

Environmental Engineering of Electric Vehicle Infrastructure and Technology in Supporting Green Tourism and Energy

Arif Devi Dwipayana ^{a,1*}, Rahmat Ahmad ^{a,2}, I Wayan Yudi Martha Wiguna ^{b,3}

^{a,1,2} Automotive Technology Program, Bali Land Transportation Polytechnic, 82161 Tabanan, Bali, Indonesia

^{b,3} Land Transportation Management Program, Bali Land Transportation Polytechnic, 82161 Tabanan, Bali, Indonesia

^{1*} arif.devi@poltradabali.ac.id, ² rahmat@poltradabali.ac.id, ³ wayan.yudi@poltradabali.ac.id

*corresponding e-mail

This is an open access article under the terms of the CC-BY-NC license

ABSTRACT

The use of technology to reduce carbon emissions that support green tourism is electric vehicles; one of its advantages is that it does not produce exhaust emissions that can pollute the environment. The purpose of this research is to see the readiness of Bali Provincial Government in preparing the engineering of the use of electric vehicles, especially infrastructure and technology to support green tourism and green energy. This research method was carried out using literacy study, data collection techniques and data sources with secondary data types. The discussion in this study can be described qualitatively based on the results of data processing that has been collected previously. The implementation of the regulation has produced results but does not show a significant impact because it only focuses on tourism areas in Denpasar City and Badung Regency. The main infrastructure in supporting electric vehicles is the availability of SPKLU in tourism areas. The use of electric buses can be further expanded, and the route can be increased, thus it will increase tourists' interest in using these services. Further research can be carried out on how much exhaust emissions and air pollution decrease in tourism areas.

Keywords: green tourism, green energy, electric vehicle, environmental engineering, infrastructure and technology

A. Introduction

Bali is one of the best tourism destinations in the world, according to Trip Advisor Bali has been named the number one most popular tourist destination in Asia and number four in the world in 2022 (Mihardja et al., 2023). Besides the popularity, there are problems threaten the sustainability of Bali tourism, especially in terms of energy and the environment. Based on IQAir (2020) data as of July 2020, there are two areas in Bali that are included in the list of the top five regions with the worst air quality in Indonesia; the cities are Ubud and Badung Regency where both cities/regencies are tourism centers in

Bali Province. The biggest contributor to air pollution today is motor vehicle exhaust emissions, this is positively correlated with the increasing number of vehicles in the 2021-2023 period in Bali Province as shown in Table 1, in addition to this, the use of coal and diesel raw materials in power plants includes providing contribution to changes in environmental quality.

According to Koens et al. (2018), the emergence of negative impacts from the mobility of tourism activities, especially the transportation sector, is not only limited to environmental problems but also causes social and economic impacts (congestion, population density in an area, low safety factors, conflicts

in the use of public space between residents and tourists). These impacts should be handled by the government as a public authority with the aim of reducing environmental pollution, improving the tourist experience, and improving the socio-economic quality of life of the community (Clavé, 2018). Voelcker (2008) stated that increasing environmental problems and depletion of fossil energy sources have led to increased research and development investment in technology for vehicles with renewable energy. Ramkissoo et al. (2013); Romão & Bi (2021) mentioned that in the context of the climate emergency and the current growth of tourism mobility (although it was temporarily paralyzed due to the Covid-19 pandemic), transportation activities related to tourism that are more environmentally conscious can certainly determine the conversion and attractiveness of a better destination, which in the end can act as a catalyst for tourist satisfaction and destination competitiveness.

The Bali Provincial Government has issued a regulation that supports the use of clean energy and the use of battery-based electric motorized vehicles (KBL) namely Bali Governor Regulation Number 45 of 2019 concerning Bali Clean Energy and Bali Provincial Governor Regulation Number 48 of 2019 concerning the Use of Battery-Based

Electric Motorized Vehicles (KBL) which are directed at preserving the natural and cultural environment while supporting government programs for energy efficiency and pollution reduction in Indonesia (Yuniza et al., 2021; Arifin et al., 2022). in the transportation sector, as well as encouraging the readiness of electric vehicle infrastructure in Bali to accelerate the transition from fossil fuel-fueled vehicles to battery-based KBL. Currently the transportation sector in the tourism area is very dominant using fossil fuel-based vehicles. The use of electric vehicles is one solution in reducing vehicle exhaust emissions and air pollution. The current growth of electric vehicles in Bali has reached 1,064 units and the majority are in downtown Denpasar and Badung Regency. For tourism vehicles, the use of electric buses and taxis from Blue Bird is currently running. The growing use of electric vehicles requires engineering infrastructure to support the movement of electric vehicles themselves, infrastructure can be technical and non-technical. For technical infrastructure, the engineering of electric vehicles starts from providing SPKLU in strategic tourism locations, gradually changing battery-based tourism vehicles and for non-technical in the form of providing incentives for tourism actors to be able to provide electric vehicles. The purpose of this research is to see the

