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University's Efforts In Addressing Climate Change Challenges : A Case at Raden Intan State Islamic University

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Abstract. Addressing climate change has become a top priority for universities worldwide. This paper examines Raden Intan State Islamic University's initiatives to confront climate change through its Eco-Campus program. In Indonesia, a country highly vulnerable to climate change, UIN Raden Intan Lampung recognizes its responsibility in promoting sustainability and reducing environmental impacts. Using a qualitative approach, this case study explores the university's comprehensive strategies, which include institutional policies and grassroots efforts. The campus focuses on reducing carbon emissions, adopting renewable energy, and enhancing climate resilience. Key initiatives include maintaining large green spaces that lower temperatures and absorb carbon dioxide, using energy-saving devices like LED lights, and installing solar panels to minimize the carbon footprint. In waste management, the university turns organic waste into compost and repurposes food waste to feed larvae, which are then processed into animal feed. Water conservation efforts are supported by artificial ponds, ensuring a reliable water supply and maintaining greenery during dry seasons. The university also promotes sustainable transportation by encouraging bicycle use and limiting vehicle parking to reduce emissions. Overall, UIN Raden Intan Lampung exemplifies how a university can integrate sustainability into campus life, serving as a model for climate change mitigation efforts.

Keyword:

Alternative energy sources, Climate adaptability, Eco-friendly university, Environment, Global warming

1. Introduction

Addressing climate change challenges has emerged as a pivotal priority for universities globally, reflecting an increasing recognition of their role in fostering socioecological transformation. The urgency to respond to the Climate Change Emergency (CEE) has catalyzed calls for structural transformations in university research, teaching, and service, as highlighted by Filho et al. (Filho et al., 2021). Universities are uniquely positioned to influence societal

change through education and research, making them key players in combating climate change and its multifaceted impacts. The integration of climate change education into university curricula has gained momentum, emphasizing the need for innovative pedagogical approaches that enhance accessibility and engagement within the higher education sector (Molthan-Hill et al., 2019). The literature indicates that effective climate change education is vital for preparing future leaders who can navigate the complexities of environmental challenges. For instance, Molthan-Hill et al. argue that universities must design innovative curricular and extracurricular strategies to incorporate climate change education effectively (Molthan-Hill et al., 2019). This sentiment is echoed by Khalo, who emphasizes that climate change education can significantly mitigate the threats posed by rising global temperatures (Khalo, 2023). However, barriers persist that hinder the effective handling of climate change issues within higher education institutions. These barriers include institutional inertia, lack of resources, and insufficient integration of climate-related topics into existing curricula (Filho et al., 2021). Filho et al. provide an overview of the challenges and opportunities associated with climate change education at universities, suggesting that a comprehensive understanding of these barriers is essential for implementing strategic actions to overcome them (Filho et al., 2021). They highlight the importance of risk communication and knowledge enhancement regarding adaptation strategies as critical components for improving institutional responses to climate threats (Filho et al., 2021). Furthermore, Kautto et al. emphasize that when climate change education and practice are closely aligned, students can acquire relevant knowledge and apply it effectively, thereby fostering a culture of sustainability within academic institutions (Kautto et al., 2018).

The 2015 Paris Agreement highlights the importance of intellectual property, technology transfer, and innovation policy in addressing climate change. Rimmer (2019) emphasizes that these elements are crucial for ensuring climate justice and equitable access to climate technologies, particularly for developing nations. This reinforces the vital role universities play in researching and facilitating technology transfer, bridging the gap between research and real-world applications. Universities are also key in adopting interdisciplinary approaches to tackle the complex challenges of climate change. Bowen et al. stress the need to integrate social sciences into climate strategies, though their specific work isn't cited here. Engaging with local communities and policymakers, universities can enhance their impact on climate mitigation and sustainable development.

In addition to research and teaching, community engagement is essential for universities to contribute to climate initiatives. Mugabi (2015) shows that universities can align their missions with societal needs, especially in addressing climate adaptation through local knowledge. Furthermore, Scott (2023) highlights the importance of climate finance for supporting these initiatives, and universities can attract funding through research and partnerships. Rimmer argues that climate justice requires rethinking intellectual property rights to ensure innovations benefit marginalized communities, necessitating proactive collaboration with stakeholders. Paris Agreement underscores the pivotal role of universities in combating climate change through interdisciplinary research, community partnerships, and equitable technology transfer. By integrating social science insights, universities can contribute to both scientifically sound and socially just climate solutions.

