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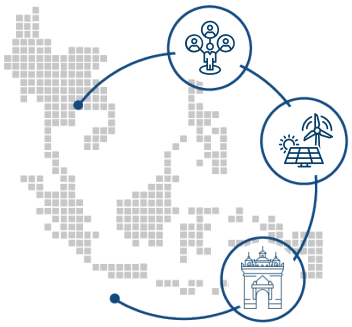
ASEAN Centre for Energy
One Community for Sustainable Energy

The 4th ASEAN International Conference on Energy and Environment

Charting ASEAN's Energy Future for Regional Interconnectivity and Resilience Under Lao PDR Chairmanship



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Highlights

- Initiated in 2021, the ASEAN International Conference on Energy and Environment (AICEE) provides a platform discussion for policymakers, researcher, and private industry to exchange ideas and incorporate insights into regional energy policy planning. In conjunction with the ASEAN Ministers on Energy Meeting (AMEM) and ASEAN Energy Business Forum (AEBF), the conference is held annually, and this year marks the 4th edition with the theme of "Charting ASEAN's Energy Future for Regional Interconnectivity and Resilience". The theme was selected based on the Lao PDR's Chairmanship theme and APAEC 2021-2025.
- The conference provided valuable insights for policymakers, focusing on six (6) prioritised topics: 1) Energy Transition and New Emerging Technologies, 2) Interconnection: Energy Security and Accessibility, 3) Sustainability, Engineering, and Infrastructure, 4) Carbon Pricing and Green Investment, 5) Energy and Digitalisation, 6) Environment, Policy, and Socioeconomics.
- The insights are synthesised into seven (7) strategic recommendations for the APAEC 2026-2030: 1) Address high initial costs and promote investment for emerging technologies, 2) Harmonise technical standards and regulatory frameworks to facilitate power interconnection, 3) Promote energy efficiency in transportation and industrial sectors (garment and textile) for sustainable infrastructure, 4) Strengthen financial mechanisms in support of carbon neutrality, including carbon markets, green bonds, and taxonomies, 5) Foster the adoption of digital technologies in energy systems, including AI and Machine Learning, 6) Integrate just and inclusive to address the multifaceted dimensions of the energy transition, 7) Support Research and Development (R&D) and data-driven solutions for long-term energy planning by fostering knowledge sharing and collaboration.

1. Introduction

The year 2024 has proven to be a critical juncture for ASEAN in driving the comprehensive implementation of the region's strategic energy blueprint—ASEAN Plan of Action on Energy Cooperation (APAEC) 2021-2025 [1]. As ASEAN accelerates its efforts to complete APAEC' milestones, connectivity and sustainability have emerged as two key priorities on the regional agenda for 2024. Under Lao PDR chairmanship, the region made significant progress in advancing regional interconnectivity while promoting efficient energy use and renewable energy through the ASEAN Power Grid (APG). However, challenges still emerge to advance further regional energy policy planning. Fostering collaboration among policymakers, researchers, and private industry through a triple-helix approach will play a crucial role in shaping the next cycle of APAEC 2026-2030. This collaborative effort will help guide the region's energy development in the years ahead.

Annually held, the 4th ASEAN International Conference on Energy and Environment (AICEE) took place in Lao PDR on 25 September 2024 with the theme of **"Charting ASEAN's Energy Future for Regional Interconnectivity and Resilience,"** 250 submitted abstracts and 68 participants representing both regional and international. This conference aims to facilitate discussions on interdisciplinary and cross-sectoral issues to promote the ASEAN Energy Blueprint and energy priorities of Lao PDR Chairmanship.

There are six (6) selected topics based on its importance and derived from the APAEC Programme Areas: 1) Energy Transition and New Emerging Technologies, 2) Interconnection: Energy Security and Accessibility, 3) Sustainability, Engineering, and Infrastructure, 4) Carbon Pricing and Green Investment, 5) Energy and Digitalisation,

6) Environment, Policy, and Socioeconomics. Details of each title of the abstracts are accessible at the 4th AICEE conference proceedings [2].