Table 1 Number of Vehicles by Regency/City in Bali Province (Unit)

Regency/City	2021	2022	2023
Kab. Jembrana	222.532	265.110	275.741
Kab. Tabanan	443.154	469.977	490.621
Kab. Badung	934.120	982.663	1.046.547
Kab. Gianyar	477.128	520.281	550.493
Kab. Klungkung	143.598	184.773	194.337
Kab. Bangli	128.690	137.644	144.545
Kab. Karangasem	216.568	232.658	248.931
Kab. Buleleng	474.431	496.621	542.799
Kota Denpasar	1.470.570	1.466.637	1.540.337
Provinsi Bali	4.510.791	4.756.364	5.016.351

Source: Central Bureau of Statistics of Bali Province (2024)

readiness of the Bali Provincial Government in preparing the engineering of the use of electric vehicles, especially infrastructure and technology to support green tourism and green energy referring to the Governor's Regulation above.

Green tourism is a form of eco-tourism that focuses on sustainable tourism or means that it does not cause damage to tourist sites and cultural heritage being visited (environmentally friendly). UNWTO states that “green tourism is environmentally sustainable travel to destinations where the flora, fauna, and cultural heritage are the primary attractions and where environmental impacts are minimized.” It also stated that “green tourism refers to tourism activities that can be maintained or sustained, indefinitely in their social, economic, cultural and environmental contexts: sustainable tourism”. Currently green tourism does not only run alone but is also supported by the use of green energy or renewable energy, such as the use of solar panels which have been widely used by hotels in the National Tourism Strategic Areas (KSPN).

The Bali Provincial Government is very serious in creating green tourism and sustainable clean energy with the aim of improving environmental quality, reducing carbon gas emissions, creating a dynamic relationship between renewable energy, economic growth and of course continuous sustainability. This section reviews the literature from several sources related to the environmental engineering of electric vehicles for supporting green tourism and energy, especially research that has been published. Beckena et al. (2003) states that the tourism sector is an energy-intensive sector that is highly dependent on energy consumption. Katircioglu et al. (2014) state that tourism activities have a positive effect on climate change while Lee & Brahmasrene (2013) show that tourism has a negative impact on climate change. Tang et al. (2017) state that the tourism sector is one of the main contributors to energy consumption and greenhouse gas

emissions. They have proposed a model for analyzing carbon emissions in the energy consumption of the tourism industry and have shown that the growth of tourist scale has an effect on increasing carbon emissions. Several literatures have highlighted the importance of reducing pollution in tourist areas to maintain sustainability and sustainability aspects (Bose et al., 2023; Mousazadeh et al., 2023; Al-Saud et al., 2024). The use of electric vehicles is a real action to support this. The province of Bali itself is currently making changes to tourism and green energy based on the 2 Governor Regulations above, the application of engineering infrastructure is more for the procurement of SPKLU and the transition of fossil fuel tourism vehicles to electric vehicles. It can be described as follows:

Zhang & Gao (2016) in their research stated that the tourism sector is one of the largest carbon emitters, they explored the effects of international tourism and economic growth in China along with energy consumption and carbon emissions, to reduce energy consumption and carbon emissions the use of tourism vehicles has been implemented. based on electricity, the use of green energy and the existence of regulations from the government that require these changes. Tang et al. (2017) have offered energy efficiency and carbon gas emission efficiency with the tourism industry model bottom-up analysis method and tourism cycle assessment theory. The results obtained need to do the development of low-carbon green tourism to attract tourists. Boutabba & Ahmad (2017) conducted a study using biofuel fuels in 12 countries with a time span of 2002-2012, the results stated that the use of biofuels offers a promising opportunity to reduce dependence on fossil fuels and concludes that biofuels are a good energy source to meet energy needs, help in alleviating poverty by making countries in energy production and environmentally friendly towards sustainable tourism. The objectives of this research is to see the readiness of the Bali Provincial Government in preparing the engineering of the use of electric vehicles, especially