UIN Raden Intan Lampung is highly committed to realizing, promoting, and establishing the Eco-Campus (green campus) program as a flagship initiative, encompassing various aspects such as economic, social, natural, and resource-related elements. This commitment extends to environmental management and various efforts to prevent pollution in the context of climate change mitigation. After all, this article aims to share best practices regarding UIN Raden Intan Lampung's efforts to mitigate climate change.

2. Methodology

The methodology for this qualitative research focuses on an in-depth case study of UIN Raden Intan Lampung's initiatives to address climate change challenges through its Eco-Campus program. This study employs a holistic approach, using observations and document analysis to explore the university's sustainability practices. The research begins with an examination of the university's infrastructure, particularly the use of open spaces, green areas, and eco-friendly facilities, to understand how these physical features contribute to broader climate mitigation efforts.

Energy conservation initiatives are explored through interviews and observational data, focusing on the implementation of energy-efficient appliances, smart power management systems, and the integration of solar panels on campus. This allows for a deeper understanding of how these technologies are influencing the university's energy consumption patterns and environmental sustainability.

Waste management practices are analyzed through interviews with campus staff and document reviews, focusing on the processes used to transform organic waste into compost and the innovative use of food waste for maggot farming. These practices are explored in the context of their contribution to sustainability and the circular economy, emphasizing the social and ecological impacts of these initiatives.

Water conservation strategies are also examined through observational data, with a focus on the construction and use of artificial ponds. These ponds are assessed for their role in supporting campus vegetation, promoting biodiversity, and mitigating the effects of drought, providing a qualitative understanding of the university's approach to water management in the face of climate change.

Lastly, transportation initiatives are explored through interviews with students and staff to assess the impact of policies such as car-free days, the promotion of bicycle use, and restricted access for online taxis. These discussions offer insights into how the university's transportation policies contribute to reducing the campus's carbon footprint and fostering a culture of sustainability. Through this qualitative approach, the research provides a nuanced understanding of how UIN Raden Intan Lampung is addressing climate change through its sustainability initiatives, with a focus on the lived experiences of the campus community and the ecological outcomes of these efforts.

3. Points of Results and Discussion

3.1. Setting and Infrastructure

The main campus of UIN Raden Intan Lampung spans a vast area of 45 hectares, providing ample space for academic buildings, green areas, and student facilities. The postgraduate campus, although smaller at 5 hectares, is dedicated to advanced studies and

research, offering a focused environment for postgraduate students. Students' dormitories are conveniently located just 1.5 kilometers from the main campus, ensuring easy access to campus facilities while also fostering a sense of community among the students.

UIN Raden Intan Lampung located in the suburban area of Sukarame, Bandar Lampung, the capital city of Lampung Province. This strategic location provides a blend of urban amenities and a serene atmosphere, ideal for academic pursuits. The campus is surrounded by community housing and expansive green open spaces, contributing to a peaceful and conducive learning environment.

(a) (b)

Figure 1. (a.) Main Campus (b.) Postgraduate Campus

The natural environment surrounding UIN Raden Intan Lampung is characterized by its rich greenery, which significantly enhances both the aesthetic appeal of the campus and its ecological sustainability. The presence of extensive green areas contributes to a serene and refreshing atmosphere, conducive to academic pursuits and extracurricular activities. This aligns with the broader objectives of promoting sustainable practices within Islamic higher education institutions, as highlighted by Hasanah, who emphasizes the importance of integrating sustainable development goals into the university's framework (Hasanah, 2024). The lush vegetation not only beautifies the campus but also plays a crucial role in fostering an environment that supports learning and community engagement. Moreover, the concept of a "Green Campus" is increasingly recognized as vital for enhancing academic performance and student well-being. Research by Atıcı et al. indicates that universities with robust green initiatives tend to perform better academically, as these initiatives create a more inviting and stimulating learning environment (Atıcı et al., 2021). This is further supported by the findings of Fatriansyah et al., who discuss the design principles of green campuses and their impact on creating environmentally friendly and sustainable educational spaces (Fatriansyah et al., 2021). The integration of green spaces within the campus serves ecological purposes and enhances the overall educational experience by providing students with a tranquil setting for study and reflection. Additionally, the commitment of UIN Raden Intan Lampung to eco-campus management is evident in its strategic initiatives aimed at promoting environmental awareness and sustainability among students and staff. According to Yetri, the university is dedicated to fostering a culture of environmental stewardship, which is essential in addressing contemporary challenges such as pollution and environmental degradation (Yetri, 2024). This commitment is crucial for cultivating a generation of students who are not only academically proficient but also environmentally conscious, thereby contributing to the broader goals of sustainable development. In conclusion, the natural environment at UIN Raden Intan Lampung, characterized by its greenery, plays a pivotal role in enhancing the

