

Saputra, Komang Adi Kurniawan; Subroto, Bambang; Rahman, Aulia Fuad et al.

Article

Eco-efficiency and energy audit to improve environmental performance : an empirical study of hotels in Bali-Indonesia

International Journal of Energy Economics and Policy

Provided in Cooperation with:

International Journal of Energy Economics and Policy (IJEEP)

Reference: Saputra, Komang Adi Kurniawan/Subroto, Bambang et. al. (2022). Eco-efficiency and energy audit to improve environmental performance : an empirical study of hotels in Bali-Indonesia. In: International Journal of Energy Economics and Policy 12 (6), S. 175 - 182.
<https://econjournals.com/index.php/ijEEP/article/download/13565/7010/31617>.
doi:10.32479/ijEEP.13565.

This Version is available at:

<http://hdl.handle.net/11159/593836>

Kontakt/Contact

ZBW – Leibniz-Informationszentrum Wirtschaft/Leibniz Information Centre for Economics
Düsternbrooker Weg 120
24105 Kiel (Germany)
E-Mail: [rights\[at\]zbw.eu](mailto:rights[at]zbw.eu)
<https://www.zbw.eu/>

Standard-Nutzungsbedingungen:

Dieses Dokument darf zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden. Sie dürfen dieses Dokument nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, aufführen, vertreiben oder anderweitig nutzen. Sofern für das Dokument eine Open-Content-Lizenz verwendet wurde, so gelten abweichend von diesen Nutzungsbedingungen die in der Lizenz gewährten Nutzungsrechte. Alle auf diesem Vorblatt angegebenen Informationen einschließlich der Rechteinformationen (z.B. Nennung einer Creative Commons Lizenz) wurden automatisch generiert und müssen durch Nutzer:innen vor einer Nachnutzung sorgfältig überprüft werden. Die Lizenzangaben stammen aus Publikationsmetadaten und können Fehler oder Ungenauigkeiten enthalten.

Terms of use:

This document may be saved and copied for your personal and scholarly purposes. You are not to copy it for public or commercial purposes, to exhibit the document in public, to perform, distribute or otherwise use the document in public. If the document is made available under a Creative Commons Licence you may exercise further usage rights as specified in the licence. All information provided on this publication cover sheet, including copyright details (e.g. indication of a Creative Commons licence), was automatically generated and must be carefully reviewed by users prior to reuse. The license information is derived from publication metadata and may contain errors or inaccuracies.



<https://savearchive.zbw.eu/termsfuse>



Eco-Efficiency and Energy Audit to Improve Environmental Performance: An Empirical Study of Hotels in Bali-Indonesia

Komang Adi Kurniawan Saputra^{1*}, Bambang Subroto², Aulia Fuad Rahman², Erwin Saraswati²

¹Faculty of Economics and Business, University of Warmadewa, PhD Student University of Brawijaya, Indonesia, ²Faculty of Economics and Business, University of Brawijaya, Indonesia. *Email: kaksaputra12@gmail.com

Received: 05 August 2022

Accepted: 25 October 2022

DOI: <https://doi.org/10.32479/ijeep.13565>

ABSTRACT

This paper examines a conceptual framework that describes the relationship between energy eco-efficiency, energy audit and environmental performance. In this paper, the authors argue that eco-efficiency and energy audits can directly affect environmental performance. This paper examines responses to a survey of general managers in hotel companies registered with the Indonesian Central Bureau of Statistics. The time horizon of data collection is cross-sectional. The hypothesis was tested using a multiple linear regression analysis approach by interpreting the regression model through the value of the significant coefficient to see the partial effect. In general, the proposed framework obtains adequate fit statistics. Furthermore, the results support the argument that eco-efficiency and energy audits positively and significantly affect the company's environmental performance. A limitation of this study relates to the small sample size, as environmental results and energy use are still considered confidential by many hotel companies. A causal relationship could not be confirmed for the results. The instrument used was fully adopted from previous research without unidimensional retesting. This study contributes to the literature-based view of natural resource energy conservation by responding to recent calls to examine energy conservation efforts on environmental performance. These results can be a special reference for policy-making in companies to improve their environmental performance continuously. This study also has important implications for energy conservation practices by describing the potential for energy savings through eco-efficiency and energy audits to improve environmental performance. These results indicate that energy conservation with improved environmental management accounting mechanisms in Indonesia seems to require more pressure as mandated by the government.

Keywords: Eco-Efficiency, Energy Audit, Environmental Performance, Energy Conservation, Environmental Management Accounting

JEL Classifications: K32; Q42; Q56; P28

1. INTRODUCTION

The importance of environmental performance is to reduce the use of scarce resources, pay attention to environmental sustainability, and increase company benefits for society and employees (Bhochhibhoya et al., 2020; Kurznack et al., 2021). If the hotel, which has the main activity of providing room services, food and beverage, and accommodation services, ignores environmental performance, the hotel will become a source of pollution and environmental damage (Asadi et al., 2020; Pereira-moliner et al., 2021). For example, the hotel industry's excessive use of groundwater (over-pumping) results in a water deficit and causes

land subsidence, which triggers flooding (Lo et al., 2021; Suamir et al., 2020).

