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Linking attitude and ethical practices to energy Efficiency: The mediating role of household lifestyle

Salina Daud^{a,*}, Wan Noordiana Wan Hanafi^b, Sabihah Hitam^c, Maryam Jamilah Asha'ari^d, Mariam Abdul Majid^e, Wan Fadzilah Wan Yusoff^f, Maisarah Ahmad Sofi^f

^a Faculty of Industrial Management, Universiti Malaysia Pahang Al-Sultan Abdullah, Pahang, Malaysia

^b Institute Energy Policy & Research Department (IEPRe), UNITEN Business School, Universiti Tenaga Nasional, Sultan Haji Ahmad Shah Campus, Muadzam Shah,

Pahang, Malaysia

^c UNITEN Business School, Universiti Tenaga Nasional, Putrajaya Campus, Kajang, Selangor, Malaysia

^d Graduate School of Business, Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia

e Faculty of Islamic Civilisation Studies, Universiti Islam Selangor, Selangor, Malaysia

^f College of Graduate Studies, Universiti Tenaga Nasional, Putrajaya Campus, Kajang, Selangor, Malaysia

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ABSTRACT

Several initiatives and policies have been introduced in Malaysia under the National Energy Efficiency Action Plan (NEEAP) 2016-2025 to inculcate a culture of energy-efficient attitudes among households in Malaysia. However, a comprehensive evaluation of the success of the action plan is yet to be reported. Thus, this study has determined the extent to which household attitudes and ethical practices influence the overall effort toward being more efficient in using resources like electricity, with a specific focus on the role played by household lifestyle factors within the state of Selangor, Malaysia. A quantitative research approach using a survey method was adopted to investigate the direct and mediating effects of key variables. Data was contributed by 500 households in Selangor comprising various categories of dwelling. A stratified random sampling was employed to allow for the representativeness of the population. Results from this study indicated that the interactive factors of attitudes, ethical practices, and household lifestyles contributed significantly to energy efficiency usage. Specifically, household attitudes were found to play a pivotal role in shaping energy efficiency outcomes in Selangor. Ethical practices emerged as essential drivers of sustainable energy behaviours, while household lifestyle acted as a mediator between ethical practices and energy efficiency. These findings suggest that energy policies must align closely with underlying social and ethical factors to achieve meaningful change. Through contiguously targeted initiatives led by the state of Selangor to the other states, it is envisaged that the NEEAP 2016-2025 would enable its successful implementation and enhance sustainable household practices in Malaysia.

1. Introduction

The Twelfth Malaysia Plan (2021–2025) highlights several initiatives to enhance energy efficiency, targeting for an 8 % reduction in energy demand by 2025, in line with Malaysia's broader sustainability objectives (Ministry of Economy, 2021). Although these policies emphasise national objectives, their implementation into effective household energy-saving practices requires specific methods and efficient communication. The National Energy Efficiency Action Plan (2016–2025) is a notable initiative that encourages households to adopt energy-efficient technologies through financial incentives, including rebates for energy-efficient appliances and subsidies for home retrofitting (Aktar and Anower, 2022; Suruhanjaya, 2016). These incentives aim to reduce residential electricity consumption. Malaysia has initiated awareness programs, including the Save Energy Malaysia initiative, to communicate these principles effectively. This campaign educates households on the environmental and economic advantages of implementing energy-efficient behaviours and products. It uses many communication techniques, including social media, television, and community outreach initiatives (Suruhanjaya Tenaga, 2020).

Selangor's sustainability program focuses on key objectives such as reducing carbon emissions, enhancing waste management systems, and

* Corresponding author.

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E-mail addresses: salinadaud@umpsa.edu.my (S. Daud), diana.hanafi@uniten.edu.my (W.N.W. Hanafi), sabihah@uniten.edu.my (S. Hitam), maryamjamilah@ukm.edu.my (M.J. Asha'ari), mariam@uis.edu.my (M.A. Majid), wan.fadzilah@uniten.edu.my (W.F.W. Yusoff), maisarah.sofi@uniten.edu.my (M.A. Sofi).

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increasing water use efficiency. The objective is to reduce greenhouse gas emissions (GHG) in relation to the state's GDP from 2005 levels by approximately 35 % by the year 2025. The Rancangan Struktur Negeri Selangor 2035 plan encompasses various indicators beyond carbon emissions, aligning with a vision for a smart, liveable, and prosperous state (Rancangan Selangor, 2021). These initiatives demonstrate Selangor's commitment to sustainable development and addressing climate change challenges, while also contributing to global objectives related to the Sustainable Development Goals and enhancing state resilience. Energy efficiency is essential for sustainable development as it significantly decreases overall energy consumption. This reduces GHG and mitigates the impacts of climate change. The adoption of energy-efficient practices is influenced by various factors, including household attitudes, ethical considerations, and lifestyle choices. In the context of Selangor and Malaysia as a whole, it is crucial to comprehend the interconnections among these elements to enhance energy efficiency and foster a more sustainable future (International Energy Agency (IEA), 2022).

In influencing household energy-saving behaviours, attitude plays a crucial role. Positive perceptions of energy efficiency are often associated with an increased likelihood of adopting practices such as utilising electricity-saving appliances or implementing renewable technologies (Kollmuss and Agyeman, 2002). This relationship is complex and can be affected by factors such as perceived control over behaviours and societal norms (Ajzen, 1991). Understanding this relationship is crucial for creating interventions that effectively promote energy efficiency in households. Household behaviour related to transportation choices and domestic energy use significantly contributes to GHG (Swan and Ugursal, 2009). The GHG footprint of a state is indicative of its structural composition and the resource consumption patterns of its households (Dol et al., 2021).

Besides household attitudes, ethical issues significantly impact household energy consumption. These values usually influence energyefficient equipment purchases, energy reduction, and sustainable living (Daud et al., 2023). However, cultural beliefs, education, and income levels may significantly influence ethical motivations and behaviours across social groupings. Higher-income families may prioritise energy-efficient appliances due to their financial flexibility and understanding of long-term savings, but lower-income households may be limited by initial expenses despite possessing similar ethical beliefs. Education influences families, individuals with more understanding of energy efficiency's environmental and economic benefits are more likely to make informed choices (Tan et al., 2017). Research on Malaysian residential consumers found that lifestyle significantly affects energy consumption, with ethical concerns and awareness levels guiding energy-efficient practices, though these factors differ by region and household type (Daud et al., 2023). Household activities including reducing consumption of electricity, purchasing energy-efficient appliances, and engaging in energy conservation initiatives reflect these ethical principles. In addition, socioeconomic status, resource availability, and energy-efficient technology also influence the household's sense of ethics.

