

DEVELOPMENT AND EMPIRICAL TESTING OF THE QUR'ANIC SUSTAINABLE ENERGY MANAGEMENT MODEL (QSEM): A FRAMEWORK FOR ETHICAL AND SUSTAINABLE ENERGY POLICY

Ajmal Jowhar T.P

(Research Scholar)

Ph.D. (Management)

Registration No.: 229116018928

Dr. Ankita Srivastava

(Associate Professor)

ABSTRACT

The current study presents the development and empirical testing of the Qur'anic Sustainable Energy Management Model (QSEM) as an approach that will help integrate ethical values into sustainable energy management and policy. The current study tries to address the lack of a value-based approach to modern-day energy issues such as rising energy consumption rates, environmental pollution, resource depletion, energy inequality, and inefficient use of resources. The proposed QSEM framework includes five main aspects related to Qur'anic teachings including ethical stewardship, environmental balance, moderate energy consumption, energy justice and social responsibility. The quantitative empirical research was carried out with the help of a structured questionnaire and five-point Likert scale. The current empirical study consisted of 110 participants and used descriptive statistics, reliability analysis, correlation analysis and model validation. The results show high level of agreement with the relevance of Qur'anic values for sustainable energy management. Qur'anic ethical responsibility had the highest mean of 4.21, whereas overall ethical dimension of QSEM framework had the mean of 4.12. Environment stewardship proved to be the variable that showed the highest level of correlation with sustainable energy management ($r = 0.72$, $p < 0.001$) followed by environmental balance ($r = 0.70$) and moderate energy consumption ($r = 0.67$). The results show that the principles of the Qur'an could serve as an ethical base for responsible energy behavior and sustainable energy policy.

Keywords: *Qur'an, Sustainable Energy Management, QSEM, Islamic Environmental Ethics, Energy Policy, Sustainability, Environmental Stewardship, Energy Justice.*

1. INTRODUCTION

Energy constitutes one of the key resources necessary for the development of economies, welfare of societies, advancement of technology and enhancement of the quality of life. Nevertheless, rising energy consumption, reliance on non-renewable resources, degradation of the environment, global warming, energy inequality and inefficient energy consumption have posed great challenges in the field of energy governance today. Consequently, sustainable energy management would require not only technological and economic factors but also ethics that could influence the patterns of production, consumption, conservation and distribution.

The Qur'an contains a comprehensive ethical perspective on the interaction of humans with the natural resources. While it does not offer a contemporary technical view on energy management, the Qur'an sets some principles of responsible governance, moderation, justice, balance, accountability, non-wastefulness and non-environmental corruption. Such principles may be regarded as a potentially valuable ethical basis for the contemporary approaches to sustainable energy management. Some terms of khalifah (stewardship), amanah (trust and responsibility), mizan (balance), adl (justice) and prohibition of israf (wastefulness) might be associated with responsible energy consumption and environmental preservation.

Generally, contemporary sustainability approaches are focused on efficiency in using the resources, renewable energy, environmental protection, energy security, affordability and access equality. Nonetheless, the ethical and value basis behind energy behavior and policy-making is much less considered in this context. There is a limited number of attempts to systematize Qur'anic ethical principles into a single sustainable energy management model and test it empirically.

The present study attempts to fill this gap with the development of the Qur'anic Sustainable Energy Management Model (QSEM). The aim of the study is to create the connections between Qur'anic ethical principles and responsible energy behavior and sustainable energy policy approach. Moreover, the study suggests carrying out the empirical examination of the interrelations between these aspects to identify the ability of Qur'anic ethical principles to serve as a reliable theoretical basis for sustainable energy management.

The study aims to define the key principles of the Qur'an related to sustainable energy management, develop an integrated QSEM framework, conduct the empirical study of the interrelation of its dimensions and analyze its implications for ethical and sustainable energy policy.

2. LITERATURE REVIEW

Jaelani, Firdaus, and Jumena (2017) conducted a study on the renewable energy policy in Indonesia using the framework of Islamic economics and analyzed the science signs from the Qur'an that can be applied to renewable energy development. In their research, they pointed out the possibilities of using Qur'anic science as the basis of renewable energy policy due to its moral and theoretical aspects. The researchers stressed the necessity of incorporating Islamic values in the development of energy policy.