campus's aesthetic and ecological sustainability. The integration of green spaces is not merely an aesthetic choice but a strategic initiative that supports academic performance and fosters a culture of environmental responsibility among students.

The campus has a remarkable open space ratio of 81.72%, which plays a crucial role in addressing climate change issues. This extensive open space helps mitigate the urban heat island effect by reducing surface temperatures, which in turn lowers the demand for energy-intensive air conditioning. The abundant greenery acts as a carbon sink, absorbing carbon dioxide and releasing oxygen, thereby contributing to the reduction of greenhouse gases in the atmosphere. Furthermore, these open green spaces enhance biodiversity by providing habitats for various plant and animal species, promoting a balanced ecosystem. The large proportion of open space also improves water management on campus, allowing for better absorption of rainwater and reducing the risk of flooding, which is increasingly important in the face of unpredictable weather patterns due to climate change.

Figure 2. A picturesque Scenery of Main Campus

By maintaining such a high ratio of open space, UIN Raden Intan Lampung not only creates a pleasant and healthy environment for its community but also actively contributes to broader climate change mitigation efforts. This commitment to ecological sustainability demonstrates the university's leadership in integrating environmental considerations into campus planning and operations, setting a positive example for other institutions to follow.

3.2. Energy Issues

In terms of energy-saving management, UIN Raden Intan Lampung utilizes energy-efficient appliances throughout the campus. This includes the installation of LED lighting, which consumes significantly less electricity compared to traditional incandescent bulbs, and the use of energy-efficient HVAC systems that optimize heating and cooling while minimizing energy waste. Additionally, the university has implemented smart power management systems to ensure that electrical devices are only in use when necessary, further reducing energy consumption. These initiatives not only lower the university's carbon footprint but also result in significant cost savings, which can be redirected to other important academic and sustainability projects.

Table 1. The number of energy efficient equipment compared to the total electrical equipment

Appliances	Total Number	Total number energy Efficient appliances	Percentage
LED Lamp	51,050	46,624	91%
Fan	210	210	100%
LED TV	120	94	78.33%

The integration of solar energy systems at the Safinatul Ulum Mosque represents a significant advancement in the utilization of renewable energy sources within the community. The mosque's solar panels, installed on its rooftops, as well as on the student dormitory and surrounding streetlights, collectively generate a total of 27,860 kWh annually. This initiative not only addresses the mosque's energy needs but also contributes to reducing the carbon footprint associated with traditional energy sources. The implementation of solar energy systems aligns with global trends emphasizing the importance of renewable energy in mitigating climate change and promoting sustainable practices (Yekinni et al., 2023). The strategic placement of solar panels on various structures within the mosque's campus illustrates a comprehensive approach to harnessing solar energy. The dormitory's recent enhancement, which includes the installation of additional panels expected to produce an extra 9,000 kWh, exemplifies a commitment to increasing energy self-sufficiency. This expansion not only bolsters the dormitory's reliance on clean energy but also serves as a model for other institutions aiming to adopt similar eco-friendly practices. The integration of solar photovoltaic (PV) systems is particularly relevant in Indonesia, where solar energy is recognized as one of the most abundant and reliable renewable energy sources (Larasati et al., 2020). Moreover, the mosque's initiative reflects broader environmental governance trends that advocate for the adoption of green technologies and sustainable practices. The concept of Eco-Pesantren, which emphasizes environmental education and the integration of renewable energy within Islamic boarding schools, further supports the mosque's efforts. By promoting eco-friendly practices, the mosque not only addresses its energy needs but also fosters a culture of sustainability within the community (Maulida, 2024). This aligns with the findings of Ganda, who discusses the relationship between environmental governance and renewable energy adoption, particularly in developing regions (Ganda, 2024).