Hotels are big players in energy consumption and consistently rank among the highest energy consumers in the tertiary building sector, which is focused on service delivery (Peng et al., 2017). One possible explanation for high energy use and inefficient energy practices is that hotels often prioritize guest comfort and experience above all else (Ceron et al., 2004; Kelly and Williams, 2007). However, there is much more that can be done besides asking guests to change towels less frequently and to increase the use of dispensers and refillable toiletries (Qiu et al., 2017). Xia

et al. (2018) research show how the integration of control systems into key building services (air conditioning, lighting, electricity, and water) can play an important role in achieving energy reduction targets set by the International Tourism Partnership while maintaining guest comfort. The hotel industry faces the challenge of reducing its carbon emissions by 66% by 2030 and 90% by 2050 in order to stay within the 2°C threshold agreed at COP21, a United Nations Climate Change initiative (Li et al., 2022; Zhang et al., 2014).

An energy efficiency program should be initiated by top management. This means that top management must clearly understand the concept of cost-benefit analysis of an energy efficiency program through the information mechanism of environmental management accounting. Therefore, the initial automatic step should use a top-down approach (Gössling et al., 2005). However, in its implementation, the details of the program must be accompanied by input from the management under it. Input from staff is critical to the success of an energy efficiency program (Backlund and Thollander, 2015). Commitment from top management must be realized to realize the program, and the first step is to conduct an energy audit. This step is important to determine the potential for savings as the basis for setting savings targets (Putri and Sari, 2019). These targets will be poured into an action plan that must be prepared together (Manurung et al., 2022; Saputra et al., 2022). A routine monitoring process must be carried out in implementing the action plan. After the implementation period is complete, conduct an evaluation to see if the savings target has been achieved (Saleh, 2020). To achieve this, it requires commitment from all parties and implementing sustainable management with an environmentally-based hotel management control system (Lai et al., 2012).

Environmental management accounting is important in a series of planning and control processes in organizations (Kim and Todorovic, 2013). Environmental management accounting consists of monetary and physical information that is applied simultaneously with three principles in organizational control, which include compliance, eco-efficiency, and strategic positioning (IFAC, 2005). The implementation of environmental management accounting in this study was carried out in response to the findings of Kim et al. (2018) that hotel managerial weaknesses, one of which is in the control aspect, are the cause of non-optimal environmental performance. Thus, the concept of environmental management accounting is appropriate to be applied to the context of environmental performance that is relevant to social and environmental protection. The pressure on companies related to the importance of environmental management accounting appears to be a gap in accounting research, especially in relation to the role of the company's environmental strategy, which is used as a basis for evaluating environmental performance using eco-efficiency (Clemens and Bakstran, 2010). This research is corroborated by Jones (2010) in a theoretical model of environmental accounting and environmental reporting in which the relationship between strategy and planning is understood through eco-efficiency, which is part of environmental management accounting principles that lead to the achievement of corporate environmental performance (Alajmi, 2012).

Hotels, as one of the service industries, are very vulnerable to causing environmental damage and producing waste that is harmful to the environment because the consumption of resources is large, especially in energy and water resources (Han et al., 2018; Stoddard et al., 2012; Stylos and Vassiliadis, 2015). So, this study is trying to expand the context of research in the hospitality service sector. This study extends the study of eco-efficiency as the main principle of environmental management accounting by providing evidence from Indonesia. Based on the researcher's knowledge, there are limitations of research that examines eco-efficiency and energy audits in relation to environmental performance in hotel companies. For example, Fleiter et al. (2012) found that eco-efficiency is a strong predictor affecting environmental performance, whereas Ferreira et al. (2010) found no such relationship. Research by Zanardo et al. (2018) even reveals that environmental audits have more influence on the company's environmental performance. As no empirical results are available from Indonesia on this relationship in the context of accounting, this study can provide preliminary evidence on the importance of eco-efficiency and energy audits and corporate environmental performance (Lara et al., 2015).

The contribution of this research is to evaluate the energy efficiency program, regardless of whether the energy efficiency program has reached its target or not. Effective program evaluation assesses what has been achieved and provides input for decision-makers to take the next steps. By evaluating, the company will automatically increase the program's effectiveness and indirectly provide motivation for the company's internal parties, management and other stakeholders (Li et al., 2022).