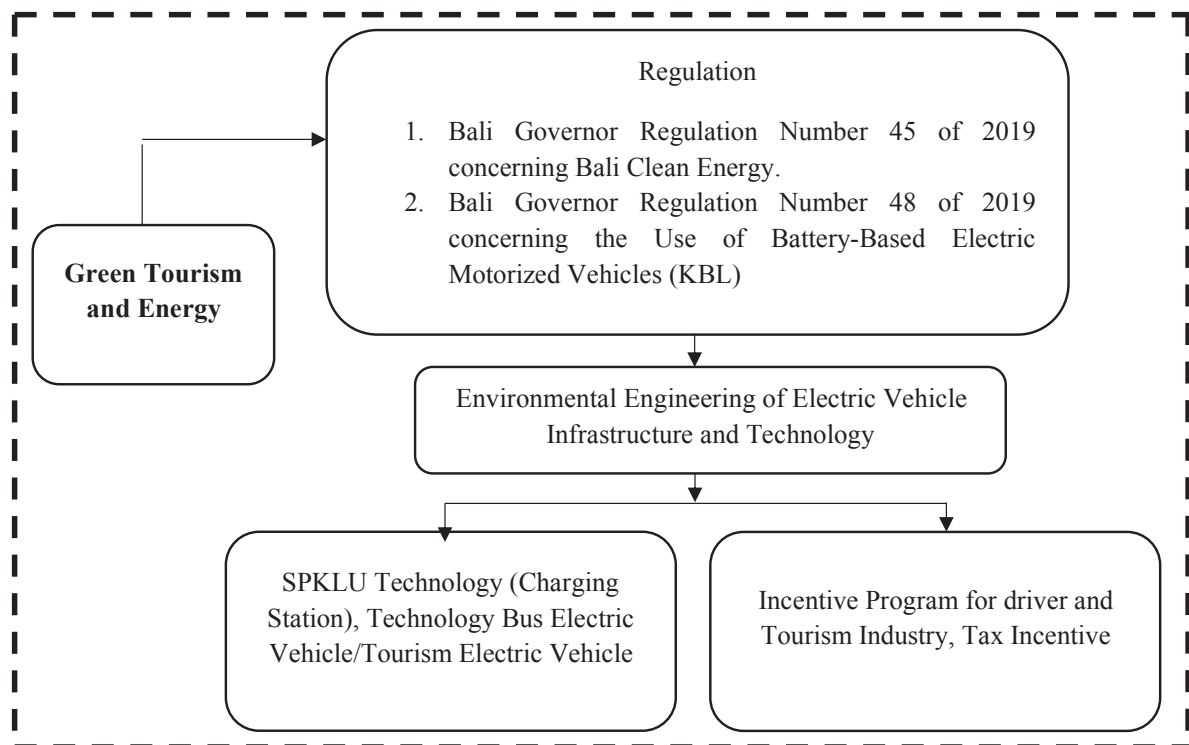


Figure 1 Green Tourism and Energy Implementation Scheme (Yuhuan Sun, 2022)

infrastructure and technology to support green tourism and green energy.

B. Methods

This research activity was carried out by the authors using literacy study, data collection techniques and data sources with secondary data types. The discussion in this study can be described qualitatively based on the results of data processing that has been collected previously. Figure 2 shows a schematic of the research methodology.

The literature review method enables researchers to implement rigorous and reliable analysis of scientific sources (Hulland & Houston, 2020; Paul et al., 2021). Several scientific review methods exist as literature-based reviews (Paul & Feliciano-Cestero, 2021), using a framework as a methodology (Xie et al., 2017), theory-based (Xie et al., 2017), reviews aimed at theory development (Paul & Mas, 2020), hybrid types (Dabić et al., 2020), and bibliometric analysis (Ruggeri

et al., 2019). Considering the research gap, the authors consider that the analysis was carried out by means of a literature review.

C. Results and Discussion

The Governor of Bali Regulation Number 45 of 2019 concerning Bali Clean Energy and the Governor of Bali Province Regulation Number 48 of 2019 concerning the Use of Battery-Based Electric Motorized Vehicles (KBL) have a big goal of maintaining the sustainability of tourism, but has not explicitly stated the obligation for tourism transportation business managers to make the switch to electric vehicles, but the provincial government of Bali has implemented several outputs of the regulation, namely PT. PLN (Persero) through PLN UID Bali built 60 units of SPKLU Fast Charging located in the ITDC Nusa Dua tourism area besides aiming to support the operation of delegation vehicles in the G-20 Summit (KTT). The SPKLU has a power of 200 kW and only takes 30