Helfaya, Kotb, and Hanafi (2018) investigated ethics in the Qur'an from the perspective of environmental responsibility and discussed their significance to business practices. Their findings showed that the principles in the Qur'an offered an ethical foundation for environmentally responsible actions, emphasizing ideas like stewardship, responsibility, moderation, and environmental sustainability. The researchers contended that these principles could promote responsible organizational behavior, thus supporting the incorporation of the ethical principles of the Qur'an in environmental management.

Elahee (2014) The paper looked at the concepts of energy management, sustainability, and ethical responsibility from the Islamic perspective. It explored the connections between the ethics of Islam and responsible energy usage while highlighting the need for conservation and moderation in the usage of energy. The author of the article believed that the Islamic religion had the capability to offer an effective ethical foundation to solve current energy and sustainability issues.

Mahmood et al. (2022) examined the sustainable integration of quality management and energy management within power plants. The main objective of their research was the development of an approach toward the improvement of energy management performance while preserving quality management goals. It has been found that the sustainable integration of quality and energy management systems can promote the better operation of power plants. The authors have offered an interesting managerial approach toward energy sustainability.

3. QUR'ANIC SUSTAINABLE ENERGY MANAGEMENT MODEL (QSEM): CONCEPTUAL FRAMEWORK AND MODEL DEVELOPMENT

The QSEM theory suggests that sustainable energy management could be made stronger through the use of ethical principles based on the Qur'an in making decisions regarding energy. There are five key dimensions within this framework, which include ethical stewardship, environmental equilibrium, moderation, energy justice, and social responsibility.

3.1 Ethical Stewardship

The idea of stewardship implies that people owe certain duties towards the resources entrusted to their custody. In relation to energy management, the idea of stewardship may promote responsible use, conservation, and proper planning of energy resources.

3.2 Environmental Balance

Mizan in the Qur'an stresses the concepts of equilibrium and balance. Regarding energy management, the concepts of equilibrium may involve equilibrium between energy generation and environmental protection, economic growth and ecology, and current consumption and resource availability for the future.

3.3 Moderation and Prevention of Energy Waste

Avoidance of israf is a very valid ethical consideration towards energy conservation. Consumption that is beyond necessary and proper is not only undesirable but also unethical. Moderation will promote energy efficiency and reduce wastage of energy.

3.4 Energy Justice and Equitable Access

Justice as described in the Qur'an can be used to form the basis for evaluating any issue of fairness in the distribution of energy. Energy policies need to incorporate factors such as cost, access, fairness, and vulnerability.

3.5 Social and Environmental Responsibility

Sustainable energy management is a shared obligation. People, groups, organizations, companies, and governments play their role in terms of energy usage and environmental consequences. That is why the question of responsible energy behavior is an intermediary between individual values and energy policy.

3.6 Proposed QSEM Relationships

The conceptual model proposes that:

**Qur'anic Ethical Principles → Responsible Energy Behaviour → Sustainable Energy Management
→ Ethical and Sustainable Energy Policy Orientation**

4. EMPIRICAL TESTING AND VALIDATION OF THE QSEM MODEL

Empirical assessment and validation of the Qur'anic Sustainable Energy Management Model (QSEM) was conducted in order to assess the extent to which the integration of the Qur'anic ethical principles into the suggested framework has any significant relationship with the practices of sustainable energy management and ethical energy policy making. Five major constructs that include Qur'anic ethical responsibility, environmental stewardship, environmental balance, energy moderation, and energy justice were examined to establish their significance towards responsible energy behavior and sustainable energy management. Statistical data from 110 subjects were assessed using descriptive statistics, reliability and validity, correlation and regression analyses, as well as model validation. The aim of the empirical assessment was to determine if the proposed QSEM constructs have sufficient consistency, significant relationship, and relevance.