At first glance, the results of this investigation are the biggest obstacles to energy efficiency projects, which in the end often lead to the wrong assumption that this project is a cost center, not a revenue center. This barrier is usually felt more severe by relatively small hotels, such as budget hotels (Gössling et al., 2005; Putri and Sari, 2019). Let alone the allocation of funds for efficiency projects, keeping cash flow in a safe position is difficult for them. This is because the top management only focuses on the amount of money that must be spent as an initial investment. Top management does not realize that energy efficiency programs are able to return the investment that must be spent within a certain period (Ceron et al., 2004; Peng et al., 2017). When that period has passed, your investment has yielded sustainable savings for years to come. For further discussion, it is explained in detail in another sub-chapter.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Environmental management enables a company to continuously manage, measure, and improve aspects of its operations to avoid deterioration in its environmental performance. In addition to using an energy eco-efficiency mechanism to implement an environmental management system, this study considers the energy audit process to control energy use and savings, both of which are a form of commitment to energy conservation. The two

types of factors are specific control systems owned by the company to improve its environmental performance. This approach is consistent with empirical research conducted by Ceron et al. (2004), Kelly and Williams (2007), Peng et al. (2017), Qiu et al. (2017). The company's orientation to the eco-efficiency system has a significant positive effect on environmental and economic performance (Li et al., 2022; Xia et al., 2018; Zhang et al., 2014). One of the main determinants of this positive relationship is the company's commitment to continue to pay attention to the eco-efficiency model as the orientation of its environmental strategy. The results of eco-efficiency will direct the company's policies towards the implementation of an environmental management system to achieve sustainable environmental performance. Previous research further noted that every company with the application of energy eco-efficiency that views energy and the environment as important to continue to improve and approach sustainable environmental performance (Saleh, 2020).

The pressures on companies related to the importance of energy audits appear to be a gap in accounting research, especially in relation to the company's environmental performance. This observation is corroborated by Backlund and Thollander (2015), namely that companies need energy audits. The result of the energy audit process is the target of the energy efficiency program. It should be remembered that management's commitment is the key to the success of energy efficiency programs (Hirst et al., 1981). The easiest way to determine efficiency targets is to look at the difference in energy intensity from the applicable standard. Make potential savings an energy efficiency target. The environmental target is hoped to be achieved by implementing a holistic accounting system because the existing system is insufficient.

2.1. Energy Eco-efficiency and Environmental Performance

Eco-efficiency is a strategy that combines the concept of economic efficiency and the concept of ecological efficiency based on the principle of efficient use of natural resources. Eco-efficiency is a strategy that produces a product with better performance, using less energy and natural resources. Eco-efficiency is a combination of economic efficiency and ecological efficiency and is basically "doing more with less," meaning producing more goods and services with less energy and natural resources (Gössling et al., 2005; Saleh, 2020). Eco-efficiency is a combined concept between economic efficiency and ecological efficiency, where the use of natural resources is minimal for maximum results, and the ecological balance is maintained. Eco-efficiency can be achieved by producing goods at competitive prices and meeting quality market needs by reducing the use of natural resources and the resulting environmental impacts in line with the capabilities and carrying capacity of the environment (Putri and Sari, 2019). There are seven key factors in eco-efficiency, namely (1) reducing the amount of material used; (2) reducing the amount of energy use; (3) reducing pollution; (4) enlarging the recycling of materials; (5) maximizing the use of renewable natural resources; (6) prolong the service life of the product; (7) increase the intensity of service (Fleiter et al., 2012).

According to Zhang et al. (2014), in the current hospitality sector, success in reducing energy costs can directly increase revenue

without the need to increase room rates or increase hotel room sales. Li et al. (2022) stated that in addition to financial and service benefits, energy efficiency is also a form of concern for environmental sustainability, which has an impact on social life. In the midst of the current issue of climate change and global warming, the form of concern for the environment that is applied in environmental performance can improve the hotel's image in the eyes of tourism actors or business people. Hotel energy savings significantly reduce greenhouse gas emissions and mitigate climate change (Gössling et al., 2005). The higher the hotel's commitment to eco-efficiency energy, the more it will help management make decisions that can improve its environmental performance. Based on the above arguments, the following hypotheses are proposed:

H1: There is a positive relationship between eco-efficiency energy and environmental performance

2.2. Energy and Environmental Performance Audit Mechanism

Energy audit is an activity of examining, collecting data, and analyzing energy use in a building in a process or system with an in-depth understanding of the object of study. The energy audit process includes several stages as follows: (1) analyzing data on the company's energy use, (2) collecting data from operating conditions in the field, (3) understanding the company's characteristics and interactions with energy based on occupancy rate and operating time, (4) evaluating conservation energy, (5) estimation of existing energy saving opportunities and (6) identification of services and consumer needs (Lai et al., 2012). By looking at historical studies, a basis can be established to identify sectors with high energy use and their impact on the energy use map (Lara et al., 2015). This information helps determine energy-saving priorities and provides an overview of hotel energy use patterns. Since more than 75% of hotel energy expenditure is in the form of electricity, the analytical approach in the following section emphasizes electricity. The following are the key steps in conducting an energy audit.

An energy audit is needed because we need a measurable use of energy. In energy management, we recognize energy accounting, an activity to record and relate energy use and costs incurred. In addition, to monitor energy use on a time scale Lara et al. (2015) state that the implementation of an energy audit can increase management knowledge about the amount of energy and costs incurred so that it will improve environmental performance. Zanardo et al. (2018) state that an energy audit is an important activity in the context of implementing energy conservation, and the purpose of an energy audit is to find out historical data from energy use and look for opportunities to save energy consumption to improve environmental performance. Energy saving efforts in a commercial building such as a hotel can only be done if it is known what the energy is used for and how much energy is used in each hotel building. This is done to conserve energy and improve environmental performance (Fleiter et al., 2012). Based on the above arguments, the following hypotheses are proposed:

H2: There is a positive relationship between energy audit and environmental performance

Figure 1 describes the relationship to be tested between eco-efficiency and energy audits on environmental performance.