The mosque's solar energy initiative also contributes to the global discourse on sustainable development. As highlighted by Behera, the integration of green technologies and effective waste management is essential for promoting sustainability (Behera, 2023). The mosque's commitment to renewable energy serves as a practical example of how local institutions can contribute to global sustainability goals. By reducing reliance on conventional energy sources, the mosque plays a role in the broader movement towards a low-carbon economy, which is increasingly recognized as vital for addressing climate change (Khan et al., 2021). Furthermore, the mosque's solar energy systems exemplify the potential for renewable energy to enhance energy security and reduce vulnerability to energy price fluctuations. As fossil fuel resources become scarcer and more expensive, the transition to renewable energy sources like solar power becomes increasingly critical. The mosque's initiative not only secures its energy supply but also sets a precedent for other institutions to

follow suit, thereby amplifying the impact of renewable energy adoption within the community (Yekinni et al., 2023). The educational aspect of the mosque's initiative cannot be overlooked. By integrating renewable energy systems into its infrastructure, the mosque serves as a living laboratory for students and community members to learn about the benefits and applications of solar energy. This educational component is crucial for fostering a new generation of environmentally conscious individuals who are equipped to tackle the challenges posed by climate change and energy sustainability (Maulida, 2024). The mosque's efforts in promoting eco-friendly practices resonate with the broader goals of environmental education and community engagement, which are essential for achieving long-term sustainability (Behera, 2023). In conclusion, the solar energy initiative at the Safinatul Ulum Mosque is a multifaceted approach to addressing energy needs while promoting sustainability and environmental stewardship. By generating significant amounts of renewable energy, reducing carbon emissions, and fostering a culture of eco-friendliness, the mosque sets a powerful example for other institutions. The integration of solar energy systems not only enhances energy self-sufficiency but also contributes to the global movement towards sustainable development, making it a noteworthy case study in the realm of renewable energy adoption (Ganda, 2024).

3.3. Waste Management

At UIN Raden Intan Lampung, the management of organic waste, particularly foliage and twigs, is a significant component of the university's sustainability initiatives. The meticulous collection and processing of this organic waste into compost not only contribute to the nourishment of campus plants but also play a crucial role in reducing landfill waste. This practice aligns with global efforts to mitigate climate change by minimizing methane emissions, a potent greenhouse gas released during the decomposition of organic matter in landfills (Khairunnisa, 2023; Supinganto et al., 2022). The conversion of organic waste into compost is supported by various studies that highlight the importance of community involvement and awareness in effective waste management practices (Rahayu, 2023; Supinganto et al., 2022; Fadhullah et al., 2022). Moreover, the university has implemented an innovative food waste management system, which includes the collection of food waste from the student canteen and other campus units. This waste is transported to a facility known as the Maggot House, where it serves as a nutrient-rich food source for black soldier fly larvae (Hermetia illucens). This bioconversion process not only diverts organic waste from landfills but also enhances the sustainability of the campus by producing valuable compost (Jalil et al., 2021; Ibadurrohman et al., 2020). Research indicates that the use of black soldier fly larvae in organic waste management is effective in reducing waste volume and improving nutrient recovery, thus contributing to a more sustainable waste management system (Jalil et al., 2021; Matheka et al., 2022; Ibadurrohman et al., 2020).

The university's approach to organic waste management reflects a broader trend in Indonesia, where community empowerment and education are vital for enhancing public participation in waste management initiatives. Studies have shown that raising awareness about the benefits of composting and organic waste recycling can significantly improve community engagement and reduce waste generation (Khairunnisa, 2023; Rahayu, 2023; Supinganto et al., 2022). Furthermore, the integration of innovative waste management practices, such as the use of larvae for waste processing, exemplifies the potential for sustainable solutions that address both environmental and educational goals (Jalil et al., 2021; Ibadurrohman et al., 2020). In conclusion, UIN Raden Intan Lampung's initiatives in organic

waste management not only contribute to a greener campus but also align with global sustainability efforts. By effectively managing organic waste through composting and innovative bioconversion techniques, the university demonstrates a commitment to reducing greenhouse gas emissions and fostering a culture of sustainability among its community members.

