

CHAPTER V

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study concludes that renewable energy consumption in ASEAN countries significantly and simultaneously influences both economic growth and environmental quality, as demonstrated through the application of the Instrumental Variables – Three-Stage Least Squares (IV–3SLS) approach. The results confirm the feedback hypothesis, with statistically significant bidirectional causality between renewable energy consumption and GDP per capita, indicating that renewable energy not only drives economic growth, but also responds to it. In parallel, renewable energy consumption also significantly reduces CO₂ emissions, consistent with the principles of Ecological Modernization Theory (EMT), which views technological advancement as a pathway to environmental improvement. These dual outcomes underscore the viability of sustainable development pathways in which economic advancement and environmental protection are mutually reinforcing. The reliability of these findings is supported by valid and relevant instruments (RE_Capacity_MW, RE_Generation_GWh, and URB), strong model diagnostics, and robust system-wide significance across all estimated equations.

However, other variables show mixed and policy-relevant effects. Foreign Direct Investment (FDI), while contributing to renewable energy uptake, exerts negative impacts on economic growth and positive effects on emissions, highlighting the need for better-targeted green investments. Similarly, Trade Openness fosters renewable adoption but is also linked to higher emissions and reduced GDP per capita, consistent with the Pollution Haven Hypothesis. Internet penetration begins to show developmental promise but reveals sectoral trade-offs that may slow renewable expansion. Taken together, these findings emphasize that while renewable energy is a viable tool for decarbonizing growth in ASEAN, maximizing its potential requires coordinated governance, strategic green investment, and stronger institutional frameworks to mitigate trade-offs and amplify long-term sustainability.

5.2 Recommendations

Drawing from the research results, several recommendations are proposed for both policymakers and academic researchers.

Recommendations for Policymakers

1. Prioritize Renewable Energy as a Catalyst for Economic Growth and Emissions Reduction

This study confirms that renewable energy consumption significantly increases GDP per capita and reduces CO₂ emissions in ASEAN countries. Policymakers should position renewable energy not only as an environmental strategy but also as a key driver of economic growth. To maximize this dual benefit, governments should expand public-private investment in renewable energy technologies, particularly solar, wind, and small-scale off-grid systems, targeting underserved and rural regions. Policy instruments such as targeted subsidies, tax incentives, and green financing mechanisms (e.g., low-interest loans, guarantees) can enhance investment appeal and accelerate deployment. This approach will help boost economic productivity, strengthen energy security, and support long-term sustainable development..

2. Direct Foreign Investment Toward Clean and Productive Sectors

The findings reveal that current FDI inflows have a negative impact on economic growth and a positive impact on CO₂ emissions, indicating that much of the existing investment may be concentrated in extractive or low-productivity, high-emission industries. However, FDI also shows a positive effect on renewable energy consumption, suggesting untapped potential in clean sectors. Therefore, ASEAN governments should introduce stricter environmental screening for FDI and actively incentivize investment in green industries, such as renewable energy generation, clean tech manufacturing, and sustainable infrastructure. Offering tax breaks, fast-track approvals, and stable regulatory frameworks for environmentally sound projects can help shift foreign capital toward supporting long-term, low-carbon growth.

Recommendations for Researchers

1. Disaggregate Renewable Energy by Type for Targeted Insights

This study treats renewable energy as an aggregate variable, which is appropriate for regional system-level analysis. However, future research should consider disaggregating renewable energy by source, such as solar, wind, hydro, or bioenergy to explore whether their impacts on economic growth and CO₂ emissions differ in magnitude or direction. Given that each technology has distinct infrastructure needs, emission profiles, and investment patterns, disaggregation can provide policymakers with more targeted insights for energy planning and prioritization, especially in diverse ASEAN contexts.

2. Build on System-Based Approaches to Capture Long-Term and Nonlinear Dynamics

The use of IV–3SLS in this study successfully addresses simultaneity and endogeneity among GDP, CO₂ emissions, and renewable energy consumption. Future researchers could build upon this by applying complementary approaches such as dynamic panel GMM, nonlinear ARDL, or SVAR models to explore lagged or asymmetric effects. These models may capture how renewable energy impacts evolve over time, or how responses differ during periods of high growth, policy shocks, or environmental stress, insights that are increasingly relevant for energy transition policy under uncertainty.