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Islamic Values in Socio-Scientific Issues-Based Science Learning for Renewable Energy Literacy

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Abstract: The energy transition requires citizens who can weigh energy choices responsibly, a capacity that concept-focused science learning has not developed. This study examines socio-scientific issues (SSI)-based science learning on energy topics, the forms and levels of Islamic value integration in science learning, and the underdeveloped domains of energy literacy, and formulates a framework uniting them for *madrasah ibtidaiyah*. This library research used a qualitative descriptive-analytical approach. Nineteen principal works retrieved from Scopus, Google Scholar, and GARUDA were selected purposively using quality, relevance, function, and traceability criteria, recorded on a data extraction sheet, and analysed through content analysis and thematic synthesis. SSI provide an arena for scientific reasoning about energy, but energy-oriented SSI research is limited, fragmented, concentrated beyond the elementary level, and dominated by the cognitive domain, while the affective and behavioural domains receive the least attention. Islamic value integration in elementary science generally stops at the content level rather than reaching the axiological level. The article proposes the Tawhidic-Socioscientific Framework for Renewable Energy Literacy, which positions *tawhid*, *khalifah*, *amanah*, *mizan*, and the prohibition of *israf* as an axiological orientation towards scientific knowledge rather than a substitute for it. The framework offers *madrasah ibtidaiyah* a mode of integration beyond pairing texts with content, built on local energy issues, an explicit stage of ethical reflection, and assessment of all three domains of energy literacy; it remains a conceptual synthesis that requires empirical validation.

Keywords: *islamic values, socio-scientific issues, renewable energy literacy, madrasah ibtidaiyah, islamic environmental ethics*

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INTRODUCTION

The transition from fossil fuels to renewable energy is one of the defining agendas of this century, and it does not rest on infrastructure and policy alone. A systematic review of 138 publications concludes that changing an energy system requires energy-literate citizens who understand how energy is produced, distributed, and consumed, recognise its environmental and social consequences, and use it efficiently (Santillán & Cedano, 2023). Without such readiness, energy policy loses its social foundation.

Energy literacy is commonly understood as a three-domain construct comprising a cognitive domain of knowledge and thinking skills, an affective domain of attitudes, values, and personal responsibility, and a behavioural domain of everyday action (DeWaters & Powers, 2011). Conceptual mastery is therefore necessary but not sufficient: a learner may know the difference between solar and fossil energy without ever changing how they consume it.

Science education in Indonesia faces difficulties on both sides. The scientific literacy of Indonesian students in PISA 2022 remains below the OECD average (OECD, 2023), while science learning that stops at conceptual mastery does not by itself build the capacity to weigh socially embedded scientific problems, such as building a solar power plant on farmland or converting household waste into energy.

The socio-scientific issues (SSI) approach was developed to address this limitation. Zeidler et al. (2005) formulate it as a framework that moves beyond the science-technology-society movement by treating learners' moral and epistemological growth as an inseparable part of science education. Controversial, open-ended, and socially embedded issues are placed at the centre of learning so that learners evaluate evidence, weigh competing viewpoints, and reach defensible decisions (Sadler & Zeidler, 2009), with the long-range aim of functional scientific literacy and engaged citizenship (Zeidler et al., 2019; Zeidler & Nichols, 2009).

Research bringing SSI together with energy topics exists, but it is limited and fragmented. Only a handful of studies treat energy explicitly as a socio-scientific issue, and they pursue separate outcomes (measurement, argumentation, or exhibition-based learning) without a shared conceptual model. Sakschewski et al. (2014) developed an instrument for measuring socioscientific reasoning and decision-making on energy-related issues; Shasha-Sharf & Tal (2023) designed a learning unit on a natural gas export dilemma for pre- and in-service science teachers; and Kellberg et al. (2025) found that the development of critical energy literacy in an exhibition on the energy transition was mediated by learners' prior conceptual knowledge of energy. These studies focus on the cognitive and reasoning domains rather than on commitment and action, and they were conducted in secondary, teacher education, or informal settings, leaving elementary education largely unexamined. A bibliometric analysis likewise shows that

SSI-based decision-making research is rarely conducted at the elementary level (Rahayu et al., 2024).