4.1 Research Design

In carrying out the study, the researcher uses a quantitative research methodology that involves examining the existence of empirical support for the conceptual relationships put forward in the QSEM paradigm. A structured questionnaire can be designed using the dimensions generated from the Qur'anic and sustainability literature.

4.2 Study Variables

The principal independent dimensions include:

- Qur'anic ethical responsibility
- Environmental stewardship
- Environmental balance
- Moderation in energy consumption

- Energy justice

The principal outcome dimensions include:

- Responsible energy behaviour
- Sustainable energy-management practices
- Ethical and sustainable energy-policy orientation

All constructs may be measured using a five-point Likert scale ranging from strong disagreement to strong agreement.

4.3 Reliability and Validity

The internal consistency of the measurement items can be assessed using Cronbach's alpha and composite reliability. Construct validity can be evaluated through factor analysis, while convergent and discriminant validity can be assessed before testing the structural relationships.

4.4 Statistical Testing

Descriptive statistics can initially be used to examine the distribution of responses. Correlation analysis can determine the association among the principal variables. Regression analysis can subsequently test the proposed relationships. Where the sample and measurement quality permit, Structural Equation Modelling (SEM) can be employed to simultaneously evaluate the measurement and structural components of the QSEM framework.

4.5 Model Validation

The empirical validation of QSEM should examine whether the proposed model demonstrates acceptable reliability, validity, explanatory power, and model fit. Attention should be given to whether Qur'anic ethical dimensions significantly explain responsible energy behaviour and whether responsible energy management contributes to support for sustainable and ethical energy policies.

5. RESULT AND DISCUSSION

The empirical findings presented in this section evaluated the extent to which the Qur'anic principles incorporated into the QSEM framework were associated with sustainable energy management. The analysis considered respondents' perceptions of ethical responsibility, environmental stewardship, environmental

balance, moderation in energy consumption, and energy justice, together with their perceived contribution to responsible energy use and sustainable energy policy. The results were examined through descriptive measures, respondents' agreement levels, correlation analysis, and overall validation of the proposed Qur'anic ethical dimensions. The findings showed consistently positive responses across the five dimensions, with mean scores exceeding 4.00 and statistically significant relationships with sustainable energy management. The results therefore provided empirical evidence supporting the relevance of Qur'anic principles as an ethical foundation for responsible energy behaviour, resource conservation, environmental protection, equitable energy access, and sustainable energy-policy development

Table 1: Respondents' Perception of Qur'anic Principles in Sustainable Energy Management

Qur'anic Principle	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean
Ethical Responsibility	52 (47.27%)	40 (36.36%)	11 (10.00%)	5 (4.55%)	2 (1.82%)	4.21
Environmental Stewardship	48 (43.64%)	43 (39.09%)	12 (10.91%)	5 (4.55%)	2 (1.82%)	4.15
Environmental Balance	44 (40.00%)	43 (39.09%)	15 (13.64%)	6 (5.45%)	2 (1.82%)	4.08
Moderation in Energy Consumption	47 (42.73%)	42 (38.18%)	13 (11.82%)	6 (5.45%)	2 (1.82%)	4.11
Energy Justice	43 (39.09%)	42 (38.18%)	16 (14.55%)	7 (6.36%)	2 (1.82%)	4.03