3. METHODS

The research was conducted in a natural setting in each hotel as the research location, where the researcher's involvement was minimal, namely when explaining the research procedures to the respondents. The research analysis unit is the organization, represented by top managers, with a target sample of 300 hotels in the Province of Bali-Indonesia registered with the Central Statistics Agency data. The time horizon of data collection is cross-sectional, that is, once at the time of filling out the questionnaire. As for the proportion of sampling, because the population has a proportional distribution that is not homogeneous and stratified, the sampling technique used is a proportionate stratified random sampling technique. Primary data was collected using a survey method, namely a self-administered survey, in which respondents filled out the questionnaire independently without any supervision from the researcher.

Before the field survey, pre-test questionnaires were distributed to teaching staff at the economics and business faculties of public and private universities in Bali, Indonesia, who were willing to participate. Lecturers were chosen because they were considered capable of understanding and providing input regarding the instruments developed so that they could help us develop questionnaires easily understood by respondents. Based on the results of this review, the author made several revisions to the wording of the questions. Data were collected in hard and soft copies (hotel email), so researchers could obtain answers to questions through various channels. When the deadline arrived, 75 responses were collected by mail and email. The study was conducted within 3 months. The response rate is up to 25%. The data in this study were analyzed using the mechanism of multiple linear regression analysis.

Respondents for this study came from the hotel industry with different stars; the sample is dominated by 5-star hotels (45% of respondents), followed by 4-star hotels (30%), and 3-star hotels (25%). Respondents represent three different hotel classes, indicating that various types of star hotels have implemented eco-efficiency and energy audits. The results of the t-test showed no statistically significant difference in responses ($P < 0.05$) by star type, and there was no concern of bias in social desirability responses. These findings indicate that the type of industry will not affect the analysis results, and there is no problem of social desirability response bias in respondents' reporting on environmental performance; we also used the Wilcoxon test for comparison. The lowest class of hotels did not participate because they had difficulty conserving energy. The main problem is financing. Energy efficiency projects are felt more heavily by relatively small hotels, such as budget hotels. Let alone the allocation of funds for efficiency projects, keeping cash flow in a safe position is difficult for them. This is because the top management only focuses on the amount of money that must be spent as an initial investment. After all, most small hotels are managed by families and are not yet professional.

Measurement of research indicators uses a five-point Likert scale, namely (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, (5) strongly agree. Eco-efficiency forms seven statement items and the energy audit variable forms six statement items. Environmental performance is "an overview of operational performance indicators that evaluate resource use, waste disposal, emissions or water consumption" (Ceron et al., 2004). These aspects are easy to measure in the short term; however, others are more difficult to measure, such as internal social benefits and their impact on stakeholders. Based on several environmental performance measurements adopted from Solovida and Latan (2017), respondents were asked questions about the use of environmental performance indicators using an instrument developed as part of the ISO 14031 standard. Environmental performance has thirteen statement items.

4. RESULTS AND DISCUSSION

The implementation of this research was carried out first by testing the validity and reliability of the instrument. The validity test uses the product moment Pearson correlation test by connecting each item score with the total score obtained in the study. The instrument reliability test is measured based on Cronbach's alpha value (Table 1).

The results of testing the validity of the research instrument can be seen in the Pearson correlation score by comparing the r table at $DF = N-2$ and a probability of 0.05. The DF score in this test is $75-2 = 73$, the r table in DF 73 is 0.1914, so if the Pearson correlation score is above that score, then the question item is declared valid. All question items are declared valid and can be used in a wider research sample based on the results above. Based on the value of Cronbach's alpha coefficient, this research instrument has a value of 0.6 then it is declared reliable or consistent so that the instrument can be used for research and has been consistent (Tables 2 and 3).

Figure 1: Research conceptual model

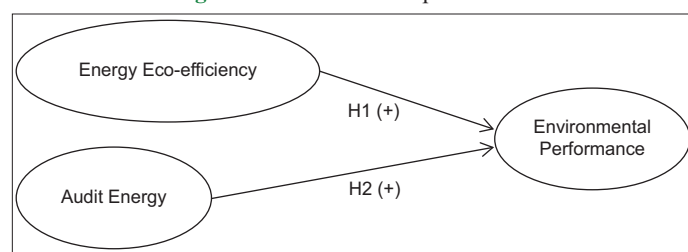


Table 1: Energy eco-efficiency model indicators and measurements

Indicator/Item	Code	Pearson correlation	Cronbach's alpha
Reducing the use of hazardous materials	EEE.1	0.799	0.806
Reduce the amount of energy use	EEE.2	0.707	
Reduce pollution	EEE.3	0.730	
Enlarge energy recycling	EEE.4	0.544	
Maximize the use of renewable resources	EEE.5	0.774	
Extend product life	EEE.6	0.504	
Increase service intensity	EEE.7	0.733	

4.1. Hypothesis Test

Multiple linear regression is an equation model that explains the relationship of one dependent variable/response with two independent variables/predictors. In this study, the independent variables are eco-efficiency and energy audit, while the dependent variable is environmental performance. The purpose of the multiple linear regression test is to predict the value of the dependent variable/response if the independent variable/predictor values are known. Testing the hypothesis of the effect of eco-efficiency and energy audit on environmental performance got the following results (Table 4).

