural landscape suggests that energy projects should not only be technically and economically viable but also respect local traditions and spiritual beliefs. Projects that align with the spiritual values of local communities are more likely to gain support and minimize social conflicts (Kamil, 2021).
2. Pawongan (Human and Human): The social dimension of THK emphasizes community engagement and welfare. Sustainable energy projects should involve local communities in decision-making processes, ensure equitable distribution of benefits, and create jobs. Furthermore, energy projects should enhance the quality of life for the people, including improving access to electricity, ensuring energy affordability, and reducing the negative impacts of energy generation on vulnerable populations (Yuniti et al., 2022). Bali's focus on community participation in energy development can be seen in the efforts to involve local communities in renewable energy initiatives, such as solar power installations (Wahyuni & Mahendra, 2021).
3. Palemahan (Human and Nature): Environmental sustainability is a core element of THK. Bali, as an island destination heavily dependent on its natural resources for tourism and agriculture, must carefully manage its energy generation to avoid adverse environmental effects. The application of THK in energy development encourages the use of renewable energy sources, such as solar and wind power, which minimize ecological damage while fostering long-term sustainability. Studies indicate that integrating renewable energy systems with local ecological values can reduce Bali's reliance on fossil fuels, particularly coal-fired plants (Setiawan & Damara, 2019).
4. Case Studies and Examples in Bali
Several energy projects in Bali demonstrate the potential benefits of incorporating THK into energy development
 - Bali's Renewable Energy Targets: The Balinese government has set ambitious renewable energy targets, aiming to increase the share of renewable sources in the island's energy mix. Initiatives

such as solar power installations and small-scale hydropower plants are examples of integrating THK values of environmental sustainability and community participation (Bali Green Energy, 2020).

- Community-based Renewable Energy Projects: In rural areas, such as the village of Sidemen, local solar power projects have been implemented with strong community involvement. These projects emphasize the values of Pawongan and Palemahan by empowering local communities and reducing environmental degradation (Wahyuni & Mahendra, 2021).

5. Challenges and Future Directions

While the integration of Tri Hita Karana into energy development in Bali holds promise, there are challenges that need to be addressed. The traditional energy infrastructure in Bali, which relies heavily on coal, poses a significant barrier to implementing sustainable practices (Setiawan & Damara, 2019). Additionally, the lack of awareness and understanding of the Tri Hita Karana concept in the broader development community may limit its widespread application. However, with growing interest in sustainable development and the recognition of Bali's unique cultural identity, there is potential to leverage THK as a guiding principle in future energy projects. Collaboration between local communities, government agencies, and private sector stakeholders will be crucial in creating energy solutions that are not only efficient but also culturally and ecologically appropriate.

METHODOLOGY

To analyze the application of the Tri Hita Karana concept in the development of sustainable electricity power plants, this article uses a qualitative approach with literature review and conceptual analysis. The aim of this method is to gain a deeper understanding of the principles of Tri Hita Karana and how these philosophies can be integrated into the practice of sustainable electricity development. This concept, within the context of electricity power plant development, is assessed by evaluating how each dimension contributes to the sustainability of energy development. This research is located at PT. Indonesia Power UBP Bali in Pesanggaran, a company that provides electricity in Bali. By using these methods, this article aims to provide a comprehensive understanding of how the development of electricity power plants can be carried out sustainably while considering the principles of harmony embedded in the Tri Hita Karana concept.

RESEARCH RESULT AND DISCUSSION

In an effort to support the clean energy transition and sustainable development in Bali, the development of solar power plants (PLTS) has become one of the main solutions for utilizing renewable energy (Kumara, 2020). One of the strategic projects developed is the solar power plant in Desa Suana, Nusa Penida. As an island region still reliant on fossil-fuel-based power plants, Nusa Penida faces challenges in providing reliable, sustainable, and environmentally friendly energy. With abundant solar energy potential, the development of a solar power plant in Desa Suana becomes a concrete step toward supporting energy diversification, reducing carbon emissions, and improving electricity access for the local community.

This solar power plant development is not only aimed at meeting the electricity needs of Nusa Penida's residents but also as part of the effort to support Bali's vision towards Net Zero Emission and the sustainable development concept based on Tri Hita Karana. With the presence of a solar power plant, it is expected that there will be improvements in the welfare of the community, environmental conservation, and the strengthening of a green economy based on renewable energy in the region.

The results of the research show that the Tri Hita Karana-based approach can enhance sustainability in power plant development in terms of social, environmental, and economic aspects.

Some key findings include:

1. Parahyangan (God)

The implementation of spiritual values in the management of electricity in Nusa Penida is manifested by the establishment of a pelinggih (temple shrine) around the temple area. This step aims to maintain a balanced relationship between the solar power plant employees and God, in line with the Tri Hita Karana concept. In addition, this spiritual approach is expected to increase environmental awareness, work ethic, and a sense of responsibility in operating the power plant sustainably and in harmony with local wisdom.

Below is an image of the Pura or pelinggih located at the Nusa Penida solar power plant.



Figure 1. Pelinggih (Temple Shrine)

A **Pura** or **peelinggih** is a sacred place in Hindu belief, serving as a space for worship to **Ida Sang Hyang Widhi Wasa** (God Almighty) and His manifestations. A **Pura** is typically a larger structure used as a center for Hindu worship, while a **peelinggih** is a smaller shrine within the **Pura**, specifically designed for particular acts of worship. The presence of **Pura** or **peelinggih** reflects spiritual values and the balance in the relationship between humans and God, in line with the Tri Hita Karana concept. A **Piodalan** ceremony at the solar power plant is held during the **Purnama Kedasa** (full moon), as an expression of gratitude to **Ida Sang Hyang Widhi Wasa** for blessings and the smooth operation of the solar power plant. This ceremony also aims to maintain spiritual balance and harmonize the relationship between humans, nature, and God, in accordance with the teachings of **Tri Hita Karana**. Through the **Piodalan** ceremony, it is hoped that all solar power plant employees will enhance their spiritual awareness, responsibility, and commitment to energy sustainability and environmental preservation.