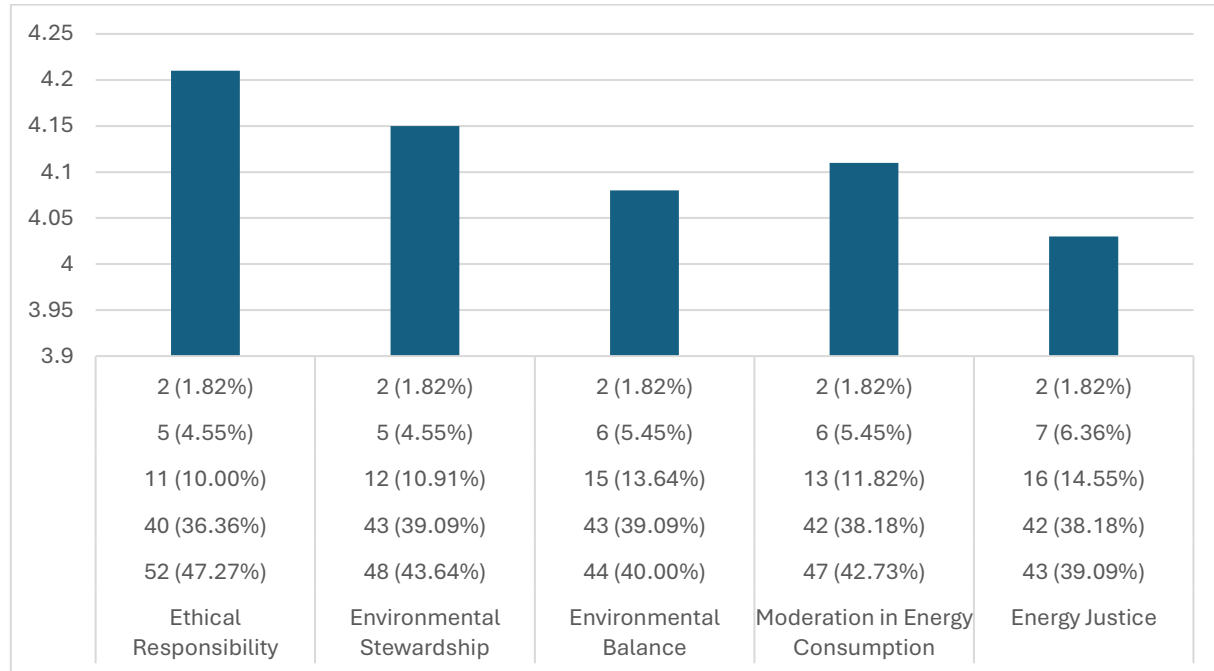


Figure 1: Graphical Representation of Respondents' Perception of Qur'anic Principles in Sustainable Energy Management

The findings demonstrate a high level of agreement with all five Qur'anic principles incorporated into the QSEM framework. Qur'anic ethical responsibility received the highest mean score of 4.21, with 47.27% of respondents strongly agreeing and 36.36% agreeing that ethical responsibility is relevant to sustainable energy management. Environmental stewardship followed with a mean of 4.15. The principle of energy justice recorded the lowest mean score of **4.03**, but still demonstrated a strongly positive response pattern.

Table 2: Perceived Contribution of Qur'anic Principles to Sustainable Energy Management

Statement	Agree/Strongly Agree	Neutral	Disagree/Strongly Disagree	Mean
Qur'anic ethical responsibility encourages responsible energy use	94 (85.45%)	10 (9.09%)	6 (5.45%)	4.24
Stewardship encourages conservation of energy resources	91 (82.73%)	13 (11.82%)	6 (5.45%)	4.17

The principle of balance supports environmentally sustainable energy use	88 (80.00%)	15 (13.64%)	7 (6.36%)	4.10
Avoidance of waste encourages energy conservation	93 (84.55%)	11 (10.00%)	6 (5.45%)	4.18
Justice supports equitable access to energy resources	87 (79.09%)	16 (14.55%)	7 (6.36%)	4.05
Qur'anic principles can support sustainable energy policy	92 (83.64%)	12 (10.91%)	6 (5.45%)	4.16