The predominance of the cognitive domain leaves open a question that these studies do not address: what makes knowledge about energy binding enough to change conduct? DeWaters & Powers (2011) found that energy-related behaviour is more strongly related to affect than to knowledge, which points to values as the missing link. For Muslim learners, Islamic thought offers such a normative resource. Nasr (2007) reads the modern environmental crisis as a symptom of severing the understanding of nature from its transcendent dimension, and Izz al-Dīn (2000) shows that, in Islamic legal and ethical sources, environmental responsibility is a moral obligation rather than a peripheral recommendation. In education, Zabidi et al. (2021) identified eight environmental conservation values in science and Islamic education textbooks, including *mizan* in the chapter on electricity and magnetism, which intersects directly with energy content. Abd Rahman et al. (2020) found that tauhidic elements were integrated mainly through teachers' role modelling and verse reflection, while students' conservation practice lagged behind their knowledge. The meeting point between Islamic values and energy content need not be forced, but its pedagogical form remains underdeveloped.

The literature on Islam and science integration carries its own difficulties. In elementary education, most studies stop at content-level integration, pairing verses or values with subject matter and then measuring cognitive outcomes (Rokhman & Amami, 2021), while in Islamic higher education integration often remains a normative add-on (Amrullah, 2026). A more promising direction treats Islamic values as organising principles for learning experience: Shobirin et al. (2026) document a nature-based Islamic elementary school in which *khalifah* and *mizan* sustain environmental commitment, Zahro et al. (2026) propose an eco-theological pedagogy for sustainable character formation at the same level, and Amrullah (2026) grounds science–Islam–culture integration in a Tauhidic epistemology, reporting gains in university students' critical thinking and environmental care. None of these studies, however, connects Islamic values to reasoning about contested energy issues at the elementary level. Some literature also tends towards an Islamisation-of-science framing that treats religious texts as validators of scientific findings. Such framing is epistemologically fragile because it blurs types of claims: empirical claims are tested against evidence, whereas normative claims are assessed through moral reasoning. Ozdemir (2003) offers a more careful path by reading environmental ethics from a Qur'anic perspective as an orientation towards nature rather than as a source of scientific propositions.

Four layers of gap emerge from this mapping. First, SSI research in Indonesia remains dominated by scientific literacy, critical thinking, and argumentation, while energy literacy has

not become a targeted outcome (Selamat, 2021). Second, energy-oriented SSI research is limited, fragmented, centred on the cognitive domain, and concentrated beyond the elementary level. Third, research integrating Islamic values into elementary science works almost entirely at the content level. Fourth, and most decisively, no study has united these three fields into a single framework explaining how scientific knowledge, reasoning about social issues, and an Islamic ethical orientation operate together in forming energy literacy.

This fourth gap converges most sharply in *madrasah ibtidaiyah* (MI). First, MI are expected to integrate Islamic values across subjects, and in science this integration is already carried through *madrasah* policy, instructional planning, and teachers' practice (Prayogo et al., 2026); MI thus hold the institutional mandate that a value-oriented framework requires, but lack a model that moves integration beyond content. Second, energy forms and their uses are already taught in elementary science, so energy issues can enter the existing curriculum without a new subject. Third, the elementary years are formative for the affective and behavioural domains: children aged 9–10 already treat electricity as a finite resource and hold positive attitudes towards saving it, yet show low intention to save more and little agency within their families (Aguirre-Bielschowsky et al., 2017). The domains least addressed by energy research are therefore precisely those in which MI, as value-oriented institutions, hold their distinctive potential.