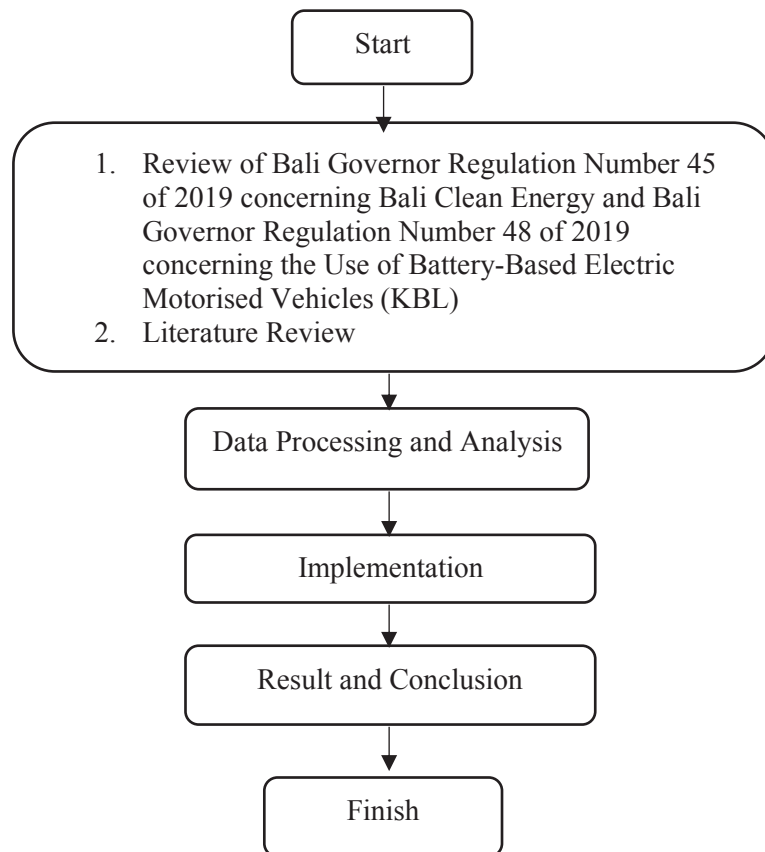


Figure 2 Research Block Diagram

minutes to charge 1 vehicle and interestingly, the SPKLU already has a renewable energy certificate. Apart from these places, SPKLU is also available in several other places, such as at the PLN ULP Denpasar office, Jalan Hayam Wuruk Denpasar and in the Bali Mandara Toll area.

The location is shown in Figure 4, with purple ultra fast charging, yellow fast charging and blue standard charging.

For future technology development, solar energy-based SPKLU can be developed, especially in coastal areas. Currently, to support green tourism and energy, the Blue Bird taxi company has operated an electricity-based taxi at Ngurah Rai International Airport.

The use of electric buses to support the National Tourism Strategic Area (KSPN) has been implemented. The electric bus serves five tourism routes as follows:

1 Route 1: I Gusti Ngurah Rai Airport-

- Central Park Kuta-Ubung-Mengwi-Bedugul-Singaraja
- 2 Route 2: I Gusti Ngurah Rai Airport-Sanur-Ubud-Kintamani-Singaraja
- 3 Route 3: Singaraja-Menjangan-West Bali National Park
- 4 Route 4: I Gusti Ngurah Rai Airport-Goa Lawah-Padangbai-Manggis-Amuk-Amed
- 5 Route 5: I Gusti Ngurah Rai Airport-Sanur-Klungkung-Besakih.

Unlike buses or other public transportation, this bus only stops at certain points and does not pick up and drop passengers other than at the places provided. to improve the affordability of tourists to the trolleybus route the provincial government of Bali needs to provide feeder to connect areas that are not reached by the main transport with larger transport routes or networks. Some of the main functions of feeders as feeder transport are: 1)