Partial regression coefficient testing aims to determine whether the partially formed regression model equations of the independent variables (eco-efficiency and energy audit) significantly affect the

dependent variable (environmental performance). Based on the results of hypothesis testing using multiple linear regression, it was found that the significant value in the regression model for eco-efficiency is 0.000 and energy audit is 0.000, at a significant level with an alpha of 0.05 and a constant value of 4.196. So, the regression equation is:

$$\text{Regression equation: } KL = 4.196 + 0.763EEE + 1.045AE$$

Decision-making is done by looking at the significant value in the Coefficients table. Usually, the basis for testing the regression results is usually carried out with a confidence level of 95% or a significance level of 5% ($\alpha = 0.05$), meaning that the hypothesis can be accepted if the significance value is below 0.05. The results of the first hypothesis test (H1) state that eco-efficiency energy has a significant positive effect on improving the environmental performance of the hotel industry in Bali, as indicated by the sig. 0.000. Also, the second hypothesis (H2) can be answered by looking at the significance value of the AE variable, which is 0.000, meaning that the energy audit has a significant positive effect on environmental performance. So the first hypothesis (H1) and second (H2) can be accepted with the statement that eco-efficiency and energy audit has a significant positive direct effect on the environmental performance of hotel companies in Bali-Indonesia.

4.2. Robustness Test

This study uses an additional analytical tool, namely the robustness test. A robustness test is used to test the validity of the research results. This robustness test was conducted on a sample of five-star hotels, which are international chains and do not have separate networks. The number of hotels that have an international management network is 45 hotels, and those with a management network are 30 hotels. The results of the robustness test can be presented in the following Table 5.

Based on these results, eco-efficiency and energy audit significantly positively affect environmental performance. This means that it is consistent with the results of hypothesis testing, so the model used in this study is solid.

5. DISCUSSION

The first hypothesis states a positive and significant relationship between eco-efficiency and environmental performance. Based on empirical evidence, hypothesis one is supported. These results provide support for research from Qiu et al. (2017), which states that energy efficiency is one of the factors that can improve company performance that leads to environmental protection. This study is also in line with the findings of Xia et al. (2018), which state that implementing energy efficiency is a proactive strategy to support economic and environmental performance. So that Putri and Sari (2019) stated that the strategy in the form of energy saving became a competitive strategy to go to green hotels. This study also finds the value when the company's environment, by providing evidence that the company's environment and society require firm action related to pollution and energy waste by hotels, so hotels need to make energy efficient, be it electricity, water, and others (Saleh, 2020). Because so far, the hotel is considered to allow

Table 2: Energy audit model indicators and measurements

Indicator/Item	Code	Pearson correlation	Cronbach's alpha
Analyzing company energy usage data	AE.1	0.826	0.773
Collecting data from operating conditions in the field	AE.2	0.894	
Understanding of company characteristics and interaction with energy based on occupancy rate and operating time	AE.3	0.680	
Energy conservation evaluation	AE.4	0.664	
Estimation of existing energy-saving opportunities	AE.5	0.686	
Identify customer services and needs	AE.6	0.479	

Table 3: Environmental performance model indicators and measurement

Indicator/Item	Code	Pearson correlation score	Cronbach's alpha
Compliance with the requirements or expectations of standard	KL.1	0.660	0.872
Energy input	KL.2	0.657	
Relationship with the community	KL.3	0.620	
The solid waste output	KL.4	0.620	
Output of air emissions	KL.5	0.761	
Financial impact	KL.6	0.739	
Maintenance for the installation, operation, facilities and facilities for physical equipment	KL.7	0.616	
Liquid waste output	KL.8	0.713	
Raw materials input	KL.9	0.554	
Water input	KL.10	0.761	
Implementation of environmental policies and programs	KL.11	0.572	
Input auxiliary materials	KL.12	0.583	
The indicators provide information about the environmental conditions locally, regionally and nationally	KL.13	0.377	

Table 4: Hypothesis test results

Model		Unstandardized coefficients		t	Sig.	95.0% confidence interval for B		Collinearity statistics	
		B	Std. error			Lower bound	Upper bound	Tolerance	VIF
1	(Constant)	4.196	4.038	1.039	0.302	-3.853	12.245		
	EEE	0.763	0.160	4.781	0.000	0.445	1.081	0.566	1.767
	AE	1.045	0.190	5.510	0.000	0.667	1.423	0.566	1.767