The novelty of this article lies in addressing the fourth gap for this setting. The article does not propose an Islamisation of science and does not claim that Islamic teachings prove any scientific theory. It proposes an epistemic division of labour: SSI provide the arena for scientific reasoning about energy, while Islamic values provide an axiological orientation concerning how that knowledge is used and energy decisions are justified. Accordingly, this study aims (1) to examine the characteristics of SSI-based science learning on energy topics, (2) to examine the forms and levels of Islamic value integration in science learning, (3) to identify the energy literacy domains that remain underdeveloped, and (4) to formulate a conceptual framework uniting the three for Islamic elementary education.

METHOD

This study is library research with a qualitative descriptive-analytical approach. Library research was chosen because the aim is conceptual examination and theory synthesis rather than the testing of causal relationships. The design follows the logic of the integrative review, which critiques and synthesizes literature from different research traditions to generate new conceptual frameworks (Snyder, 2019), and the theory-synthesis approach to conceptual articles (Jaakkola, 2020).

As library research, the study involved no human participants; its research subjects are documents, namely the scholarly discourse in three fields: SSI-based science education, energy literacy, and Islamic values in science and environmental education. The primary data are nineteen principal works that form the analysed corpus (Table 1). The secondary data are supporting sources used for methodological grounding, policy context (OECD, 2023), and external comparison during the discussion; these were not coded.

Data were collected through documentation Bowen, (2009) by searching Scopus, Google Scholar, and GARUDA (the Indonesian national research portal), supplemented by backward citation tracking from key works. Search strings combined keyword groups with Boolean operators, namely ("socio-scientific issues" OR socioscientific) AND (energy OR "renewable energy" OR "energy literacy"), and ("Islamic values" OR tauhid* OR "Islamic environmental ethics") AND ("science education" OR "environmental education" OR "elementary"), together with their Indonesian equivalents ("nilai Islam", "integrasi Islam dan sains", "*madrasah ibtidaiyah*", "literasi energi"). Foundational theoretical works were admitted regardless of publication year, whereas empirical studies were limited to 2011–2026.

Works were selected purposively using four inclusion criteria. First, quality: journal articles had to be peer-reviewed and indexed in Scopus, Web of Science, or ERIC, or published in journals accredited by the Indonesian national accreditation system (SINTA); books and chapters had to be issued by university presses, university research centres, or established academic publishers with editorial review. Second, relevance: the work has a direct conceptual connection to at least one of the three fields. Third, function: the work serves as a primary reference, either by formulating a theoretical framework or by presenting original empirical findings. Fourth, traceability: author, publisher, and DOI or stable URL are fully identifiable. Works that merely mention a concept without assigning it a conceptual role, opinion pieces, and non-peer-reviewed sources were excluded.

The researchers served as the key instrument, supported by a data extraction sheet that recorded each work's bibliographic identity, educational level and setting, the role of the issue in learning, the energy literacy domain addressed, the Islamic values mentioned, the level of integration, and the main findings. The nineteen works were grouped into three thematic clusters, as presented in Table 1, reflecting three research traditions that have proceeded independently.

Table 1. Grouping of Data Sources into Three Thematic Clusters

No.	Cluster	Works	Focus of the cluster
1.	A. Socio-scientific issues and science education (6 works)	(Putra, 2022; Selamat, 2021; Karisan & Zeidler, 2017; Sadler & Zeidler, 2009; Zeidler & Nichols, 2009; Zeidler et al., 2005)	SSI framework, functional scientific literacy, and SSI research in Indonesia
2.	B. Energy issues and energy literacy (5 works)	(Kellberg et al., 2025; Santillán & Cedano, 2023; Shasha-Sharf & Tal, 2023; Sakschewski et al., 2014; DeWaters & Powers, 2011)	Three-domain energy literacy construct, reasoning instruments, and energy issues as a learning context
3.	C. Islamic values and Islamic environmental ethics (8 works)	(Shobirin et al., 2026; Zahro et al., 2026; Rokhman & Amami, 2021; Zabidi et al., 2021; Abd Rahman et al., 2020; Nasr, 2007; Ozdemir, 2003; ‘Izz al-Dīn, 2000)	Islamic environmental ethics, the human–nature relation, and Islamic value integration in science learning

Data analysis followed qualitative content analysis (Elo & Kyngäs, 2008) and thematic synthesis (Thomas & Harden, 2008) in three stages: content analysis of each work to identify its key concepts, arguments, and findings; descriptive coding within each cluster using the categories of the extraction sheet; and cross-cluster synthesis generating analytical themes that go beyond any individual work. These analytical themes form the basis of the proposed framework. Text excerpts from the analysed works serve the role that interview snippets play in field research and are presented, with page numbers, in the Discussion.