This brief provides strategic measures that ASEAN can adopt, drawing on insights from the conference discussions to shape the region's energy future. Aligned with the conference's theme of energy interconnectivity and resilience, the brief emphasizes the role of emerging technologies and inclusive policies in fostering a sustainable energy-environment nexus. Additionally, the policy brief aims to provide enhanced views for APAEC Drafting Committee insights to be considered in the development of APAEC 2026-2030, under the theme "Advancing Regional Cooperation in Ensuring Energy Security and Accelerating Decarbonisation for a Just and Inclusive Energy Transition" [3].

2. ASEAN Triple Helix Energy Engagement

The ASEAN International Conference on Energy and Environment (AICEE) is the official platform that brings together policymakers, private sectors, and academic institutions across the region. Held annually in conjunction with the ASEAN Ministers on Energy Meeting (AMEM) and ASEAN Energy Business Forum (AEBF), AICEE facilitates knowledge sharing among these key stakeholders. It highlights cutting-edge research, encourages diverse perspectives, and promotes innovative solutions to address the intricate challenges of the region's energy transition and environmental sustainability.

Since 2021, AICEE is committed to fostering diversity and inclusiveness, creating a platform for the exchange of rich ideas and perspectives that strengthen ASEAN communities. By engaging the academic community, the conference also provides an opportunity for academicians to contribute their valuable insights through presented abstracts. This policy brief focuses on the latest abstracts presented at the 4th AICEE, with the aim of progressively incorporating academic insights.

3. Key Insights

The conference has generated valuable insights that can inform ASEAN policymakers on the **challenges** and **opportunities** associated with the current energy trends. The following points are derived from the designated topics discussed during the conference:

3.1. Energy Transition and New Emerging Technologies

The studies under the topic of energy transition and new emerging technologies explore innovative solutions to address. technical challenges in energy systems, focusing on enhancing efficiency and interconnectivity to ensure energy security and accessibility. It also led to cost savings as these technologies known to influence price volatility and consumer buying power, as emerging economics demand charges are substantial.

These studies cover a range of technologies, including energy storage systems, offshore wind energy, and solar-heat pump systems, highlighting their cost-effectiveness, lifespan, and market competitiveness. Meanwhile, emerging technologies also diversely covered from smart microgrids and wireless energy distribution which present groundbreaking methods for optimising energy distribution and transmission. The other research stressed conversion of hazardous cleaner fuel for more optimised emission reduction amid abundant of fossil fuel-based sources in the region. Additionally, several studies emphasise the importance of community participation to ensure equitable benefits from the energy transition.

Other research focuses on decarbonisation pathways, incorporating techno-economic assessments and policy analyses, such as evaluating emission factors and exploring the integration of biomass co-firing in existing power plants. Beyond the power sector, there is also study that investigate long-term planning for the transportation sector using multi-period optimisation models to identify cost-optimal decarbonisation strategies.

The common challenges identified include high initial costs, despite the clear economic viability for scaling these technologies. These findings underscore the need for enabling infrastructure investments and cost-saving approaches to support an innovative and emerging sustainable energy technologies to be deployed.

3.2. Interconnection: Energy Security and Accessibility

Emerging topics of ASEAN Energy Interconnection encompasses cases of regional power grid integration, including not only ASEAN's power grid vision but also initiatives outside the region, such as the European Union and Southern African Power Pool Integration Projects. As it is central for regional cooperation in ensuring a secure and accessible energy supply. In addition, there are also studies that deep dive into the specific case by area such as Central Coast Province in Vietnam, which discuss energy poverty as part of accessibility and Greater Mekong Subregion, which elaborate the socio-economic implications.

ASEAN countries can leverage their energy interconnection opportunities to improve energy security, strengthen regional cooperation, and foster sustainable economic development. The expansion of the ASEAN Power Grid through cross-border electricity transmission can significantly enhance regional energy security by improving the availability of renewable energy resources. With lessons learned from the European Union (EU) Power Grid and Southern Africa's Power Pool, it is significant to harmonise technical standards and regulatory policies for an integrated regional market.

In financial aspects, foreign investments on renewable energy infrastructure in the Greater Mekong Subregion (GMS) can significantly improve regional energy security while supporting economic growth. Specifically, in Vietnam, the ongoing process of securitisation can provide valuable experiences to share with ASEAN countries in aligning energy policies with national interests, domestic environmental policy, and international green transition commitments.