Table 5: Hotel regression results with international and national management

Independent Variable	International		National	
	Coefficient	Probability	Coefficient	Probability
Eco-efficiency	0.798	0.001*	0.711	0.009*
Energy Audit	0.972	0.000*	1.157	0.001*

Dependent variable: Environmental Performance, *Significant at 1%

excessive energy use for guests, only cares about profit, and ignores energy conservation (Teng et al., 2012). As Ayoub et al. (2014) stated, a company orientation that aims to improve the environment by conserving energy will gain legitimacy from the community. Thus, the hotel industry must consistently carry out energy efficiency programs as a form of energy conservation with the aim of business sustainability. In addition, the empirical evidence research shows that environmental performance indicators should be continuously developed by considering the company's energy use performance. The effect of eco-efficiency on environmental performance shows the importance of measuring energy use and the limitations required by the hotel without disturbing customer comfort. This can be supported by research from Chedwal et al. (2015), which states that hotel customers currently demand to be green-oriented, which means more attention to the environment and the natural resources it uses, including water energy, electricity and others.

The second hypothesis states that energy audits have a positive effect on environmental performance. Empirical evidence states that the hypothesis can be accepted. This means that hotel companies need an energy audit to improve their environmental performance. The more consistently hotels commit to energy conservation through energy audits, the hotel's environmental protection will be realized for customers and the community (Khemiri and Hassairi, 2005). The natural resources used must be managed properly by avoiding the use of excessive energy (Teng et al., 2012). Hotel companies that have conducted environmental audits are still limited. This study shows that only hotels that are classified as large or star. This is because star hotels tend to pay attention to pressure from stakeholders to conserve energy, to achieve performance that is not only economic or financial performance, but rather to gain more legitimacy by improving environmental performance (Ayoub et al., 2014; Chedwal et al., 2015; Khemiri and Hassairi, 2005). The results empirically state that an energy audit is important to create hotel environmental performance, which leads to hotel sustainability. The strategy on energy conservation has also been carried out by hotel management (Alajmi, 2012). Data evidence has been able to answer the commitment of hotels to conduct energy audits consistently

(Zanardo et al., 2018). For example, most hotels in Bali already have records or data related to electricity, water, diesel oil, gas, and others (Saputra et al., 2022). Many hotels also have waste treatment systems to recycle energy, such as managing water to be recycled and reused (Ayoub et al., 2014; Saleh, 2020).

This study contributes to the environmental management accounting literature, particularly in the application of eco-efficiency principles and energy audits, as well as environmental performance, by responding to recent calls to combine energy conservation systems (energy efficiency and auditing) with corporate performance (Ern et al., 2016). This is the latest research conducted on the service industry in Indonesia. This study provides empirical evidence that energy conservation mechanisms can be used as a competitive strategy to become a green innovation so that it has an effect on improving environmental performance. This study also has important implications for hotel management practices because it illustrates the potential for energy savings without compromising customer convenience and services provided (Chedwal et al., 2015). Strategically, hotel managers must campaign for energy conservation and improve environmental performance as one of the company's responsibilities to stakeholders (Putri and Sari, 2019). In other conditions, managers can also make strategic alliances with environmentally friendly energy providers and carry out environmental innovations, green products, waste management, and energy conservation ideas, which in turn will increase the sustainability of their business (Ayoub et al., 2014; Fleiter et al., 2012; Khemiri and Hassairi, 2005; Lara et al., 2015; Teng et al., 2012). Thus, managers must adopt an energy conservation system through eco-efficiency and energy audits as a tangible manifestation of the development of environmental management accounting implementation because this can be a solution to gain community legitimacy, as well as a solution to the company's economic and environmental challenges (Saputra et al., 2021).

Most importantly, this research supports the Law of the Republic of Indonesia Number 30 of 2007 concerning Energy, which states that all companies in Indonesia are required to make systematic, planned and integrated efforts to conserve domestic energy resources and improve the efficiency of energy resource utilization. The implementation of energy conservation is carried out at all stages of energy management, including energy supply, exploitation, energy utilization and energy resource conservation. The government certainly hopes that all parties can support the implementation of the strategy for implementing energy conservation so that the targets for reducing final energy consumption, reducing energy intensity, and targeting energy elasticity by 2025 are met.

6. CONCLUSION

Environmental management accounting mechanisms formulated in eco-efficiency systems and energy audits can benefit hotel companies by providing information about their operational activities, particularly related to energy use, energy saving potential, and energy conservation, for legitimizing and improving hotel environmental performance. Several studies have examined eco-efficiency as a form of environmental management accounting commitment, but mostly in the manufacturing industry (Fleiter et al., 2012; Putri and Sari, 2019). Moreover, still little is done in the service industry, even though the hotel service industry has great potential related to environmental impacts to cause an energy crisis, especially electricity, water, gas and other resources (Kelly and Williams, 2007; Lai et al., 2012; Peng et al., 2017). The findings of this study have confirmed the predictions from the study that eco-efficiency and energy audits are important in the hotel industry, especially in terms of improving environmental performance.