Trustworthiness was maintained in three ways. First, every factual claim was traced back to its original source and asserted only to the extent that the source itself asserts it. Second, Islamic values were not read into works that do not mention them, so that absence of mention is reported as absence. Third, coding was carried out by the first two authors and cross-checked by the third, with disagreements resolved through discussion, and interpretations were compared against the supporting literature (Bowen, 2009; Elo & Kyngäs, 2008).

RESULTS AND DISCUSSION

Results

Socio-Scientific Issues as a Contextual Approach to Science Learning

Examination of Cluster A shows that the strength of SSI lies in the character of the issue rather than in any particular instructional technique. A suitable issue rests on scientific concepts, involves stakeholders with differing interests, contains uncertainty, and admits no single answer settled in advance. This character compels learners to move from recalling to weighing (Zeidler et al., 2005).

The cluster also reveals two distinct uses of SSI. The first treats the issue as a context, a backdrop that arouses interest before the conceptual material is delivered and is then set aside.

The second treats the issue as a pedagogical framework that organises the entire flow of learning through identifying stakeholders, evaluating conflicting evidence, and formulating a decision. Only the second is consistent with the original intent, which positions moral and epistemological growth as a purpose of science education rather than a by-product (Zeidler & Nichols, 2009).

In Indonesia, SSI research tends to centre on twenty-first century skills, general scientific literacy, and teaching material development (Putra, 2022; Selamat, 2021). Internationally, studies more often develop reasoning and understanding of the nature of science than measure changes in attitude and behaviour (Karisan & Zeidler, 2017). Energy issues therefore do not occupy a position commensurate with their urgency, and action has not become a principal target.

Renewable Energy as a Socio-Scientific Issue

Examination of Cluster B shows that renewable energy satisfies every criterion of a socio-scientific issue. It rests on concepts of energy conversion and efficiency, involves stakeholders with conflicting interests, contains uncertainty about long-term consequences, and admits no single answer. A solar power plant on farmland, biomass from agricultural waste, or the choice between energy subsidies and clean energy investment are structurally equivalent to the energy policy dilemma used by Shasha-Sharf & Tal (2023), after which participants used more argument types.

The suitability of energy issues has also been demonstrated instrumentally. Sakschewski et al. (2014) developed a measure of socioscientific reasoning and decision-making designed specifically for energy-related issues, showing that the capacity to weigh energy choices can be operationalised and assessed. The obstacle to bringing energy issues into learning therefore lies not in the absence of conceptual tools but in research focus and the availability of teaching materials.

Kellberg et al. (2025) add an important condition: the development of critical energy literacy in an issue-based environment was mediated by learners' prior conceptual knowledge of energy rather than by their interest in the topic. Issue-based learning thus builds on, rather than bypasses, a conceptual foundation; debate without energy concepts risks being ungrounded in evidence.

Coverage of the Energy Literacy Domains

Cross-work examination within Cluster B reveals a consistent imbalance across the three domains, summarised in Table 2. Research has concentrated on evaluating energy knowledge and developing measurement tools, whereas the influence of energy literacy on decision-making and conduct forms a smaller strand (Santillán & Cedano, 2023; DeWaters & Powers, 2011).