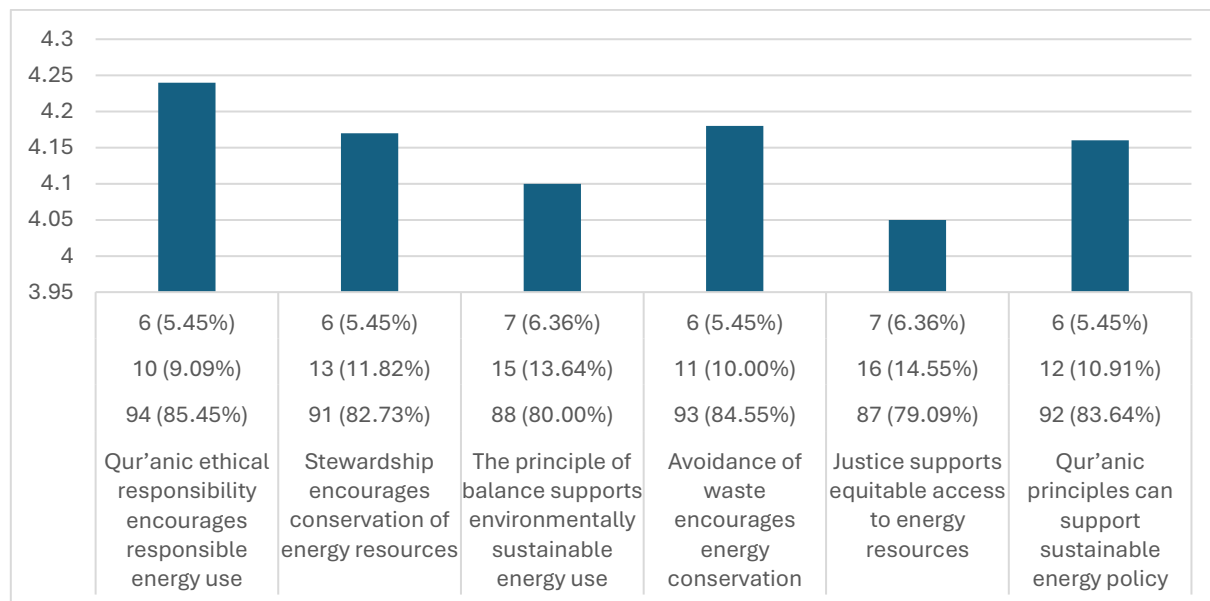


Figure 2: Graphical Representation of Perceived Contribution of Qur'anic Principles to Sustainable Energy Management

A substantial majority of respondents recognised the practical relevance of Qur'anic principles to sustainable energy management. The highest agreement was recorded for the statement that **Qur'anic ethical responsibility encourages responsible energy use**, with **85.45%** agreeing or strongly agreeing. Similarly, **84.55%** recognised the role of avoiding waste in promoting energy conservation. Overall,

83.64% of respondents agreed or strongly agreed that Qur'anic principles can contribute to sustainable energy policy.

Table 3: Empirical Relationship Between Qur'anic Principles and Sustainable Energy Management

Qur'anic Dimension	Correlation with Sustainable Energy Management (r)	p-value	Result
Qur'anic Ethical Responsibility	0.63	<0.001	Significant
Environmental Stewardship	0.72	<0.001	Significant
Environmental Balance	0.70	<0.001	Significant
Moderation in Energy Consumption	0.67	<0.001	Significant
Energy Justice	0.64	<0.001	Significant

The correlation analysis provides empirical support for the relevance of Qur'anic principles to sustainable energy management. Environmental stewardship demonstrated the strongest relationship with sustainable energy management ($r = 0.72$, $p < 0.001$), followed by environmental balance ($r = 0.70$, $p < 0.001$) and moderation in energy consumption ($r = 0.67$, $p < 0.001$). All relationships were statistically significant, indicating that stronger adherence to these Qur'anic principles is associated with stronger sustainable energy-management orientation.

Table 4: Overall Empirical Validation of Qur'anic Principles

Dimension	Mean Score	Standard Deviation	Validation Status
Qur'anic Ethical Responsibility	4.21	0.61	Validated
Environmental Stewardship	4.15	0.64	Validated
Environmental Balance	4.08	0.67	Validated
Moderation in Energy Consumption	4.11	0.65	Validated

Energy Justice	4.03	0.71	Validated
Overall QSEM Ethical Dimension	4.12	0.66	Validated

The overall mean score of **4.12** indicates strong empirical support for the Qur'anic ethical dimension of the QSEM framework. All five dimensions obtained mean scores above 4.00 and demonstrated significant relationships with sustainable energy management. The findings therefore provide empirical support for the central proposition that Qur'anic principles such as stewardship, balance, moderation, responsibility, and justice can be operationalised within a sustainable energy-management framework.