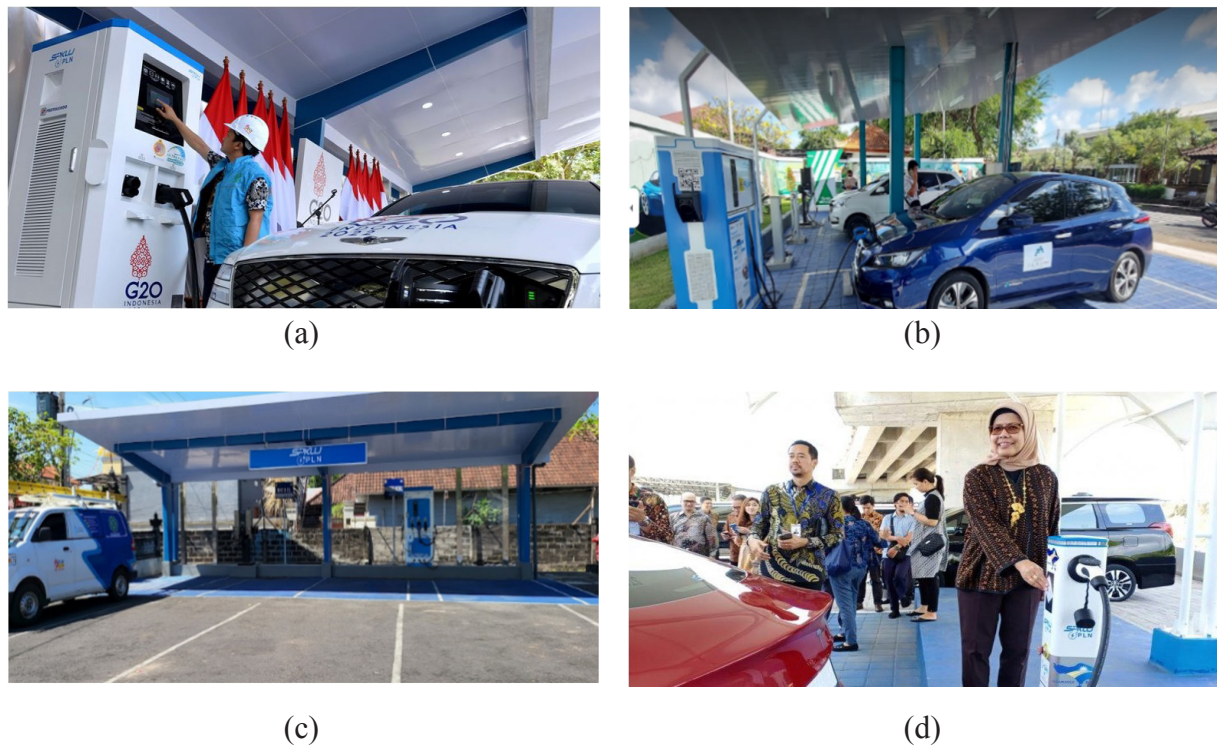


Figure 3 (a), (b), (c), (d). SPKLU in Bali

The current number of SPKLUs in several regencies of Bali Province is shown in Table 1.

No	Regency	Number of SPKLU
1	Buleleng	43
2	Denpasar	30
3	Badung	8
4	Klungkung	10
5	Gianyar	1
6	Jembrana	12
7	Karangasem	1
8	Tabanan	1

Source: Bali Provincial Transport Department (2024)

Extending Transport Reach: Connecting areas of tourism, 2) Improving Mobility: Provides better transport access to remote tourism areas and 3) Time and Cost Efficiency: Allows tourists to more easily change modes of transport without the need for a private vehicle. Adding of electric bus routes in the National Tourism Strategic Area (KSPN) in Bali is necessary to support sustainability and reduce air pollution. This will help reduce carbon emissions and support the Net Zero Emission

program in the transportation sector. Electric buses will also help maintain better air quality in crowded tourism areas, enhance the tourists' experience, and reduce dependence on fossil fuel vehicles. Thus, this initiative is aligned with Bali's vision as a green and sustainable tourism destination. Alternative additions to e-bus routes in the National Strategic Tourism Area (KSPN) in Bali Province may include several strategies: 1) Integrated Tourism Routes: Add e-bus routes that connect major