Table 2. Coverage of the Energy Literacy Domains in the Reviewed Literature

No.	Domain	Coverage	Remaining gap
1.	Cognitive	Most extensively addressed; focused on energy concepts, conversion, and the evaluation of sources	Renewable energy concepts are often detached from their social context
2.	Affective	Addressed to a limited extent; usually measured as a general attitude towards the environment	No attitude instrument specific to energy issues and grounded in values is available
3.	Behavioural	Least addressed; rarely measured outside the classroom setting	No long-term evidence of change in energy-related behaviour

Forms and Levels of Islamic Value Integration

Examination of Cluster C yields three levels of Islamic value integration that differ in depth, as presented in Table 3. The content level pairs verses, *hadith*, or values with subject matter without altering the structure of learning, a pattern documented by Rokhman & Amami (2021) in elementary schools. The pedagogical level makes values into principles that organise learning activity, as in the nature-based Islamic elementary school described by Shobirin et al. (2026) and the eco-theological pedagogy proposed by Zahro et al. (2026). The axiological level, in which values inform decisions about real problems, is the deepest. The reviewed literature shows a dominance of the first level, a few works reaching the second, and virtually none reaching the third.

Table 3. Levels of Islamic Value Integration in Science Learning

No.	Level	Description	Representation in the reviewed literature
1.	Content	Verses, *hadith*, or values are paired with subject matter without altering the structure of learning	Dominant (Rokhman & Amami, 2021; Zabidi et al., 2021)
2.	Pedagogical	Values function as principles organising learning activity, reflection, and experience	Limited (Shobirin et al., 2026; Zahro et al., 2026; Abd Rahman et al., 2020)
3.	Axiological	Values function as a framework of consideration in reaching decisions about contested real-world problems	Virtually absent

Two works show that the meeting point already exists but has not been activated. Zabidi et al. (2021) found *mizan* applied in a science textbook's chapter on electricity and magnetism, yet as content that is mentioned rather than a consideration that is used, and Abd Rahman et al. (2020) found that students' conservation practice lagged behind their knowledge.

Discussion

The Limits of a Cognitively Framed Energy Literacy

Two excerpts from the corpus make this imbalance concrete. Santillán & Cedano (2023, p.1) observe that "most of the work performed around energy literacy addresses its evaluation

among different groups". DeWaters & Powers (2011, p. 1699) report that "energy-related behaviors are more strongly related to affect than to knowledge", and that conservation behaviour fell between middle and high school students despite gains in knowledge. The domain that most strongly shapes action is thus the domain least addressed by research.

This imbalance is a structural gap that cannot be closed by adding instructional hours or deepening subject matter, because the problem lies not in the quantity of knowledge but in the absence of a normative basis that makes that knowledge binding. Knowing that burning fossil fuels produces carbon emissions does not by itself generate an obligation to reduce them; a statement about what is the case does not yield a statement about what ought to be done without a normative premise originating outside science. Values perform precisely this function, which additional scientific information cannot replace.

This reading is consistent with the SSI framework, in which moral growth is constitutive of science education (Zeidler et al., 2005) and the formation of virtue and character is a long-range pedagogical goal (Zeidler et al., 2019). The framework anticipates an ethical dimension but does not specify which ethical tradition supplies it. In a *madrasah*, that question has a culturally available and institutionally legitimate answer. Evidence from Muslim contexts indicates that Islamic teachings, organisations, and religious leaders can influence climate change perceptions and mitigation activities (Koehrsen, 2021), and conservation initiatives in Indonesia have begun to revive an Islamic approach to environmental protection (Mangunjaya & McKay, 2012).

Islamic Values as an Axiological Orientation

The same pattern appears in Cluster C. Abd Rahman et al. (2020, p.1) report that the integration of tauhidic elements "only takes place through two approaches", namely teachers' advice and role modelling and the search for the meaning of related verses, and that students "require enhancements concerning their practices of environmental conservation". Values are recognised and taught, yet no pedagogical form turns them into grounds for decisions.

Examination of Cluster C yields five values with a direct conceptual connection to energy education rather than merely to the environment in general (Table 4).