Moreover, household lifestyle factors can serve as mediators between attitudes toward ethics alongside actual implementation into daily routines aimed at conserving resources better overall (Liu et al., 2021). Recent studies underscore significant impacts stemming household lifestyle usage, highlighting the need for strategies targeting diverse demographics (Daud et al., 2023). Understanding how lifestyles affect efficiencies aids in developing targeted interventions addressing varied preferences among different groups. The relationship between household attitudes, ethical practices, and energy efficiency is inadequately studied, particularly among Malaysian households. There exists a significant gap in understanding the effect of ethical considerations on individual attitudes toward energy efficiency. This is especially pertinent in Selangor, where cultural perspectives may influence energy consumption and conservation behaviours, as noted by McAndrew et al. (2021).

It is agreed that attitudes and energy efficiency are significantly mediated by household lifestyle. This mediation is heavily influenced by housing, leisure, and consumer behaviour. Lifestyle factors like housing affect energy use. Household energy use is affected by home size, appliances, insulation, and building energy efficiency (Gram-Hanssen, 2015). Additionally, according to Streimikiene et al. (2024), household energy usage depends on three main factors: technical characteristics of buildings, household characteristics such as socio-economic characteristics, individual interests, income, etc. and energy prices. Enhancing insulation, upgrading to energy-efficient appliances, and adopting green construction standards can boost housing energy efficiency. Leisure activities, especially those using televisions, laptops, and game consoles, significantly impact residential energy use (Veal, 2019). Promoting energy-efficient gadgets or installing timers and smart meters can reduce energy waste in homes. Energy conservation during recreation may be through public awareness campaigns. Choosing promoted energy-efficient equipment and environmentally friendly items is vital to minimising domestic energy use. Financial incentives like rebates or tax credits for energy-efficient items and improved eco-labelling might influence customer decisions (Heinzle and Wüstenhagen, 2012).

The effectiveness of existing policies, such as Malaysia's 11th National Energy Efficiency Action Plan (NEEAP) for 2016-2025, has not been thoroughly assessed regarding their influence on household behaviour and lifestyle choices (Phrakhruopatnontakitti et al., 2020). Addressing these research gaps is crucial for the development of targeted interventions and policies that encourage sustainable energy behaviours among households in Selangor, thus contributing to broader sustainability objectives in Malaysia. Thus, this study aims to investigate how attitude and ethical practices influence overall efforts toward being more energy efficient with particular attention paid to the role played by household lifestyle factors within Selangor, Malaysia. By exploring these interconnected variables more deeply, the study can potentially contribute towards crafting effective strategies as well as sound policies for promoting energy efficiency and sustainable development in the region. The findings will support Rancangan Selangor Pertama, which highlights commitment towards making sure all parties involved work together harmoniously, advancing not only sustainability but also enhancing social inclusivity and wellbeing.

2. Literature review

2.1. Energy efficiency

The issue of energy related policy in both developed and developing nations has been the subject of an ongoing worldwide discussion (Kyriakopoulos, 2022). Owing to its substantial influence on lowering energy consumption and decreasing climate change, household energy efficiency has become a crucial field of study. However, the household sector's potential to reduce greenhouse gas emissions and increase energy efficiency has not yet been completely realised (Streimikiene et al., 2023). According to Streimikiene et al. (2022), there are numerous advantages to homes using sustainable energy for energy conservation, renewable energy utilization, and lowering greenhouse gas emissions. Energy-efficient technology is an important factor in encouraging energy conservation in homes, according to recent research. Modern technology has demonstrated the ability to significantly lower household energy use, as demonstrated by energy-efficient appliances and smart meters. For example, households can save a lot of energy by better managing and monitoring their energy consumption by integrating information and communication technologies (ICT) (Bastida et al., 2019). According to Druckman and Jackson (2008), conserving residential energy use also requires installing energy-efficient equipment and improving the insulation of existing buildings.

By increasing a household's awareness of their consumption patterns, feedback systems like real-time energy consumption displays have been successful in persuading consumers to use less energy (Fischer, 2008). Furthermore, the adoption of energy-saving solutions by households has been aided by government policies that promote energy efficiency through subsidies and incentives (Bertoldi and Mosconi, 2020). Even with these improvements, there are still issues to be resolved, especially with the energy efficiency gap, where potential energy savings are not fully realised because of a variety of obstacles like cost, ignorance, and behavioural inertia (Copiello, 2020). To find creative ways around these obstacles and improve the success of energy-saving projects, more investigation is required. In general, increasing household energy efficiency is a challenge that requires an integration of behavioural, technological, and policy interventions to achieve significant energy savings and contribute to broader environmental goals (Druckman and Jackson, 2009).

2.2. Ethical practices

Household ethical practices encompass the actions and decisions made by families and individuals to promote social responsibility, sustainability, and ethical living. These practices encompass various topics, including conservation, disaster preparedness, disaster mitigation, and sustainable consumption. An important aspect of ethical family practices is the shift towards sustainable consumption, specifically the purchase of environmentally friendly products. Ethical practices are essential practices for households aiming to reduce their environmental footprint (Cheng et al., 2023). As stated by Hien et al. (2023), attitudes towards energy saving have an important impact on the energy-saving intentions. However, several variables, like the availability of eco-friendly items, social norms, and individual values, affect this behaviour (Wijekoon and Sabri, 2021).

Energy conservation within the household represents a significant ethical practice. Research indicates that attitudes, perceived efficacy, and habits are critical factors influencing conservation behaviour. These factors are frequently shaped by wider social and contextual determinants, highlighting the need for targeted interventions that tackle both barriers and motivators (Nguyen, 2023). Disaster preparedness constitutes a fundamental aspect of ethical household practices, encompassing emergency planning and resource management to guarantee safety and resilience against natural hazards. This practice is influenced by factors including awareness, education, and resource accessibility, which differ significantly among various demographic groups (Harvey, 2010; Poortinga et al., 2004). Ethical practices in households necessitate a thorough comprehension of the fundamental drivers and obstacles.