2. Pawongan Aspect (Human Relations with Others)

The Pawongan aspect in the management of the Solar Power Plant (PLTS) in Nusa Penida refers to the harmonious relationship between humans, both within the workplace and with the surrounding community. In the Tri Hita Karana concept, Pawongan emphasizes the importance of social welfare, collaboration, and good relationships among employees, stakeholders, and the local community. Below is an image of a donation to the community that organized a Ngabel Masal ceremony from the village.



Figure 2. Donation to the Community

The donation to the community in Nusa Penida is a form of social responsibility and the company's commitment to supporting the welfare of the local population. These contributions can include basic necessities, educational facilities, healthcare resources, and support for religious and cultural activities. Through this initiative, it is expected that a harmonious relationship will be established between the Nusa Penida Solar Power Plant (PLTS) and the surrounding community, thereby strengthening the values of togetherness and mutual cooperation in building a better and more sustainable life.

At the Nusa Penida Solar Power Plant, the **Pawongan** aspect is applied through various initiatives, such as:

1. **Local Community Empowerment** - Providing training and job opportunities for local residents in the operational and maintenance aspects of the power plant.
2. **Synergy with Tradition and Culture** - Respecting local wisdom by holding customary ceremonies and religious activities together with the surrounding community.
3. **Employee Welfare Improvement** - Creating a comfortable work environment, upholding the values of mutual cooperation, and ensuring a balance between work responsibilities and social life.
4. **Education and Socialization Programs** - Organizing educational activities about renewable energy for the local community and schools to enhance understanding of the importance of energy sustainability.

By applying the **Pawongan** principle, the Nusa Penida Solar Power Plant not only serves as an environmentally friendly energy source but also contributes to building harmonious and sustainable social relationships. Furthermore, the participation of the community in the planning and operation of the power plant demonstrates increased stakeholder involvement, reducing the potential for conflict and enhancing community acceptance.

3. Palemahan Aspect (Human Relations with the Environment)

The **Palemahan** aspect in the management of the Solar Power Plant (PLTS) in Nusa Penida is related to the balance and harmony between humans and the surrounding natural environment. In the **Tri Hita Karana** concept, **Palemahan**

emphasizes the importance of preserving nature and utilizing resources wisely to avoid damaging the ecosystem.

At the Nusa Penida Solar Power Plant, the **Palemahan** aspect is implemented through various efforts, including:

1. **Utilization of Clean and Environmentally Friendly Energy** – As a solar-based power plant, the Nusa Penida PLTS reduces reliance on fossil fuels and decreases carbon emissions, helping to maintain air quality and mitigate climate change.
2. **Environmental Conservation** – Conservation efforts are carried out by maintaining cleanliness around the PLTS area, planting trees for green cover, and responsibly managing operational waste to prevent contamination of soil and water sources.
3. **Sustainable Resource Management** – Water, land, and operational materials are managed efficiently to avoid over-exploitation that could harm the environmental balance.
4. **Mitigation of Impacts on Ecosystems** – Each development and expansion of the PLTS considers the presence of local flora and fauna to ensure that the natural habitats in Nusa Penida are not disturbed.

Through the application of the **Palemahan** aspect, the Nusa Penida Solar Power Plant is not only a sustainable energy source but also plays a role in preserving the harmony between technology, humans, and nature for a greener and more sustainable future.

The use of environmentally friendly technologies, such as renewable energy (solar, wind, and biomass), as well as the environmental conservation programs carried out by the company, has had a positive impact on the ecosystem around the power plant.

The **Tri Hita Karana** concept provides an effective framework for realizing sustainable development (Syahriyah and Zahid, 2022). In the context of electricity power plant development in Bali, this approach allows for the harmonization of energy needs with social and environmental sustainability.

Key Findings:

1. **Spiritual and Technological Balance** – The implementation of religious values in energy management policies helps create a harmonious work environment and raises awareness about social and environmental responsibilities.
2. **Improved Community Welfare** – Community empowerment programs conducted by PT Indonesia Power, such as training local labor and developing renewable energy-based small businesses, have improved the local economy.
3. **Ecological Sustainability** – The use of renewable energy as part of the transition to clean energy, coupled with environmental impact mitigation strategies, shows that the **Tri Hita Karana** approach can be a solution for sustainable development.

Challenges and Solutions:

While the **Tri Hita Karana**-based approach has shown positive impacts, there are several challenges faced in its implementation:

1. **Technical and Infrastructure Constraints** - The development of renewable energy requires substantial investment and infrastructure readiness. The solution is to collaborate with strategic partners in green energy projects.
2. **Community Engagement** - Not all communities understand the benefits of renewable energy. Therefore, education and socialization should be enhanced to increase public awareness.
3. **Regulations and Policies** - The implementation of sustainable energy must be supported by clear regulations. The government needs to accelerate the creation of incentive policies for renewable energy.

CONCLUSIONS AND RECOMMENDATIONS

From the results of this research, it can be concluded that the application of the **Tri Hita Karana** concept in the development of electric power plants in Bali is able to create a balance between the spiritual, social, and environmental aspects. With the right strategies, the **THK** concept can serve as a model for sustainable development that can be applied in various energy projects across Indonesia.

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