Empirical evidence finds that eco-energy efficiency can affect environmental performance. This means that the more the company is committed to energy efficiency, the higher the company's environmental performance will be. Other empirical evidence also finds that energy conservation by conducting consistent energy audits will improve the company's environmental performance. The analysis results using the regression method support the argument that hotel companies with international and national management affiliates have the same commitment to energy conservation (eco-efficiency and energy audits) to improve their environmental performance. These results can be seen from the empirical evidence carried out by the robust testing method. These results can be used as a reference for the company's policy-making to improve environmental performance continuously. These findings suggest that public and business policies should particularly emphasize the application of energy conservation strategies to encourage the integration of potential energy-saving and environmental issues into decision-making and control processes (Ceron et al., 2004). This study also has practical implications for accounting and environmental managers and top management in general, suggesting that managers should adopt energy conservation and environmental protection initiatives to focus on natural resource issues in their companies.

REFERENCES

- Alajmi, A. (2012), Energy audit of an educational building in a hot summer climate. *Energy and Buildings*, 47, 122-130.
- Asadi, S., Omsalameh, S., Nilashi, M., Abdullah, R., Samad, S., Yadegaridehkordi, E., Aljojo, N., Razali, N.S. (2020), Investigating in fluence of green innovation on sustainability performance : A case on Malaysian hotel industry. *Journal of Cleaner Production*, 258, 120860.
- Ayoub, N., Musharavati, F., Pokharel, S., Gabbar, H.A. (2014), Energy consumption and conservation practices in Qatar-a case study of a hotel building. *Energy and Buildings*, 84, 55-69.
- Backlund, S., Thollander, P. (2015), Impact after three years of the Swedish energy audit program. *Energy*, 82, 54-60.
- Bhochhibhoya, S., Pizzol, M., Marinello, F., Cavalli, R. (2020), Sustainability performance of hotel buildings in the Himalayan region. *Journal of Cleaner Production*, 250, 119538.
- Ceron, J.P., Dubois, G., Gossling, S., Peeters, P., Patterson, T., Richardson, R. (2005), The eco-efficiency of tourism. *Ecological Economics*, 54(4), 417-434.
- Chedwal, R., Mathur, J., Agarwal, G.S., Dhaka, S. (2015), Energy saving potential through energy conservation building code and advance energy efficiency measures in hotel buildings of Jaipur City, India. *Energy and Buildings*, 92, 282-295.
- Clemens, B., Bakstran, L. (2010), A framework of theoretical lenses and strategic purposes to describe relationships among firm environmental strategy, financial performance, and environmental performance. *Management Research Review*, 33(4), 393-405.
- Ern, S.Y., Abdullah, A., Yau, F.S. (2016), Contingency factors influencing MAS design of manufacturing firms in Malaysia. *Asian Journal of Accounting and Governance*, 7, 1-9.
- Ferreira, A., Moulang, C., Hendro, B. (2010), Environmental management accounting and innovation: an exploratory analysis. *Accounting Auditing and Accountability Journal*, 23(7), 920-928.
- Fleiter, T., Schleich, J., Ravivanpong, P. (2012), Adoption of energy-efficiency measures in SMEs-an empirical analysis based on energy audit data from Germany. *Energy Policy*, 51, 863-875.
- Gössling, S., Peeters, P., Ceron, J.P., Dubois, G., Patterson, T., Richardson, R.B. (2005), The eco-efficiency of tourism. *Ecological Economics*, 54(4), 417-434.
- Han, H., Lee, J.S., Trang, H.L.T., Kim, W. (2018), Water conservation and waste reduction management for increasing guest loyalty and green hotel practices. *International Journal of Hospitality Management*, 75, 58-66.
- Hirst, E., Berry, L., Soderstrom, J. (1981), Review of utility home energy audit programs. *Energy*, 6(7), 621-630.
- Jones, M.J. (2010), Accounting for the environment: Towards a theoretical perspective for environmental accounting and reporting. *Accounting Forum*, 34(2), 123-138.
- Kelly, J., Williams, P. (2007), Tourism destination water management strategies: An eco-efficiency modelling approach. *Leisure Loisir*, 31(2), 427-452.
- Khemiri, A., Hassairi, M. (2005), Development of energy efficiency improvement in the Tunisian hotel sector: A case study. *Renewable Energy*, 30(6), 903-911.
- Kim, J.T., Todorovic, M.S. (2013), Towards sustainability index for healthy buildings-Via intrinsic thermodynamics, green accounting and harmony. *Energy and Buildings*, 62, 627-637.
- Kim, Y.H., Barber, N., Kim, D.K. (2018), Sustainability research in the hotel industry: Past, present, and future. *Journal of Hospitality Marketing and Management*, 28(2), 1-45.
- Kurznack, L., Schoenmaker, D., Schramade, W. (2021), A model of long-term value creation. *Journal of Sustainable Finance and Investment*, 2021, 1-19.
- Lai, J.H.K., Yik, F.W.H., Man, C.S. (2012), Carbon audit: A literature review and an empirical study on a hotel. *Facilities*, 30, 417-431.
- Lara, R.A., Pernigotto, G., Cappelletti, F., Romagnoni, P., Gasparella, A. (2015), Energy audit of schools by means of cluster analysis. *Energy and Buildings*, 95, 160-171.
- Li, Y., Liu, A.C., Yu, Y.Y., Zhang, Y., Zhan, Y., Lin, W.C. (2022), Bootstrapped DEA and clustering analysis of eco-Efficiency in China's hotel industry. *Sustainability*, 14(5), 2925.
- Lo, W., Purnomo, S.N., Sarah, D., Aghnia, S., Hardini, P. (2021), Groundwater modelling in urban development to achieve sustainability of groundwater resources: A case study of semarang city, indonesia. *Water (Switzerland)*, 13(10), 13101395.
- Manurung, D.T.H., Hidayah, N., Setiany, E., Saputra, K.A.K., Hapsari, D.W. (2022), Does carbon performance and green