2.3. Household lifestyle

Household consumption plays a dual role, serving as both a driver of socio-economic progress and a significant contributor to carbon emissions (Huang et al. (2024). To support a greener future and minimize environmental harm, it is crucial for households to adopt sustainable habits (Lubowiecki-Vikuk et al., 2021). This is particularly important as lifestyle choices, including energy consumption patterns, dietary habits, and overall spending behaviors, directly influence household carbon footprints and significantly impact greenhouse gas emissions (Long et al., 2017; Steen-Olsen et al., 2016). Drosos et al. (2020) suggest that consumer attitudes toward sustainability play a crucial role in shaping household energy efficiency decisions. Households that prioritise environmentally friendly practices are more likely to support and adopt renewable energy sources, reflecting a broader commitment to sustainable living. In the context of Malaysia's transition to a low-carbon state, transforming household lifestyles is a key component of collective sustainability efforts. Household behaviors play a critical role in determining energy consumption patterns, as daily choices regarding routines, product usage, and transportation methods contribute to overall energy demand (Ngah and Tsong, 2011). By recognising the role of consumer behaviour in energy consumption, policymakers, researchers, and stakeholders can develop strategies and interventions that target behavioural changes (Šćepanović et al., 2017). These efforts may include educational campaigns, financial incentives, regulations, and the promotion of energy-efficient technologies. By addressing both the supply and demand sides of the energy equation, a more sustainable and low-carbon energy future can be achieved (Bahinipati et al., 2022). In contemporary society, it is nearly impossible for households to remain unaware of the impact of their lifestyle and consumption choices (Królikowska-Tomczak and Machnik, 2019). This heightened awareness is partly because sustainability is increasingly recognised as a valuable principle (Enquist et al., 2007). By presenting a widely applicable research framework that focuses on behaviour and impact, this study aimed to contribute to the understanding of lifestyles in the context of societal transitions. The framework will offer a way to analyse and assess the practices and behaviours that constitute different lifestyles and how they can be influenced or transformed within specific socio-cultural and socio-technical contexts. The Household Lifestyle Energy indicators used in this research are Housing, Leisure Activities, Purchasing, Mobility, Food Consumption and Wastage reflect the various aspects of households' daily lives that have a significant impact on their energy consumption patterns.

2.3.1. Housing

Housing plays a significant role in achieving climate and other sustainability objectives (Wang and Tsai, 2022). Globally the operation of buildings (residential and non-residential included) is estimated to account for 26 % of global energy-related emissions (IEA, 2023). Gram--Hanssen (2015), highlights that housing involves more than just having a physical space; it encompasses creating an environment that supports everyday activities related to self-care and caring for others. According to Eon et al. (2018), the trends in housing-related lifestyles clearly affect household energy use and environmental impact, both directly (e.g., heating, cooking, electricity for lighting and appliances, personal hygiene) and indirectly (e.g., the energy and resources embedded in material goods). For instance, the rise in the number of domestic appliances led to an increase in electricity demand for appliances and lighting, rising from 16 % of household energy consumption in 2000 to 19 % in 2012. Huebner et al. (2015) found that building factors accounted for the most significant variability in energy consumption. Other researchers have also examined specific characteristics of buildings or dwellings, such as the dwelling's surface area and the building's age, which is often a key factor in driving energy-efficient retrofits (Achtnicht and Madlener, 2014; Dolšak, 2023). Essentially, older buildings are more likely to undergo energy-efficient retrofits.

2.3.2. Leisure activities

Leisure activities play a vital role in improving quality of life while also promoting sustainability (Vaugeois et al., 2022; Yoon et al., 2021). Leisure activities refer to enjoyable pastimes pursued during free time, promoting both physical well-being and mental relaxation. Engaging in such activities fosters an active lifestyle, which enhances overall happiness, reduces stress, and improves quality of life (Ye et al., 2023). These activities encompass various forms of relaxation, entertainment, knowledge expansion, and spontaneous social interactions, including watching television or videos, listening to the radio, and using computers at home (Veal, 2019). Technologies have significantly changed the dynamics of the home, particularly influencing home-based leisure activities. Hamayun (2022) states that individuals using digital devices often shift between various digital media formats without forming a deep emotional connection to any specific activity. This impact largely depends on the specific type of technology and how it is used by individuals and social groups within the household (Beeri et al., 2007). The Internet and Internet-based media enable people to engage in social leisure activities through digital platforms, allowing household members to connect, stay in touch with friends and acquaintances, and meet new people (López-Sintas et al., 2017). Modern households have access to technologies that previous generations did not have. Devices like gaming consoles and DVD players offer new, energy-consuming ways to enjoy leisure activities (Brenčič and Young, 2009).

2.3.3. Purchasing

Purchasing energy-efficient products that lower energy consumption and costs while improving energy efficiency is a key aspect of sustainable energy consumption (Husain et al., 2022). This also includes using energy-efficient household appliances, which not only incorporate sustainable energy sources within the home but also help prevent general energy waste. Drosos et al. (2020) found that many consumers adopt energy-efficient habits, such as using energy-saving lamps and switching off lights when leaving a room. Additionally, a considerable number of respondents consider energy labels when purchasing home appliances, demonstrating increased awareness of energy efficiency in consumer decision-making. Despite the advantages of energy-efficient appliances, many people continue to use their old household items. According to the Association of Water and Energy Research Malaysia (AWER, 2012), the adoption of energy-efficient products in Malaysia is still low, largely because households prefer cheaper, less energy-efficient options. Research suggests that higher disposable income can sometimes lead to less environmentally friendly household behaviours (Trotta, 2018). Households with more financial resources may not feel the pressure to budget for energy costs, leading to less economical behaviour in terms of energy savings. In contrast, those with lower disposable income are more likely to seek ways to reduce energy expenses and adjust their behaviour accordingly. Financial constraints are acknowledged as a major barrier to effective retrofitting efforts (Felius et al., 2020).

2.3.4. Mobility

Sustainable household mobility plays a key role in tackling global environmental issues while enhancing urban living standards (Stojanovi'c et al., 2023). The transportation sector remains a major source of greenhouse gas emissions and noise pollution, with personal vehicle usage contributing significantly to these challenges (Aminzadegan et al., 2022). In Malaysia, efforts are underway to improve energy efficiency by encouraging fuel-efficient and electric vehicles through incentives (Abbasi et al., 2021; Daud et al., 2023). Expanding public transport aims to reduce car usage and support greener commuting (Abd Majid and Jaaffar, 2023; Wang and Xing, 2024). Additionally, eco-driving techniques are promoted to enhance fuel efficiency and lower emissions (Ma et al., 2024). Reducing car dependence and fostering sustainable mobility requires a variety of complementary policy measures. The existing mobility framework is shaped not only by individual behaviours and preferences (Shove and Walker, 2010) but also by a complex network of institutions, infrastructure, and daily practices that together reinforce reliance on cars (Mattioli, 2020).

2.3.5. Food consumption

The rising levels of food consumption have intensified environmental challenges. Damari and Kissinger (2024) suggests that household food consumption is a key factor influencing energy efficiency, as food production, storage, and preparation require substantial energy inputs. The study highlights that different household types exhibit varying consumption patterns, which in turn affect their environmental footprint and energy use. Lőrincz et al. (2023), further emphasise that adopting indirect efficiency behaviours in food consumption such as selecting meals that require varying amounts of energy for preparation, from none (e.g., cold meals) to low (e.g., microwaving) and high (e.g., using an electric oven) can play an important role in reducing this footprint. However, traditional eating habits present a significant obstacle to sustainable food consumption. Many households prefer to stick to their established dietary patterns (Mäkiniemi and Vainio, 2014). Additionally, a substantial number of individuals are either unaware of or sceptical regarding the environmental implications of food production (Phan, 2024; Vittersø and Tangeland, 2015). Furthermore, some households do not see the benefits of choosing more sustainable food options and lack the motivation to make such changes (Vittersø and Tangeland, 2015).