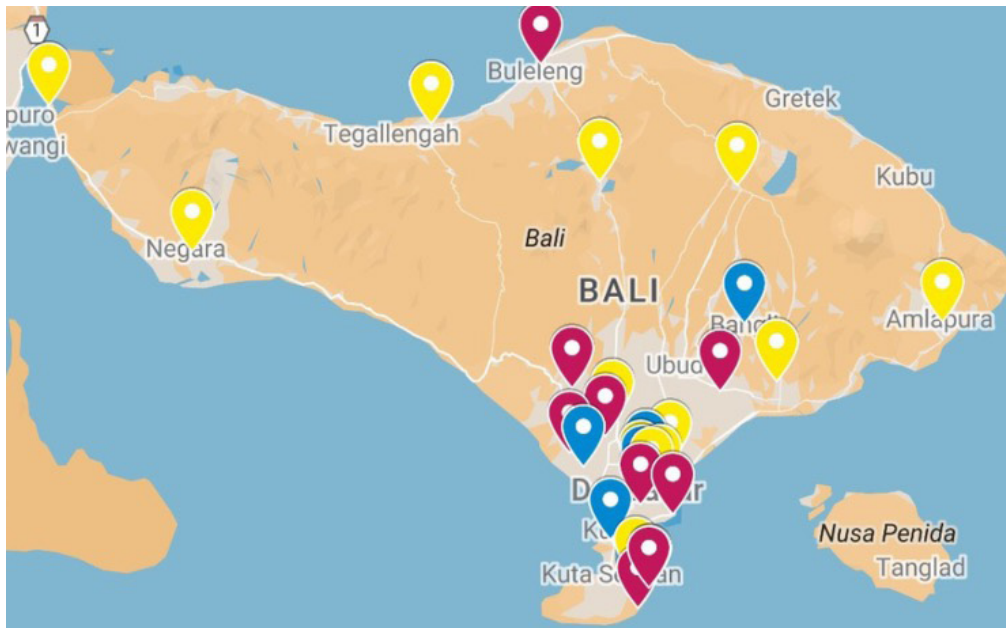


Figure 4 Map of SPKLU Location Points

tourist destinations, such as Ubud, Kuta, Nusa Dua, and Tanah Lot, 2) Airport Connecting Routes: Integrate e-bus with quick access to Ngurah Rai Airport and tourism areas, 3) Urban Routes: Improving connectivity within key cities such as Denpasar and Gianyar with sustainable and eco-friendly routes, 4) Circular Bali Route: Provides e-bus that cover the entire length of Bali, connecting tourist villages with famous destinations. Currently in Bali, many tourists rent motorbikes to make mobilisation

easier, the Bali provincial government can collaborate with rental owners, one of which provides special incentives for ownership of electric motorbikes and requires every rental entrepreneur to rent out electric motorbikes. Based on the data from Bali Department of Manpower and Energy and Mineral Resources (ESDM) (Saputra, 2022), there have been 1,064 electric vehicles, both motorcycles and electric cars. The procurement of electric vehicles is carried out by SOEs, private



Figure 5 Inauguration of the Use of Electric Taxi at Ngurah Rai International Airport



Figure 6 Use of Electric Buses at KPSN in Bali Province

companies to individual ownership (Ewelina & Grysa, 2021; Nur & Kurniawan, 2021; Wellings et al., 2021). Based on data from the Bali Provincial Transportation Department as of the second quarter of 2024, there are currently 7360 units of electric vehicles, consisting of 1) three-wheeled cars 61 units, 2) mini buses 919 units, 3) motorbikes 6365 units, and 4) sedans 15 units. Most electric vehicles are still in the centre of Denpasar City and Badung Regency, but there are still very few to support transportation in tourism areas. Tourism actors themselves are still very minimal to use electric vehicles, this happens due to many factors including, the expensive price of electric vehicles, the mileage that is minimal and the absence of incentives provided by the local government.

However, we can see that there has been seriousness from the local government as the holder of regulations related to environmental engineering for electric vehicles in terms of infrastructure and technology. Environmental Engineering of Electric Vehicle Infrastructure and Technology that can be currently carried out is in accordance with the concept given by the author above, namely the main infrastructure that must be prepared is the availability of SPKLU at strategic points of tourism areas and by implementing solar energy-based SPKLU and providing Incentive Programmes for drivers and Tourism Industry, Tax Incentive,

and other incentives. The limitation of this research is to discuss the implementation and provide recommendations for the acceleration of Bali Governor Regulation Number 45 of 2019 concerning Bali Clean Energy and Bali Governor Regulation Number 48 of 2019 concerning the Use of Battery-Based Electric Motorised Vehicles (KBL) in supporting the achievement of green tourism and green energy.

D. Conclusion

Bali Governor Regulation Number 45 of 2019 concerning Bali Clean Energy and Bali Provincial Governor Regulation Number 48 of 2019 concerning the Use of Battery-Based Electric Motorized Vehicles (KBL) as the umbrella for implementing green tourism and energy are the right things to maintain the sustainability of Bali tourism which relies more on tourism, nature, culture and customs. The implementation of the regulation has had results but has not had too significant an impact, because it only focuses on tourism areas in Denpasar City and Badung Regency, the main infrastructure in supporting electric vehicles is the availability of SPKLU in tourism areas, the use of electric buses can now be more expanded and routes can be further expanded, so as to increase the interest of tourists to use the service.

The provision of incentives has been regulated in the regulation, but it would be better if it is regulated in more detail for business entities/companies/individuals that are specifically engaged in the transportation sector so that tourism actors can make the transition from changing the use of fossil fuel vehicles to electricity and targeting when this can be made can be realized. Suggestions for further research are how much of a reduction in exhaust emissions and air pollution by the operation of electric buses and electric taxis in tourism areas and what tourism actors want so that the acceleration of the use of electric vehicles to support green tourism and energy could be achieved more quickly.