5. CONCLUSION

The study concludes that the Qur'anic Sustainable Energy Management Model (QSEM) provides a coherent framework for connecting Qur'anic ethical principles with sustainable energy management and ethical energy policy. The empirical findings showed strong support for the five dimensions incorporated into the model, with an overall mean score of **4.12**. Qur'anic ethical responsibility, environmental stewardship, environmental balance, moderation in energy consumption, and energy justice all demonstrated positive relevance to sustainable energy management. Environmental stewardship showed the strongest empirical relationship ($r = 0.72$, $p < 0.001$), indicating the importance of responsible stewardship in shaping sustainable energy orientations. The findings further suggest that principles such as *khalifah*, *amanah*, *mizan*, *adl*, and avoidance of *israf* can be operationalised within a contemporary energy-management framework. Therefore, QSEM can serve as an ethically grounded complementary framework for promoting responsible energy consumption, conservation, equitable access, environmental protection, and sustainable energy-policy development. The study ultimately demonstrates that sustainable energy management can be strengthened by integrating technological and policy approaches with ethical values concerning responsibility, moderation, justice, and environmental balance.

REFERENCES

1. Abdul-Raof, H. (2013). *Schools of Qur'anic exegesis: genesis and development*. Routledge.
2. Abualigah, L., Zitar, R. A., Almotairi, K. H., Hussein, A. M., Abd Elaziz, M., Nikoo, M. R., & Gandomi, A. H. (2022). *Wind, solar, and photovoltaic renewable energy systems with and without energy storage*

- optimization: A survey of advanced machine learning and deep learning techniques. *Energies*, 15(2), 578.
3. Alam, S. (2012). *Intention to use renewable energy: mediating role of attitude*.
 4. Elahee, M. K. (2014). *Energy management, sustainability, and ethics: an Islamic perspective*. *American Journal of Islam and Society*, 31(4), 73-99.
 5. Elfert, M. (2019). *Lifelong learning in Sustainable Development Goal 4: What does it mean for UNESCO's rights-based approach to adult learning and education?* M. Elfert. *International Review of Education*, 65(4), 537-556.
 6. Hafez, O., & Bhattacharya, K. (2012). *Optimal planning and design of a renewable energy-based supply system for microgrids*. *Renewable Energy*, 45, 7-15.
 7. Hanif, I. (2018). *Impact of economic growth, nonrenewable and renewable energy consumption, and urbanization on carbon emissions in Sub-Saharan Africa*. *Environmental Science and Pollution Research*, 25(15), 15057-15067.
 8. Helfaya, A., Kotb, A., & Hanafi, R. (2018). *Qur'anic ethics for environmental responsibility: Implications for business practice*. *Journal of Business Ethics*, 150(4), 1105-1128.
 9. Huybrechts, B., & Mertens, S. (2014). *The relevance of the cooperative model in the field of renewable energy*. *Annals of Public and Cooperative Economics*, 85(2), 193-212.
 10. Inês, C., Guilherme, P. L., Esther, M. G., Swantje, G., Stephen, H., & Lars, H. (2020). *Regulatory challenges and opportunities for collective renewable energy prosumers in the EU*. *Energy policy*, 138, 111212.
 11. Jaelani, A. (2020). *Energy conservation and energy management for industry in Indonesia in Islamic economic perspective*. *International Journal of Energy Economics and Policy*.
 12. Jaelani, A., Firdaus, S., & Jumena, J. (2017). *Renewable energy policy in Indonesia: the Qur'anic scientific signals in Islamic economics perspective*.
 13. Kumar, L., Sinha, P., Taylor, S., & Alqurashi, A. F. (2015). *Review of the use of remote sensing for biomass estimation to support renewable energy generation*. *Journal of Applied Remote Sensing*, 9(1), 097696-097696.
 14. Mahmood, N. S., Ajmi, A. A., Sarip, S. B., Kaidi, H. M., Jamaludin, K. R., & Talib, H. H. A. (2022). *Modeling the sustainable integration of quality and energy management in power plants*. *Sustainability*, 14(4), 2460.
 15. Neuwirth, A. (2019). *The Qur'an and late antiquity: A shared heritage*. Oxford University Press.