UIN Raden Intan Lampung is making significant strides in sustainable waste management, addressing climate change through innovative solutions. The university generates a substantial 578,073 tons of organic waste annually, which includes 144 tons of food waste and 240 tons of leaves. The majority of this food waste originates from the cafeteria, comprising leftover rice, food scraps, and chicken or fish bones. Rather than contributing to landfill mass, this waste is repurposed as feed for maggots, which are raised in the green corner of the campus. This practice not only reduces waste but also supports sustainable animal feed production. Furthermore, the institution addresses another significant waste stream: branch waste. Each year, 194,073 tons of branch waste are processed and transformed into briquettes. These briquettes serve as an alternative fuel source, potentially reducing the reliance on fossil fuels and lowering greenhouse gas emissions.

This method not only helps manage waste more efficiently but also significantly reduces greenhouse gas emissions. Organic waste in landfills decomposes anaerobically, producing methane, a potent greenhouse gas that contributes to climate change. By redirecting food waste to the Maggot House, the campus minimizes methane production and transforms waste into a valuable resource. The larvae can be processed into high-quality protein for animal feed, reducing the need for resource-intensive feedstocks and promoting a circular economy. This initiative showcases the campus's commitment to environmental stewardship and its proactive approach to mitigating climate change through sustainable waste management practices.

3.4. Water Management

UIN Raden Intan Lampung has proactively addressed climate change issues by implementing a comprehensive water conservation program. This initiative includes the construction of 11 artificial ponds, collectively covering an area of 22,716 square meters. These ponds serve multiple purposes, significantly enhancing the campus’s sustainability efforts. The primary function of these artificial ponds is to store water, ensuring a reliable supply for the campus's daily needs. This is particularly crucial during the dry season, when water scarcity becomes a pressing issue. By maintaining a consistent water supply, the ponds help to mitigate the adverse effects of droughts, which are becoming more frequent and severe due to climate change.

UIN Raden Intan Lampung has taken significant steps to combat climate change through the implementation of a comprehensive water conservation program, which includes the construction of artificial ponds. These ponds are designed to serve multiple purposes, primarily focusing on water storage to ensure a consistent supply for the campus's daily needs. This initiative is particularly vital during the dry season when water scarcity poses a serious challenge. The presence of these ponds helps to mitigate the adverse effects of droughts, which have been increasingly frequent and severe due to climate change (Neto et al., 2022; Islam et al., 2019). The construction of artificial ponds is a well-documented strategy for enhancing water availability in regions affected by drought. Studies have shown that small reservoirs and artificial ponds can significantly influence the evolution of drought conditions by providing a buffer against water scarcity (Neto et al., 2022; Islam et al., 2019).

The strategic placement of these ponds allows for the collection and storage of rainwater, which can be utilized during periods of low precipitation, thus supporting the campus's sustainability efforts (Santos et al., 2021). Furthermore, the integration of such water conservation measures aligns with broader sustainability initiatives observed in various educational institutions worldwide, which aim to promote responsible water management and environmental stewardship (Zhao & Zou, 2015; Zou et al., 2015; Kostoulas-Makrakis & Makrakis, 2012). Moreover, the benefits of artificial ponds extend beyond mere water storage; they also contribute to biodiversity conservation and ecosystem resilience. Research indicates that these ponds can enhance habitat connectivity and support various aquatic species, thereby playing a crucial role in maintaining ecological balance in modified landscapes (Santos et al., 2021; Briggs et al., 2019). By fostering biodiversity, these artificial ponds not only serve immediate practical needs but also contribute to long-term ecological health, which is essential in the face of ongoing climate challenges (Santos et al., 2021; Briggs et al., 2019).

Figure 3. Artificial Pond for Water Conservation

Additionally, these ponds support the maintenance of campus vegetation, which plays a critical role in reducing the urban heat island effect, sequestering carbon, and maintaining local biodiversity. The ponds also support fish maintenance, contributing to the campus's ecological balance and providing educational opportunities for students and researchers engaged in conservation projects. This water conservation program is a testament to UIN Raden Intan Lampung's commitment to sustainability and climate resilience. By addressing water scarcity and promoting ecological balance, the university not only enhances its own sustainability but also sets an example for other institutions to follow in the fight against climate change (Tzanakakis et al, 2020).

3.5. Transportation Initiative

UIN Raden Intan Lampung has implemented a parking area restriction or reduction program for the past three years (from 2021 to 2023). This program includes car-free days on Fridays, the use of bicycles with dedicated bicycle parking, restricted access for online motorcycle taxis, and a motor vehicle parking system available only for students and university staff. UIN Raden Intan Lampung has implemented a parking area restriction and reduction program from 2021 to 2023. This program includes:

- **Car-Free Fridays**: Encouraging a reduction in vehicle use on Fridays.
- **Bicycle Use**: Promoting the use of bicycles with dedicated bicycle parking areas.
- **Restricted Access for Online Motorcycle Taxis**: Limiting the entry of online motorcycle taxis to reduce congestion.