E. References

- Al-Saud, K. M., Alali, R., Abouelela, A. S., & Al Saud, A. M. (2024). Exploring the Feasibility for Utilizing Recycled Palm Waste in Decorative Design Applications as Enhancements for Tourist Destinations: A Step toward Environmental Sustainability. *Sustainability*, 16(3), 1–28. <https://doi.org/10.3390/su16031003>
- Arifin, S., Firdaus S. A., A. H., & Putri, A. R. E. (2022). Integrated Solar Energy Application System Development to Catalyze Public Participation Towards Bali Clean Energy Through Crowd-Based Business Models. *Indonesian Journal of Energy*, 5(2), 114–130. <https://doi.org/10.33116/ije.v5i2.151>
- Beckena, S., Simmons, D. G., & Frampton, C. (2003). Energy use Associated with Different Travel Choices. *Tourism Management*, 24(3), 267–277. [https://doi.org/10.1016/S0261-5177\(02\)00066-3](https://doi.org/10.1016/S0261-5177(02)00066-3)
- Bose, A., Basak, D., Roy, S., Chowdhury, I. R., Abdo, H. G., Aldagheiri, M., & Almohamad, H. (2023). Evaluation of Urban Sustainability through Perceived Importance, Performance, Satisfaction and Loyalty: An Integrated IPA–SEM-Based Modelling Approach. *Sustainability*, 15(12), 1–22. <https://doi.org/10.3390/su15129788>
- Boutabba, M. A., & Ahmad, N. (2017). On the Economic Determinants of Biofuel Consumption: An Empirical Analysis for OECD Countries. *International Journal of Global Energy Issues*, 40(6), 400–418. <https://doi.org/10.1504/IJGEI.2017.089612>
- Clavé, S. A. (2018). Urban Tourism and Walkability. In E. Fayos-Solà & C. Cooper (Eds.), *The Future of Tourism* (pp. 195–211). New York: Springer, Cham. <https://doi.org/10.1007/978-3-319-89941-1>
- Dabić, M., Vlačić, B., Paul, J., Dana, L. P., Sahasranamam, S., & Glinka, B. (2020). Immigrant Entrepreneurship: A Review and Research Agenda. *Journal of Business Research*, 113, 25–38. <https://doi.org/10.1016/j.jbusres.2020.03.013>
- Ewelina, S. M., & Grysa, K. (2021). Assessment of the Total Cost of Ownership of Electric Vehicles in Poland. *Energies*, 14(16), 1–20. <https://doi.org/10.3390/en14164806>
- Hulland, J., & Houston, M. B. (2020). Why Systematic Review Papers and Meta-Analyses Matter: An Introduction to the Special Issue on Generalizations in Marketing. *Journal of the Academy of Marketing Science*, 48, 351–359. <https://doi.org/10.1007/s11747-020-00721-7>
- IQAir. (2020). *World's Most Polluted Countries & Regions*. IQAir. <https://www.iqair.com/world-most-polluted-countries>
- Katircioglu, S. T., Feridun, M., & Kilinc, C. (2014). Estimating Tourism-Induced Energy Consumption and CO2 Emissions: The Case of Cyprus. *Renewable and Sustainable Energy Reviews*, 29, 634–640. <https://doi.org/10.1016/j.rser.2013.09.004>
- Koens, K., Postma, A., & Papp, B. (2018). Is Overtourism Overused? Understanding