- investment affect carbon emissions disclosure ? *Journal of Environmental Accounting and Management*, 10(4), 335-344.
- Peng, H., Zhang, J., Lu, L., Tang, G., Yan, B., Xiao, X., Han, Y. (2017), Eco-efficiency and its determinants at a tourism destination: A case study of Huangshan National Park, China. *Tourism Management*, 60, 201-211.
- Pereira-moliner, J., López-Gamero, M.D., Font, X., Molina-Azorín, J.F., Tari, J.J., Pertusa-Ortega, E.M. (2021), Sustainability, competitive advantages and performance in the hotel industry : A synergistic relationship. *Journal of Tourism and Services*, 23(12), 132-149.
- Putri, W.H., Sari, N.Y. (2019), Eco-efficiency and eco-innovation: Strategy to improve sustainable environmental performance. *IOP Conference Series Earth and Environmental Science*, 245(1), 12049.
- Qiu, X., Fang, Y., Yang, X., Zhu, F. (2017), Tourism eco-efficiency measurement, characteristics, and its influence factors in China. *Sustainability*, 9(9), 1634.
- Saleh, M.M.A., Jawabreh, O.A. (2020), Role of environmental awareness in the application of environmental accounting disclosure in tourism and hotel companies and its impact on investor's decisions in Amman stock exchange. *International Journal of Energy Economics and Policy*, 10(2), 417-426.
- Saputra, K.A.K., Jayawarsa, A.A.K., Prihandani, N.M.I. (2022), Antonio gramsci hegemonical theory critical study : Accounting fraud of Hindu-Bali. *International Journal of Business*, 27(2), 1-11.
- Saputra, K.A.K., Manurung, D.T.H., Rachmawati, L., Siskawati, E., Genta, F.K. (2021), Combining the concept of green accounting with the regulation of prohibition of disposable plastic use. *International Journal of Energy Economics and Policy*, 11(4), 84-90.
- Saputra, K.A.K., Mu'ah, Jurana, Korompis, C.W.M., Manurung, D.T.H. (2022), Fraud prevention determinants : A balinese cultural overview. *Australasian Accounting Business and Finance Journal*, 16(3), 167-181.
- Solovida, G.T., Latan, H. (2017), Linking environmental strategy to environmental performance: Mediation role of environmental management accounting. *Sustainability Accounting, Management and Policy Journal*, 8(5), 595-619.
- Stoddard, J.E., Pollard, C.E., Evans, M.R. (2012), The triple bottom line: A framework for sustainable tourism development. *International Journal of Hospitality and Tourism Administration*, 13(3), 233-258.
- Stylos, N., Vassiliadis, C. (2015), Differences in sustainable management between four-and five-star hotels regarding the perceptions of three-pillar sustainability. *Journal of Hospitality Marketing and Management*, 24(8), 791-825.
- Suamir, I.N., Sudirman, Ardita, I.N., Santanu, G. (2020), Experimental and numerical optimization on chilled water configuration for improving temperature performance and economic viability of a centralized chiller plant. *Journal of Physics Conference Series*, 1450(1), 012106.
- Teng, C.C., Horng, J.S., Hu, M.L.M., Chien, L.H., Shen, Y.C. (2012), Developing energy conservation and carbon reduction indicators for the hotel industry in Taiwan. *International Journal of Hospitality Management*, 31(1), 199-208.
- Xia, B., Dong, S., Zhao, M., Li, Z., Li, F., Li, Y., Cheng, H. (2018), Analysis of economic efficiency and eco-efficiency of Chinese star hotels based on SBM model. *IOP Conference Series Earth and Environmental Science*, 190(1), 12066.
- Zanardo, R.P., Siluk, J.C.M., de Souza Savian, F., Schneider, P.S. (2018), Energy audit model based on a performance evaluation system. *Energy*, 154, 544-552.
- Zhang, J.J., Joglekar, N., Heineke, J., Verma, R. (2014), Eco-efficiency of service co-production: Connecting eco-certifications and resource efficiency in US hotels. *Cornell Hospitality Quarterly*, 55(3), 252-264.