- **Exclusive Motor Vehicle Parking**: Reserving parking spaces only for students and university staff.

These measures demonstrate the university's commitment to promoting sustainable transportation and reducing its carbon footprint (Handayani, 2024). Carbon footprint as transportation results could be seen on the figure below.

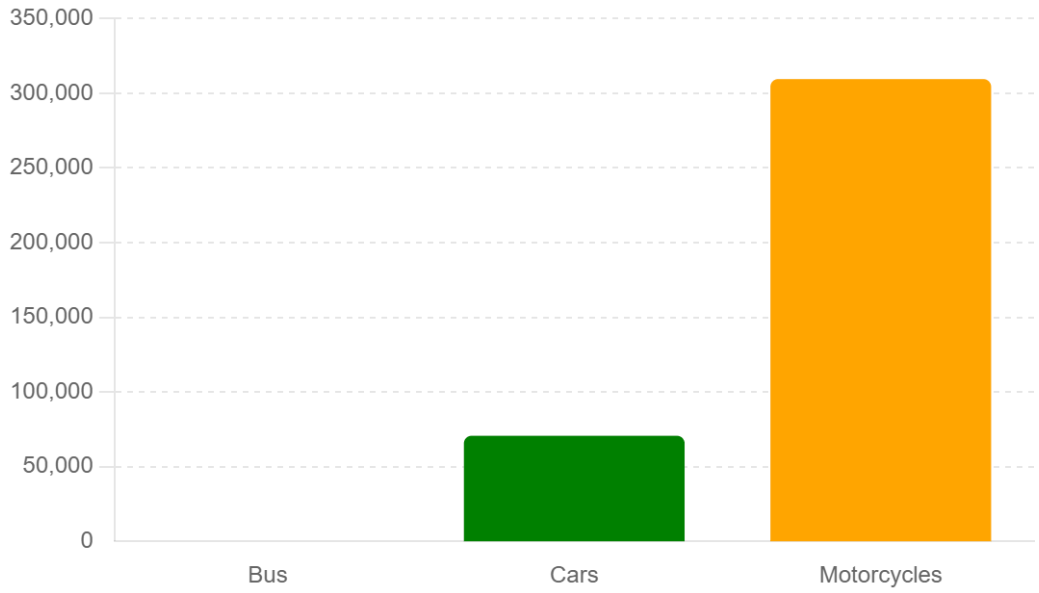

Figure 4. Carbon Footprint by Source at UIN Raden Intan Lampung In 2023

The carbon footprint from cars is significant, amounting to 70,656 metric tons. This reflects the emissions from 368 cars entering the campus, contributing substantially to the overall carbon footprint. While at the same time the highest carbon footprint comes from motorcycles, with a total of 309,504 metric tons. This is due to 3,224 motorcycles entering the campus, making motorcycles the largest contributor among the three sources.

The university has a total parking area of 12,555 square meters, which represents 2.4% of the total campus area. This efficient use of space highlights the university's efforts to manage parking effectively and minimize the environmental impact of vehicle use on campus. UIN Raden Intan Lampung's transportation initiatives reflect a strong commitment to environmental sustainability and climate change mitigation. By reducing reliance on fossil fuels and promoting green transportation, the university sets an example for other institutions and contributes to the global effort to combat climate change (Kashem, 2024). These efforts not only benefit the university community but also support the broader objective of ensuring a healthier and more sustainable planet.

4. Summary

Universities worldwide are prioritizing the response to climate change challenges, recognizing the urgency to integrate climate change education and sustainable practices into their operations. UIN Raden Intan Lampung exemplifies this commitment through its Eco-Campus program, which includes effective management of parking areas and the promotion of sustainable transportation. Initiatives such as car-free Fridays, bicycle use, and restricted access for online motorcycle taxis help reduce the university's carbon footprint. The significant carbon emissions from cars and motorcycles highlight the need for continued

efforts in sustainable transport. Overall, these initiatives demonstrate the university's role in mitigating climate change and promoting a sustainable future.

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