- the Impact of Tourism in a City Context. *Sustainability (Switzerland)*, 10(12), 1–15. <https://doi.org/10.3390/su10124384>
- Lee, J. W., & Brahmasrene, T. (2013). Investigating the Influence of Tourism on Economic Growth and Carbon Emissions: Evidence from Panel Analysis of the European Union. *Tourism Management*, 38, 69–76. <https://doi.org/10.1016/j.tourman.2013.02.016>
- Mihardja, E. J., Alisjahbana, S., Agustini, P. M., Sari, D. A. P., & Pardede, T. S. (2023). Forest Wellness Tourism Destination Branding for Supporting Disaster Mitigation: A Case of Batur UNESCO Global Geopark, Bali. *International Journal of Geoheritage and Parks*, 11(1), 169–181. <https://doi.org/10.1016/j.ijgeop.2023.01.003>
- Mousazadeh, H., Ghorbani, A., Azadi, H., Almani, F. A., Zangiabadi, A., Zhu, K., & Dávid, L. D. (2023). Developing Sustainable Behaviors for Underground Heritage Tourism Management: The Case of Persian Qanats, a UNESCO World Heritage Property. *Land*, 12(4), 1–17. <https://doi.org/10.3390/land12040808>
- Nur, A. I., & Kurniawan, A. D. (2021). Proyeksi Masa Depan Kendaraan Listrik di Indonesia: Analisis Perspektif Regulasi dan Pengendalian Dampak Perubahan Iklim yang Berkelanjutan. *Jurnal Hukum Lingkungan Indonesia*, 7(2), 197–220. <https://doi.org/10.38011/jhli.v7i2.260>
- Paul, J., & Feliciano-Cestero, M. M. (2021). Five Decades of Research on Foreign Direct Investment by MNEs: An Overview and Research Agenda. *Journal of Business Research*, 124, 800–812. <https://doi.org/10.1016/j.jbusres.2020.04.017>
- Paul, J., Lim, W. M., O’Cass, A., Hao, A. W., & Bresciani, S. (2021). Scientific Procedures and Rationales for Systematic Literature Reviews (SPAR-4-SLR). *International Journal of Consumer Studies*, 45(4), 1–16. <https://doi.org/10.1111/ijcs.12695>
- Paul, J., & Mas, E. (2020). Toward a 7-P Framework for International Marketing. *Journal of Strategic Marketing*, 28(8), 681–701. <https://doi.org/10.1080/0965254X.2019.1569111>
- Ramkissoo, H., Smith, L. D. G., & Weiler, B. (2013). Testing the Dimensionality of Place Attachment and its Relationships with Place Satisfaction and Pro-Environmental Behaviours: A Structural Equation Modelling Approach. *Tourism Management*, 36, 552–566. <https://doi.org/10.1016/j.tourman.2012.09.003>
- Romão, J., & Bi, Y. (2021). Determinants of Collective Transport Mode Choice and its Impacts on Trip Satisfaction in Urban Tourism. *Journal of Transport Geography*, 94, 1–9. <https://doi.org/10.1016/j.jtrangeo.2021.103094>
- Ruggeri, G., Orsi, L., & Corsi, S. (2019). A Bibliometric Analysis of the Scientific Literature on Fairtrade Labelling. *International Journal of Consumer Studies*, 43(2), 134–152. <https://doi.org/10.1111/ijcs.12492>
- Saputra, H. N. (2022). Jumlah Kendaraan Listrik di Bali Tumbuh Signifikan. *Bisnis.Com*. <https://bali.bisnis.com/read/20220913/537/1577124/jumlah-kendaraan-listrik-di-bali-tumbuh-signifikan>
- Tang, C., Zhong, L., & Ng, P. (2017). Factors that Influence the Tourism Industry’s Carbon Emissions: a Tourism Area Life Cycle Model Perspective. *Energy Policy*, 109, 704–718. <https://doi.org/10.1016/j.enpol.2017.07.050>
- Voelcker, J. (2008). Spectral Lines: An Almost All-Electric Car? *IEEE Spectrum*, 45(4), 9–9. <https://doi.org/10.1109/MSPEC.2008.4476427>
- Wellings, J., Greenwood, D., & Coles, S. R. (2021). Understanding the Future Impacts of Electric Vehicles—An Analysis of Multiple Factors That

- Influence the Market. *Vehicles*, 3(4), 851–871. <https://doi.org/10.3390/vehicles3040051>
- Xie, E., Reddy, K. S., & Liang, J. (2017). Country-Specific Determinants of Cross-Border Mergers and Acquisitions: A Comprehensive Review and Future Research Directions. *Journal of World Business*, 52(2), 127–183. <https://doi.org/10.1016/j.jwb.2016.12.005>
- Yahya, H. (2021). *Banyaknya Kendaraan Menurut Kabupaten/Kota di Provinsi Bali (Unit), 2018-2021*. Badan Pusat Statistik Provinsi Bali. <https://bali.bps.go.id/indicator/17/248/2/banyaknya-kendaraan-menurut-kabupaten-kota-di-provinsi-bali.html>
- Yuniza, M. E., Pratama, I. W. B. E., & Ramadhaniati, R. C. (2021). Indonesia's Incentive Policies on Electric Vehicles: The Questionable Effort from the Government. *International Journal of Energy Economics and Policy*, 11(5), 434–440. <https://doi.org/10.32479/ijeep.11453>
- Sun, Y., Ding, W., & Yang, G. (2022). Green innovation efficiency of China's tourism industry from the perspective of shared inputs: Dynamic evolution and combination improvement paths. *Ecological Indicators* 138 (2022) 108824. journal homepage: www.elsevier.com/locate/ecolind
- Zhang, L., & Gao, J. (2016). Exploring the Effects of International Tourism on China's Economic Growth, Energy Consumption and Environmental Pollution: Evidence from a Regional Panel Analysis. *Renewable and Sustainable Energy Reviews*, 53, 225–234. <https://doi.org/10.1016/j.rser.2015.08.040>