2.3.6. Waste management

Implementing energy-efficient waste management practices, such as recycling, waste reduction, and waste-to-energy conversion, can yield substantial environmental benefits. Pongpunpurt et al. (2022) highlight that proper waste sorting at the source is essential for efficient waste management, as it helps reduce landfill dependence, minimize pollution, and improve the recycling process for materials such as plastic, paper, and glass. Similarly, Zheng et al. (2022) emphasise that household waste, which consists of materials like paper, plastic, glass, metal, and organic matter, plays a crucial role in the overall waste management system, making proper sorting and disposal practices vital for sustainability. This type of waste significantly contributes to global environmental pollution (Immurana et al., 2022). With the global population rising, the volume of household waste continues to grow, posing serious environmental challenges. Human activities, especially in residential areas, are major contributors to waste production. To address this issue, reducing unnecessary waste and choosing eco-friendly products are effective measures for mitigating the environmental impact of solid waste (Chu et al., 2023). Thus, reducing household waste is integral to promoting sustainable waste management and minimising pollution. These indicators are fundamental in influencing household behaviour and lifestyle choices that substantially impact energy consumption. Examining these indicators collectively allows researchers to better understand the influence of behaviours in various domains on overall energy consumption and carbon emissions. This approach identifies specific areas for targeted interventions and policies to promote sustainable energy practices. Informed decisions and the adoption of energy-efficient habits enable individuals to contribute to a sustainable future.

2.4. Attitude

Household attitudes toward energy consumption are multifaceted constructs that encompass beliefs, perceptions, preferences, and behaviours regarding energy use. These attitudes are shaped by a range of factors, including individual values, socioeconomic status, cultural norms, environmental awareness, and technological advancements (Li et al., 2024). Three main components of attitudes are Relative Advantage, Compatibility, and Complexity. Relative Advantage pertains to the perceived benefits of adopting certain energy-saving behaviours or technologies compared to alternatives. These benefits may include cost savings, environmental advantages, health improvements, convenience, social status, and energy security (Atanasov et al., 2023; Lin et al., 2023). Compatibility, which measures how well attitudes toward energy use align with technological, social, cultural, economic, and policy contexts. For example, positive attitudes toward renewable energy are more likely to result in adoption if the technology is accessible and affordable (Asif et al., 2023). Compatibility is also shaped by social norms, economic realities, policy incentives, and psychological factors (Rahman and Thill, 2023). Lastly, Complexity involves the various factors influencing energy consumption behaviours, such as personal values, cultural norms, economic considerations, technological perceptions, and policy frameworks (Ogiemwonyi et al., 2023). Understanding these components allows stakeholders to develop more effective strategies to encourage sustainable energy practices and promote positive behavioural changes.

2.5. Hypotheses development

2.5.1. The relationship between attitude and ethical practice

A positive attitude is a crucial factor influencing the purchase of energy-efficient appliances (Waris et al., 2022; Waris and Hameed, 2021). Wang et al. (2023) found that attitude significantly affects household intentions to conserve energy. Similarly, Pop et al. (2022) concluded that a positive attitude toward energy conservation directly impacts households' behaviour, leading them to adopt practices like using energy-saving bulbs or choosing low-energy products. Recent research highlights three key components; Relative Advantage, Compatibility, and Complexity that shape household energy consumption behaviour. Households are more likely to adopt energy-efficient practices when they perceive benefits such as cost savings (Ekim et al., 2023) and when these behaviours align with their values (Compatibility). The perceived ease of understanding and implementing these practices (Complexity) also plays a role (Kleinschafer et al., 2021). Sossa et al. (2023) emphasised that both internal (e.g., values) and external factors (e.g., policy incentives) are vital in shaping energy consumption behaviours. Psychological and demographic factors, such as attitudes, social norms, and perceived behavioural control, also significantly influence energy-saving intentions (Zhang et al., 2023). Additionally, financial capability affects energy efficiency decisions, with higher-income households showing stronger intentions to conserve energy (Trotta, 2021). Understanding these dynamics is essential for developing effective policies to enhance household energy efficiency (Salas-Zapata et al., 2023). Building on previous empirical findings, the following hypotheses are proposed.

H1. There is a significant positive effect between attitude and ethical practice among households in Selangor

2.5.2. The relationship between ethical practice and energy efficiency

Energy efficiency is greatly influenced by ethical household practices. Studies reveal that ethical consumption, exemplified by the acquisition of energy-efficient appliances, is associated with greater levels of energy efficiency in a household's overall consumption patterns (Tan et al., 2021). Furthermore, ethically conscious households frequently report being more conscious of how much energy they consume, which encourages them to take proactive steps to save energy. This knowledge supports a way of living that prioritises energy conservation and sustainability (Zhou et al., 2024). Energy-efficient technology adoption may rise if ethical practices are considered while making decisions in the home. Research indicates that families are more willing to purchase energy-saving equipment and habits when they perceive energy efficiency as an ethical duty (Du et al., 2023). Building on previous empirical findings, the following hypotheses are proposed.

H2. There is a significant positive effect between ethical practice and energy efficiency among households in Selangor

2.5.3. The relationship between ethical practice and household lifestyle

Ethical practices significantly influence household lifestyle decisions, particularly in consumption patterns. Research shows that ethically-conscious consumers tend to make lifestyle choices aligned with their values, such as choosing eco-friendly products and reducing waste (Tan et al., 2021). Furthermore, households that embrace ethical behaviours, like supporting local businesses and fair trade, often experience broader lifestyle changes that promote sustainability and community engagement (Zhang et al., 2024). Studies indicate that families incorporating ethical decision-making into their daily routines report greater satisfaction and stronger familial relationships (Henderson and Mitrova, 2020). In addition, a coherent lifestyle is promoted when ethical actions and home beliefs are in sync. Families that place a high value on social responsibility and sustainability tend to establish common objectives in these areas, which leads to a cohesive way of making decisions on lifestyle(Aguirre-Sanchez et al., 2023). Finally, adopting ethical practices can result in behavioural adaptations that improve households' general well-being. Because shared values foster a nurturing and peaceful home environment, families that practise ethical lifestyle report better relationships and communication (Fischbacher et al., 2021). Building on previous empirical findings, the following hypotheses are proposed.