However, geopolitical tensions, technical barriers, financial constraints, policy misalignment, and social and environmental impacts remain significant challenges. The significant role of a major external power in ASEAN may lead to geopolitical power struggles, as other regional actors may be concerned about this power's growing influence over energy policies in the region. Political concerns over sovereignty and regional tensions may create obstacles for ASEAN Power Grid. This issue is further compounded by the absence of a unified regulatory framework within ASEAN, which impedes the seamless implementation of cross-border electricity transmission.

Additionally technical challenges such as ensuring grid compatibility, establishing uniform market codes, and developing adequate infrastructure, along with persistent financial risks for private investors to fund. With study case from Vietnam, energy poverty may worsen due to climate changes (temperature and rainfall), especially in poorer areas where households are already struggling with income and energy access. Addressing these will require coordinated regional efforts, strong policy frameworks, and effective governance to ensure energy projects are both sustainable and equitable.

3.3. Sustainability, Engineering, and Infrastructure

The research under this topic addresses the potential for energy efficiency enhancements in the ASEAN region's two most energy-intensive demand sectors, transportation and the industrial sector (garment and textile). The region's energy intensity is projected to decline with the implementation of policies and programs that emphasise better fuel economy, increased EV penetration, and more public transportation options. In addition to these measures, a study also looked at how to layout green spaces with renewable energy to connect transportation hubs and stations. These green spaces can help reduce emissions by serving as carbon sinks and lowering energy intensity. Building on this focus on energy efficiency, the study on garment and textile operations identifies further opportunities for improvement within the industrial sector. While some energy-saving strategies come at no cost, others may require investment; however, all lead to substantial reductions in energy consumption. Additionally, another study emphasises that implementing carbon credit mechanisms can play a crucial role in reducing overall emissions in the sector.

Complementing these findings, another area of research explores sustainable practices in hydropower operations. This study examines how solid waste is handled, as well as wastewater and biological treatments and incineration. By integrating more sustainable technology and improving material handling, hydropower facilities can align better with regional and national climate goals.

The focus on innovative solutions also extends to infrastructure development, where research highlights strategies to support the AMS's energy transition. For instance, the use of biomethane derived from palm oil mill liquid effluent (POME) demonstrates how hazardous waste can be transformed into a sustainable fuel alternative, replacing natural gas in buildings, transport, and industry. In a separate study, breakwater modelling is examined for its role in improving the sustainability and performance of floating marine solar energy systems.

Despite these advancements, the transition to a sustainable energy future requires substantial investment. Infrastructure development and capital costs remain high, necessitating knowledge sharing and data-driven long-term planning. A study on Build–Operate–Transfer (BOT) projects underscore the importance of robust policies, technology adaptability, and stakeholder collaboration. For example, the study highlights the Nam Ngiep 1 Power Company in Laos, demonstrating how a well-executed transfer phase can ensure the continued operation and export of electricity to neighboring Thailand, thereby supporting the region's energy goals.

3.4. Carbon Pricing and Green Investment

This topic emphasises the importance of carbon pricing and green investment in combating climate change and meeting Paris Agreement goals. It explores carbon markets and trading mechanisms that reduce emissions and promote low-carbon technologies, alongside green investment strategies that fund renewable energy, energy efficiency, and sustainable infrastructure. Key subtopics include financial tools like Green Bonds and the role of supportive policies and regulations in advancing global energy transitions.

One study explores whether a behavioural economic approach (nudge) can encourage Australian financial institutions (AFIs) to invest in ASEAN's clean energy transition (CET). The findings contribute to green finance and behavioural economics by identifying cost-efficient and scalable policies that foster international green investment. Another study examines Malaysia's development of the Bank Negara Malaysia Climate Change and Principles-based Taxonomy (BNM CCPT), comparing it to global taxonomies and providing recommendations for enhancing the framework.

The study emphasises the importance of equipping financial analysts with the knowledge needed to accurately evaluate the economic potential, environmental impact, and carbon footprint of green technologies. Bridging this knowledge gap in energy transition and transition finance is critical for the effective application of taxonomies and maintaining the integrity of sustainable finance.