Table 4. Five Islamic Values and Their Function in Energy Education

No.	Value	Working definition	Function in energy education	Reference
1.	*Tawhid*	The oneness of God; nature as a signed creation rather than a neutral commodity	Ontological orientation: energy sources are not treated merely as objects of exploitation	(Abd Rahman et al., 2020; Nasr, 2007; Ozdemir, 2003)

No.	Value	Working definition	Function in energy education	Reference
2.	*Khalifah*	Human stewardship of the earth as a trust rather than as ownership	Shifts the question from how much may be taken to on what grounds it may be taken	(Shobirin et al., 2026; ‘Izz al-Dīn, 2000)
3.	*Amanah*	A trust for which an account must be rendered to the one who entrusted it	Basis for intergenerational accountability in managing energy resources	(Zabidi et al., 2021; ‘Izz al-Dīn, 2000)
4.	*Mizan*	Balance and proportion within the order of creation	Ecological limit on energy systems; already documented as intersecting with electricity content	(Shobirin et al., 2026; Zabidi et al., 2021)
5.	Prohibition of *israf*	Prohibition of excess and wastefulness in the use of resources	Demand-side ethics: normative basis for efficiency and restraint in energy consumption	(‘Izz al-Dīn, 2000)

These five values operate in the normative rather than the empirical domain. The prohibition of *israf*, for example, adds nothing to knowledge of thermodynamic efficiency, but it supplies a reason for restraining consumption that cannot be derived from that knowledge. Islamic environmental ethics refers to QS al-A‘rāf (7): 31 as a textual basis of this prohibition and reads it as a principle of consumption restraint rather than a prohibition on using resources at all (‘Izz al-Dīn, 2000). This keeps the value an orientation rather than a scientific claim.

This position differs from an Islamisation of science framing, which places religious texts and scientific findings in an unnecessary competition. Nasr (2007) locates the problem in the way nature is perceived, while Ozdemir (2003) shows that a Qur’anic reading of the environment functions as an ethical orientation towards nature. Neither claims that religious texts contain scientific propositions. Keeping the two types of claims distinct also protects teachers from the false contradictions between science and faith that Mansour (2011) observed among Muslim science teachers.

The Tawhidic-Socioscientific Framework for Renewable Energy Literacy

Synthesis across the three clusters yields one principal analytical theme: SSI and Islamic values operate in different domains and are for that very reason complementary. SSI supply the arena for evaluating evidence, weighing competing claims, and constructing arguments (Sadler & Zeidler, 2009), answering what is the case; Islamic values supply an axiological orientation, answering what ought to be done with that knowledge. On this basis, the article proposes the Tawhidic-Socioscientific Framework for Renewable Energy Literacy, which moves through six layers (Table 5), with a feedback path from the sixth layer back to the second, since reaching a decision enriches how learners read later issues.

Table 5. The Six Layers of the Tawhidic-Socioscientific Framework

Layer	Component	Content
1	Scientific knowledge of energy	Energy concepts and conversion, efficiency, renewable technologies, environmental impact
2	Socio-scientific energy issue	Genuine controversy, plural stakeholders, scientific uncertainty, competing trade-offs
3a	Scientific reasoning	Evidence evaluation, argumentation, informed scepticism
3b	Islamic ethical reflection	*Tawhid*, *khalifah*, *amanah*, *mizan*, prohibition of *israf*; runs alongside layer 3a and is complementary, not substitutive
4	Renewable energy literacy	Cognitive, affective, and behavioural domains in an integrated manner
5	Energy decision	A decision defensible on scientific and ethical grounds alike
6	Environmental responsibility	Stewardship enacted in concrete action; feeds back into layer 2

Note. The framework is a conceptual synthesis derived from the literature review and has not been empirically validated. Source: authors' construction.

The framework rests on four propositions: (1) an epistemic division of labour between scientific reasoning and value orientation; (2) complementarity rather than substitution, since Islamic values answer not the empirical question of photovoltaic efficiency but the normative question of how an energy choice is justified; (3) energy literacy as a three-domain construct, with Islamic values functioning most tangibly in the affective and behavioural domains; and (4) the status of the framework as a working hypothesis rather than a tested model.