H3. There is a significant positive effect between ethical practice and household lifestyle in Selangor

2.5.4. The relationship between household lifestyle and energy efficiency

The concept of lifestyle has influenced energy policy discussions since the 1970s (Nader and Beckerman, 1979). Energy-related lifestyles involve the everyday activities shaped by social norms that impact how much energy households use at home (Gram-Hanssen, 2015). These lifestyles cover choices related to food, housing, transportation, household goods, leisure, and communication, all of which contribute to unsustainable practices (Labandeira et al., 2020). Looking ahead, achieving carbon neutrality will heavily rely on adopting sustainable household practices (Neuvonen, 2014). Studies indicate that changing our daily habits and consumption patterns can significantly reduce emissions (Froemelt and Wiedmann, 2020; Shigetomi et al., 2021). Key strategies include investing in energy-efficient appliances (Hosan et al., 2022), opting for alternative transportation to cut down on car use (Huang et al., 2024), and reducing single-use plastics (Ali et al., 2022). These adjustments in lifestyle are crucial for creating a more sustainable future. Building on previous empirical findings, the following hypotheses are proposed.

H4. There is a significant positive effect between household lifestyle and energy efficiency among households in Selangor

2.5.5. Mediating role of household lifestyle on the relationship between ethical practice and energy efficiency

Ethical practices play a key role in shaping household lifestyles, often encouraging more sustainable and responsible choices. People who follow ethical principles tend to reflect these values in their consumption habits, showing a sense of responsibility toward the environment and society. Research shows that individuals guided by ethical principles often demonstrate environmental responsibility through their consumption patterns, particularly in energy usage (Khalid et al., 2024). Aydın and Ünal (2015), explain that a household's lifestyle not only affects their environmental awareness but also drives responsible actions, such as reducing energy use and embracing green technologies. Similarly, Tandon et al. (2023) emphasise that green consumption, driven by ethical values, promotes environmentally responsible actions. In essence, household lifestyle acts as a mediator between ethical practices and energy efficiency. By fostering a sustainability focused lifestyle, ethical practices lead individuals to adopt energy-saving actions, demonstrating how an ethically driven way of living supports energy efficiency. Building on previous empirical findings, the following hypotheses are proposed.

H5. Household lifestyle mediates the relationship between ethical practice and energy efficiency among households in Selangor

3. Research framework

Fig. 1 presents the research framework and the proposed hypotheses for the study.

4. Methodology

This study employed a quantitative research approach using a survey method to investigate the influence of attitude and ethical practices on energy efficiency, with household lifestyle as a mediating factor. The household's attitude consists of three dimensions, which are relative



Fig. 1. Research framework.

advantage, compatibility, and complexity, while household lifestyle factors comprise housing, leisure activities, purchasing, mobility, food consumption, and waste. The research process flowchart is illustrated in Fig. 2 below.



Fig. 2. Research process.

4.1. Population and sampling

The population of the study was households in Selangor district. The study was conducted in the Petaling district of Selangor. Petaling was chosen due to its higher electricity bills compared to other districts in Selangor, indicating significant energy consumption patterns that are relevant to this study. A sample of 500 households from various dwelling types (bungalow, terrace, semi-detached, detached house, condominium or apartment, low-cost house, low-cost flat, townhouse, flat house, and cluster house) were chosen. A stratified random sampling technique was employed to ensure the sample is representative of various types of dwellings within Petaling. The inclusion criteria for participants are energy bill payers and being able to understand and respond to the survey questionnaire in English or Bahasa Malaysia.

4.2. Instrument development

An expert review session was conducted to get the experts' comments and recommendations on the draft questionnaire. The draft questionnaire was developed based on measurement items from the previous studies. The purpose of employing an established measurement from previous studies was to link with them and fill the research gap that was identified in the theoretical framework. Then changes were made to the questionnaire to remedy the ambiguous statements, remove unnecessary or redundant terms, and improve the flow and structure of the questions. It will then be validated in a focus group discussion (FGD) session. FGD was then carried out through a discussion with relevant energy practitioners and households in Selangor. Their role was to review the content of the questionnaire for relevance, clarity, understandability, and speed of completion. The focus group session consists of at least 15 members, including ten (10) households and five (5) representatives from an energy company (Tenaga Nasional Berhad). Subsequently, a pilot study was conducted to verify the viability of the developed determinants. The questionnaire was distributed to thirty (30) households in Selangor. The responses of the pilot study will be used to improve the clarity of individual questions and the format. These adjustments are sought to improve the reliability and validity of the survey instrument. The final structured questionnaire was developed using indicators and items generated from experts' reviews, focus group discussions, and a pilot study. It consists of four sections: energy efficiency, attitude towards energy efficiency, ethical practices, household lifestyle factors, and demographic information, all of which are measured using a 5-point Likert scale.

4.3. Data collection

The questionnaires were disseminated to the 500 respondents in the Petaling district through a self-administered survey from March to May 2024. The survey was administered to heads of households as they are responsible for paying utility bills and managing household energy use. Each survey was completed in the presence of the data collector without any interference. Respondents were selected from ten (10) types of houses (bungalow, terrace, semi-detached, detached house, condominium or apartment, low-cost house, low-cost flat, townhouse, flat house, and cluster house). The face-to-face interviews were chosen over alternatives like telephonic or email interviews due to their ability to facilitate more in-depth discussions. As noted by Aborisade (2013), this method allows for a richer exchange of information, enabling interviewers to ask more detailed follow-up questions and obtain comprehensive responses. This personal interaction also aids in building rapport with respondents, which can lead to more thoughtful answers.

4.4. Data analysis

The collected data was analysed using Statistical Package for Social Science (SPSS) Statistics and Partial Least Square Equation Model (PLS-SEM) software. SPSS was used for data cleaning, screening and descriptive statistics for demographic characteristics of the respondents. PLS-SEM was used to analyse the measurement models and structural models for the studied variables, which were attitude, ethical practices, household lifestyle, and energy efficiency.

5. Results

5.1. Respondents

A total of 500 surveys were distributed and collected. Due to the presence of the data collector a 100 % of response was obtained. The respondents are predominantly male with 340 respondents (68.0 %), with a significant portion of respondents aged between 36 and 59 years, 293 respondents (58.6 %). The majority are married (66.0 %), and most hold diplomas (29.8 %) or higher education degrees (31.6 %). Most respondents work full-time (81.4 %), with nearly half (49.2 %) earning below RM5,250 monthly. Household sizes are mostly small, with 255 respondents (51.0 %) having 1-3 members, and a similar trend is observed in electricity bills, where 235 (47.0 %) of respondents pay between RM250 and RM500 monthly. Lastly, the housing data reveals that the respondents live in a variety of housing types, with terrace houses being the most common 88 respondents (17.6 %). Other significant housing types include low-cost houses 56 respondents (11.2 %) and flat houses 59 respondents (11.8 %). Table 1 presents a detailed respondents' profile.

5.2. Measurement model analysis

The reliability and validity of the adapted items were analysed based on previous research by Bryman and Cramer (2012). To assess the second-order reflective constructs of attitude and household lifestyle, the two-stage analytical approach proposed by Henseler and Fassott (2010) and Ringle et al. (2012) were employed. This involved deriving construct scores from first-order constructs (Becker et al., 2012). The validity and reliability of these second-order measurements were then evaluated, as demonstrated in Figs. 3 and 4.

5.3. The reliability analysis and validity analysis

A comprehensive reliability analysis was conducted to ensure the instrument produced consistent and stable results for further analysis (Mohajan, 2017). The analysis was performed using PLS-SEM 4 and both indicator reliability and internal consistency reliability were examined. For indicator reliability, factor loadings of each indicator within its construct were evaluated, following Hair Jr et al.'s (2021) recommended threshold of 0.50 as shown in Table 2. This evaluation led to the removal of sixteen items that fell below the threshold, including three items from Housing (H1, H3, H7), three from Mobility (MOB2, MOB7, MOB9), two from Food Consumption (FC3, FC5), one from Purchasing (P5), two from Ethical Practice (EP2, EP7), and five from Energy

Characteristics		Frequency	Percentage (%)
Gender	Male	340	68.0
	Female	160	32.0
Age	18–35	182	36.4
0	36–59	293	58.6
	60 and above	25	5.0
Status	Single	116	23.2
	Married	330	66.0
	Single parent	54	10.8
Education Level	Professional	23	4.6
	Diploma	149	29.8
	PhD/Master	77	15.4
	Degree	81	16.2
	Others	170	34.0
Employment Status	Full-time employee	407	81.4
	Self-employed	60	12.0
	Others	33	6.6
Monthly Household	Below RM5,250	246	49.2
Income	RM5,250 -	190	38.0
	RM11,820		
	More than	64	12.8
	RM11,820		
Number of Households	1-3 people	255	51.0
	4-6 people	198	39.6
	More than 6 people	47	9.4
Average Electricity Bill	Below RM250	109	21.8
	RM250 - RM500	235	47.0
	RM501 - RM750	98	19.6
	RM751- RM1000	27	5.4
	More than RM1000	31	6.2
Type of house	Bungalow	39	7.8
	Terrace	88	17.6
	Semi-D	51	10.2
	Condominium	51	10.2
	Low-cost house	56	11.2
	Low-cost flat house	51	10.2
	Townhouse	43	8.6
	Flat house	59	11.8
	Cluster house	29	5.8
	Village house	33	6.6

Efficiency (EE2, EE12, EE13, EE14, EE15). Following these removals, the remaining measurement items demonstrated significant loadings ranging from 0.55 to 0.84. Internal consistency reliability, assessed through composite reliability as proposed by Hair et al. (2019), showed satisfactory Cronbach's alpha and Composite Reliability values ranging from 0.86 to 0.94, exceeding the recommended threshold of 0.70. Subsequently, validity analysis encompassed both convergent and discriminant validity measures. While some constructs exhibited Average Variance Extracted (AVE) values below the recommended 0.5 thresholds, these were deemed acceptable according to (Fornell and Larcker, 1981) criteria, as their composite reliability values exceeded 0.7, thus supporting the measurement model's validity.

As for discriminant validity, the HTMT evaluates the discriminant validity of constructs. According to Henseler et al. (2015), any constructed values less than 0.90 indicate a lack of discriminant validity. Following that, the results of the PLS algorithm show that all of the HTMT values for the four constructs in this study are less than 0.90, indicating that discriminant validity was established in this study as shown in Table 3. The HTMT values less than 0.90 indicate that all four indicators in the current study are conceptually distinct.

5.4. Measurement goodness fit

The goodness of fit assessment in this study was conducted using multiple indices. The Standardised Root Mean Square Residual (SRMR), which measures the discrepancy between the estimated model and actual data in standard units, revealed values of 0.07 for the saturated model and 0.09 for the estimated model. According to Hu and Bentler



Fig. 3. First order construct.



Fig. 4. Second order construct.

(1999), an SRMR value below 0.08 suggests a good fit, indicating that the saturated model meets this criterion and demonstrates a better fit compared to the estimated model. The normed fit index (NFI) values were found to be 0.52 for the saturated model and 0.51 for the estimated model. While NFI values range from 0 to 1, with higher values indicating better fit, both models demonstrated relatively low values, suggesting a marginal fit (Henseler et al., 2015). Additionally, the chi-square value of 28.18 (calculated as 11443.08/(407-6)) did not exceed the standard threshold of 3, indicating a decent model fit (Mantel, 1963). The collective assessment of these goodness-of-fit indices demonstrates that the saturated model provides a superior fit to the data compared to the estimated model, as evidenced by its more favourable SRMR, d_ULS, d_G, and Chi-square values. Although the NFI values were low for both models, the saturated model maintained a marginally better performance, ultimately supporting its selection as the better-fitting model as shown in Table 4.

5.5. Structural model analysis

5.5.1. Direct effect analysis

The empirical relationships among variables were examined based on the principle that empirically related indicators reflect the same concept and can be included in the same index. Following Hair Jr et al. (2021) guidelines, the analysis reported path coefficients, standard errors, and t-values for the structural model using a 5000-sample re-sample bootstrapping procedure (Ramayah et al., 2018). The significance criteria for measurement indicators stipulated that path coefficients should exceed 0.1, with t-values greater than 1.645 at p < 0.05 or exceeding 2.33 at p < 0.01 (Lohmöller, 2013). Based on these criteria, as shown in Table 4, all four hypotheses demonstrated significant relationships and were consequently accepted. The coefficient of determination (R²) for energy efficiency was 0.66, indicating that attitude, household lifestyle, and ethical practice collectively explained 66 % of the variance in energy efficiency, representing a moderate level of explanatory power as shown in Table 5.

5.5.2. Mediating analysis

This section examines the mediating effect of household lifestyles on the relationship between ethical practice and energy efficiency (H5). The analysis incorporated both direct and indirect impacts of the independent variable on the dependent variable through the mediating variable. Following Hair Jr et al. (2014) recommendation, the mediation analysis employed Preacher and Hayes (2008) approach using Structural Equation Modelling (SEM), which was selected over regression techniques due to its capacity to model both measurement and structural relationships while providing overall index values. The bootstrapping

Table 2

Reliability and validity.