Implications for Islamic Elementary Education

For science learning in MI, the framework directs teachers to select energy issues close to learners' experience, such as solar energy in the immediate environment, biomass from agricultural waste, or household waste as an energy source, and to treat the issue as a pedagogical framework in which learners identify stakeholders, evaluate conflicting evidence, and formulate a decision on scientific and ethical grounds together. Ethical reflection follows scientific reasoning rather than replacing it, so that learners distinguish questions of fact from questions of value and conceptual mastery remains the foundation (Kellberg et al., 2025). Prior studies show that this is feasible at the elementary level. An SSI-based rational decision-making model with interactive multimodal materials significantly improved Indonesian fifth graders' environmental understanding (Rahayu et al., 2026), and elementary preservice teachers supported by a community of practice were able to plan and enact SSI instruction (Kinskey & Zeidler, 2024).

At this level the framework requires adjustment rather than dilution. Issues should be local, concrete, and observable; decisions should concern learners' own conduct and their immediate community rather than national policy; and ethical reflection is better carried through narrative, habituation, and simple projects than through abstract argument. In a nature-

based Islamic elementary school, *khalifah* and *mizan* sustained environmental commitment when they were enacted rather than merely stated (Shobirin et al., 2026); in MI, integration carried through *madrasah* policy, lesson planning, and teachers' practice strengthened scientific attitudes such as curiosity, honesty, and openness to evidence alongside responsibility (Prayogo et al., 2026); and a systematic review links integrated thematic learning, contextual Qur'anic reflection, and experiential activities to environmental awareness at cognitive, affective, and spiritual levels (Saputro et al., 2025). Teachers are not asked to find a verse for every topic but to design a stage of ethical consideration within an existing instructional sequence, extending the two narrow approaches reported by Abd Rahman et al. (2020).

For curriculum developers and assessment designers, the framework calls for assessment beyond cognitive tests. The affective and behavioural domains are measurable: DeWaters & Powers (2011) assessed affect and self-reported behaviour alongside knowledge, and Aguirre-Bielschowsky et al. (2017) examined attitudes, intended behaviour, and agency among children aged 9–10. MI can adapt such approaches into simple attitude scales, energy-use diaries kept with families, observation of habits such as switching off unused lights, and reflective journals in which learners justify energy decisions on scientific and ethical grounds. Authentic assessment of learning trajectories, as built into the integrative model of Amrullah (2026), offers a further route. As long as assessment measures knowledge only, learning will continue to be pulled in that direction.

Limitations

As library research with purposive selection, this study does not cover all available literature. The five values were selected for their connection to energy, so environmental values such as *ihsan* and *taawun* are not discussed. The study tests no causal relationship and cannot claim that integrating Islamic values raises energy literacy. Above all, the framework has not been empirically validated; it is a proposition awaiting testing

CONCLUSIONS

SSI-based science learning offers an adequate arena for reasoning about energy, and renewable energy satisfies every criterion of a socio-scientific issue, yet energy-oriented SSI research remains limited, fragmented, and concentrated beyond the elementary level. Islamic value integration in elementary science largely halts at the content level and has not reached the axiological level at which values inform decisions. The affective and behavioural domains of energy literacy, which most strongly shape action, remain the least developed.

Synthesising these findings, the Tawhidic-Socioscientific Framework positions *tawhid*, *khalifah*, *amanah*, *mizan*, and the prohibition of *israf* as an axiological orientation towards

scientific knowledge rather than a substitute for it. For MI, it offers a classroom-operable mode of integration beyond the pairing of texts, built on local energy issues, an explicit stage of ethical reflection, and assessment reaching all three domains. Future research should develop and validate a value-sensitive energy literacy instrument for Indonesian elementary learners, produce teaching materials through design-based research, and test the framework empirically, particularly its proposition concerning the affective and behavioural domains.

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