Variable First Order Construct	Item Code	Initial model	Modified Model	Variable Second Order Construct	Construct Reliability and		
					Cronbach's Alpha	CR	AVE
Relative Advantage	RA1	0.62	0.62	Attitude	0.90	0.91	0.39
	RA2	0.77	0.77				
	RA3	0.50	0.50				
	RA4 DAE	0.71	0.71				
	RA5 RA6	0.60	0.60				
Compatibility	COMPB1	0.70	0.70				
compationity	COMPB2	0.68	0.68				
	COMPB3	0.68	0.68				
	COMPB4	0.66	0.66				
	COMPB5	0.65	0.65				
	COMPB6	0.71	0.71				
Complexity	COMPLAT	0.77	0.77				
	COMPLAZ COMPLAZ	0.61	0.61				
	COMPLX3	0.68	0.68				
	COMPLX5	0.69	0.69				
	COMPLX6	0.70	0.70				
Housing	H1	0.36	deleted	Consumer Lifestyle	0.94	0.94	0.32
	H2	0.68	0.72				
	H3	0.48	deleted				
	H4	0.75	0.78				
	H5	0.72	0.74				
	H6	0.65	0.67				
	П/ Ц9	0.49	0.60				
	H9	0.39	0.60				
	H10	0.60	0.58				
Leisure Activities	LA1	0.62	0.62				
	LA2	0.55	0.55				
	LA3	0.71	0.71				
	LA4	0.73	0.73				
	LA5	0.59	0.59				
Mobility	MOB1	0.67	0.70				
	MOB2	0.40	deleted				
	MOB3 MOB4	0.77	0.79				
	MOB5	0.64	0.79				
	MOB6	0.76	0.78				
	MOB7	0.44	deleted				
	MOB8	0.68	0.70				
	MOB9	0.46	deleted				
	MOB10	0.70	0.70				
Food Consumption	FC1	0.63	0.63				
	FC2	0.80	0.80				
	FC3 FC4	0.48					
	FC5	0.44	deleted				
	FC6	0.62	0.62				
	FC7	0.59	0.59				
Purchasing	P1	0.63	0.64				
	P2	0.68	0.68				
	P3	0.63	0.64				
	P4	0.75	0.77				
	P5	0.47	deleted				
	P0 P7	0.77	0.77				
Wastage	WSTGE1	0.72	0.72				
	WSTGE2	0.74	0.74				
	WSTGE3	0.67	0.67				
	WSTGE4	0.75	0.75				
	WSTGE5	0.77	0.77				
	WSTGE6	0.55	0.55				
Ethical Practice	EP1	0.76	0.79	Ethical Practice	0.86	0.89	0.59
	EP2 ED2	0.49	deleted				
	EP3 FD4	0.70	0.70				
	EP5	0.72	0.74				
	EP6	0.81	0.84				
	EP7	0.42	deleted				
	EP8	0.75	0.76				
Energy Efficiency	EE1	0.78	0.80	Energy Efficiency	0.88	0.89	0.46
	EE2	0.41	deleted				

(continued on next page)

Table 2 (continued)

Variable First Order Construct	Item Code	Initial model	Modified Model	Variable Second Order Construct	Construct Reliability and Validity		and Validity
					Cronbach's Alpha	CR	AVE
	EE3	0.72	0.73				
	EE4	0.71	0.72				
	EE5	0.62	0.60				
	EE6	0.71	0.74				
	EE7	0.65	0.65				
	EE8	0.68	0.70				
	EE9	0.58	0.58				
	EE10	0.64	0.65				
	EE11	0.69	0.72				
	EE12	0.33	deleted				
	EE13	0.49	deleted				
	EE14	0.36	deleted				
	EE15	0.48	deleted				
	EE16	0.56	0.57				

Table 3

Discriminant Validity.

	Attitudo	Household	Energy	Ethical
	Aunude	Lifestyles	Efficiency	Practice
Attitude			_	
Household Lifestyles	0.89			
Energy Efficiency	0.80	0.86		
Ethical Practice	0.73	0.83	0.82	

Table 4

Measurement goodness fit.

	Saturated model	Estimated model
SRMR	0.07	0.09
d_ULS	11.73	22.36
d_G	5.14	5.41
Chi-square	11443.08	11801.30
NFI	0.52	0.51

analysis revealed a confidence interval ranging from 0.36 to 0.58, indicating a statistically significant and positive mediation effect of household lifestyles. The absence of zero within this confidence interval, coupled with a significant P-value (P < 0.001), provides strong statistical evidence for the mediating role of household lifestyles. The bootstrapping results, as presented in Table 6, confirm the significance of the indirect effect of ethical practices on household energy efficiency through household lifestyles. This finding highlights the critical role that household lifestyles play in bridging the gap between ethical business practices and sustainable energy outcomes.

Table 5

Bootstrapping	analysis –	direct	effect.
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Path coefficient, β Standard Deviation High CL R^2 Hypotheses t-value P values Low CL Decision H1 Attitude → Ethical Practice 0.72 0.03 21.74 P < 0.0010.66 0.79 Supported 0.66 Ethical Practice \rightarrow Energy Efficiency 0.25 0.07 0.38 H2 3.61 P < 0.0010.11 Supported Supported Ethical Practice → Household Lifestyles 0.76 0.03 30.1 0.81 H3 P < 0.0010.72 H4 Household Lifestyles → Energy Efficiency 0.60 0.07 9.13 P < 0.0010.48 0.74 Supported

Table 6

Results of the analysis on mediation effects - indirect effect.

		Path coefficient, β	Standard Deviation	t- Value	Low CL	High CL	P values	Decision
H5	Ethical Practice \rightarrow Household Lifestyles \rightarrow Energy Efficiency	0.46	0.05	8.45	0.36	0.58	P < 0.001	Supported

6. Discussion

The objective of this study is to identify specific factors that would contribute significantly to the sustainability of energy efficiency with a specific focus on ethical practices arising from household lifestyles. Efficient energy usage within a household is not sustainable if each individual in the household subscribes to different values of ethical behaviours, but rather, a culmination of collective behaviours of each member of the household arising from their shared perceptions towards ethical behaviour. Findings from this study indicate that the eventual achievement of energy efficiency within a household is rooted within each household member's perception of the relative advantage of each energy-saving as shown in the study by Ogiemwonyi et al. (2023), and the alignment of attitude's positive energy use and ability to handle various factors influencing energy consumption behaviours (Appiah et al., 2023; Ogiemwonyi et al., 2023).

6.1. Direct effects

To determine the influence of each relevant variable on the other, four direct effects were hypothesised and tested, namely, household attitude and ethical practice, ethical practice and energy efficiency, ethical practice and household lifestyle, and household lifestyle and energy efficiency. Consumer attitude is found to have a significant relationship with ethical practice. The effect of attitude on ethical practice when tested using the components of relative advantage, compatibility and complexity adapted from Pop et al. (2022), Ekim et al. (2023) and Kleinschafer et al. (2021) is found to be significant. Findings from this study are in congruence with the works of Pop et al. (2022), Ekim et al. (2023) and Kleinschafer et al. (2021) indicating that households that have a positive attitude toward energy conservation tend to translate their beliefs into practice.

Ethical practice, in turn, leads members of the household to adopt

energy efficiency behaviour, as highlighted in this study. Respondents are found to uphold their ethical values when purchasing energyefficient appliances (Tan et al., 2021), exercise prudence in their energy consumption and make conservation of energy a part of their daily routine (Zhou et al., 2023). Their behaviour is consistent with the findings by Du et al. (2023) who reported that households that engage in ethical practices believe that they are duty-bound to buy energy-efficient appliances.

When ethical practice was tested on household lifestyle, a positive relationship was found. When it comes to domestic consumption, Tan et al. (2021) concluded that households that are considering any lifestyle decisions, like purchasing environmental-friendly products, often let their ethical values guide their decisions. Likewise, they are more inclined to prioritise social responsibility and sustainability (Aguirre et al., 2022; Zhang et al., 2024) by buying fair-trade products and supporting businesses within their locality. Indeed, families embodying ethical behaviours often display a clear sense of purpose and a structured lifestyle in their daily activities (Henderson and Mitrova, 2020). As such, they are more adaptable and accommodating when responding to any changes to their lifestyle.

One significant factor contributing to the attainment of a low-carbon state in Malaysia is the successful transformation of household lifestyles. Households are increasingly aware of their roles in energy consumption practices and are making informed decisions regarding the purchase of energy-efficient appliances and transportation methods. The findings of this study indicate a significant positive relationship between household lifestyle and energy efficiency in households within the state of Selangor. Respondents show a willingness to adjust their energy-related daily activities and consumption behaviours, including decisions concerning food, housing, transportation, consumer goods, leisure, and communication. This includes their willingness to change consumption patterns that can reduce emissions (Froemelt and Wiedmann, 2020; Shigetomi et al., 2021).

The findings also suggest a cascading effect where the adoption of energy-efficient practices in one area often leads to increased awareness and implementation in others. For instance, households that initiated energy-saving measures in home appliance usage were 2.3 times more likely to subsequently adopt sustainable transportation practices (Zhang et al., 2024). This interconnected nature of lifestyle changes highlights the importance of comprehensive approaches to promoting energy efficiency that address multiple aspects of daily life simultaneously. The findings align with recent research indicating that a successful transition to a low-carbon society requires integrated lifestyle modifications rather than isolated behavioural changes (Henderson and Mitrova, 2020; Liu et al., 2021). These findings suggest that Selangor's approach to sustainable transportation and energy efficiency could provide valuable insights for other developing regions while indicating the need for integrated transport-energy policies that combine infrastructure development with behavioural incentives.

6.2. Mediation effect

To determine the mediating role of household lifestyle on the relationship between ethical practice and energy efficiency, this study uses six indicators that shape household behaviours and lifestyle choices such as (1) housing, which emphasises on the presence of an environment that supports everyday activities related to self-care and caring for others; (2) leisure activities that facilitate relaxation, entertainment, expanding knowledge, and spontaneous social engagement at home (Veal, 2019); (3) making a conscious decision when purchasing energy-efficient products (Hosan et al., 2022); (4) mobility, which involves transiting toward low-carbon mobility systems from those that are dependent on finite non-renewable resources; (5) reducing the carbon footprint associated with food consumption; and (6) implementation of waste management practices. Results of the mediation analysis distinctly indicate that household lifestyles function as a mediating variable in the relationship between ethical practices and energy efficiency, supporting the findings by Aydın and Ünal (2015) who contended that a household lifestyle not only affects their environmental awareness but also drives responsible actions, while Khalid et al. (2024) concluded that an individual's ethical beliefs would steer the person toward a responsible behaviour, and Tandon et al. (2023) advocated that ethical values promote environmentally responsible actions.

In summary, all of the hypotheses are listed in Table 7 below.

7. Conclusion

This study aims to address the effects of attitude and ethical practices on energy efficiency and determine if household lifestyle has any mediating effects on these relationships. The results show how attitudes and ethical practices influence household behaviours and energy efficiency. They also indicate that household lifestyle has a significant mediating effect on the relationship between household attitude, ethical practices, and energy efficiency. These findings also contribute substantially to developing targeted energy-saving plans in Selangor, corresponding with the Rancangan Selangor Pertama's 2025 goals for sustainability, social inclusion, and well-being. Based on the outcomes of this project, the Selangor state government may consider establishing neighbourhood-based energy efficiency initiatives, including workshops, peer-to-peer education, and displays to encourage households to conserve energy. Financial incentives for renovating older homes with energy-efficient technologies like insulation and solar panels would be able to decrease energy usage, especially for middle- and low-income households. Expanding public transportation networks, tax incentives for electric vehicles, and charging infrastructure would reduce transportation energy use and promote low-carbon mobility. Public education campaigns on ethical consumption, energy-efficient products, and sustainable lifestyles might be launched online to reach more people. These efforts might be strengthened by granting discounts on energyefficient items and developing sustainability awareness campaigns with the private sector and NGOs.

However, the study's concentration on Selangor families limits its applicability to other Malaysian regions. Malaysia is geographically, culturally, and economically diverse, so states like Kelantan and Perlis, with different infrastructural development levels and socio-economic conditions, may have different energy consumption patterns and face unique challenges in implementing energy-efficient practices. Thus, future studies should involve households from varied Malaysian locations to capture the complete spectrum of views, ethical practices, and lifestyle factors that affect energy usage. Addressing these restrictions and targeting interventions can help Selangor meet its sustainability targets by making families aware of energy-saving methods and

Table 7	
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Summary	of	hypot	heses	testing
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Нурс	otheses	Path coefficient, β	t- value	Results
H1	There is a significant positive effect between attitude and ethical practice among households in Selangor	0.72	21.74	Accepted
H2	There is a significant positive effect between ethical practice and energy efficiency among households in Selangor	0.25	3.61	Accepted
H3	There is a significant positive effect between ethical practice and household lifestyle in Selangor	0.76	30.1	Accepted
H4	There is a significant positive effect between household lifestyle and energy efficiency in Selangor	0.60	9.13	Accepted
H5	Household lifestyle mediates the relationship between ethical practice and energy efficiency among households in Selangor	0.46	8.45	Accepted

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motivated to execute them.

Given that Selangor is the most advanced state in Malaysia, the outcomes from this study would be able to pave the way for other states to embark on similar energy-efficiency initiatives to strive to develop their own goals for sustainability, social inclusion, and well-being.

CRediT authorship contribution statement

Salina Daud: Writing – original draft, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. Wan Noordiana Wan Hanafi: Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. Sabihah Hitam: Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. Maryam Jamilah Asha'ari: Writing – review & editing, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. Mariam Abdul Majid: Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. Mariam Abdul Majid: Writing – review & editing, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. Wan Fadzilah Wan Yusoff: Writing – review & editing, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. Maisarah Ahmad Sofi: Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. Maisarah Ahmad Sofi: Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

Data will be made available on request.

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