In one of the studies, the potential benefits and obstacles of carbon pricing in combating climate change were tackled and examined to draw its implications for policies in Vietnam. Another study evaluated Vietnam's carbon pricing legislation by comparing its nascent framework to the advanced systems in the US and Japan. The study identified best practices in regulatory scope, implementation, and enforcement while highlighting Vietnam's challenges, such as regulatory gaps and limited stakeholder engagement.

One study examines the feasibility of establishing hubs at universities in the Greater Mekong Subregion (GMS) to promote environmental awareness and practices for achieving carbon neutrality using the UN Carbon Offset Platform. Key results include a 50% reduction in carbon footprints and financial benefits from carbon credit sales. Another study on UAB Bank in Myanmar highlights the bank's strategies to lower energy use, carbon emissions, and water discharge, aligning these efforts with the UN Sustainable Development Goals.

In the agricultural sector, a study explores the potential benefits of combining carbon trading with sustainable rice cultivation in ASEAN. Economic advantages include increased income through carbon credits, reduced costs, and improved investment opportunities, while environmental benefits encompass reduced methane emissions, healthier soils, and greater biodiversity. The study emphasises the sector's potential to transition from a significant methane emitter to a net carbon sequester through carbon trading.

Focusing on Indonesia, another study delves into the country's need to develop carbon markets and deploy carbon capture, utilisation, and storage (CCUS). It emphasises the role of mechanisms ranging from voluntary carbon credits to carbon taxes and provides comprehensive policy recommendations for building an effective carbon pricing system.

3.5. Energy and Digitalisation

The abstracts provide insights into several technological advancements in energy systems and their integration with data-driven methodologies. Under this topic, several studies have explored the role of digital technologies in enhancing energy efficiency and reliability. This also encompasses Artificial Intelligence (AI), smart grids, regulatory assessment on metering infrastructure, machine learning for energy consumption forecasting and the Internet of Things (IoT) for geothermal energy operations. These abstracts highlight opportunities and identify challenges which could be the key to unlock the full potential of more energy-efficient technologies.

The advancements discussed in the abstracts offer significant opportunities for enhancing energy management and sustainability. For instance, the implementation of Advanced Metering Infrastructure (AMI) technology enables real-time monitoring of energy consumption, improving both individual and societal energy efficiency. Similarly, incorporating microgrids into smart offices contributes to reducing carbon emissions and promoting sustainable energy practices. AI-driven predictive maintenance, particularly with Long Short-Term Memory (LSTM) models, can extend battery life and improve energy storage reliability, which is crucial for renewable energy integration. Moreover, machine learning models, such as LSTM and Convolutional Neural Networks (CNN), offer more accurate predictions for renewable energy consumption, supporting better grid management and energy planning. Digital transformation in geothermal energy operations, integrating Business Intelligence (BI) and predictive analytics, enhances asset management and production efficiency, leading to tangible profitability and increased productivity.

Despite these opportunities, several challenges must be overcome. Regulatory processes for AMI implementation may be difficult to manage and ensuring that all stakeholders understand the benefits and compliance requirements can be complex. Integrating AMI technology into existing infrastructure may also be costly. In other cases, transitioning from theoretical models to real-world applications in microgrid testing presents validation and scalability issues. Predictive maintenance models for batteries are heavily reliant on the availability and quality of sensor data, and their computational intensity can pose challenges for efficient deployment. Additionally, the integration of various factors in renewable energy consumption forecasting complicates the process, and deep learning models risk overfitting if not carefully trained. Lastly, the digital transformation of geothermal energy operations requires significant changes to existing processes and infrastructure, along with effective data management and employee adaptation to new technologies.

3.6. Environment, Policy, and Socioeconomics

The topic discusses the socioeconomic implications of energy policies, focusing on inclusive transitions, just energy partnerships, and sustainable development. It also examines environmental impacts, policy frameworks for renewable energy.

Several studies examine a wide array of policy frameworks and governance mechanisms as key drivers of energy transition and decarbonisation across ASEAN by leveraging energy efficiency, climate finance, coal phase-out strategies, and the integration of environmental safety within management systems. Just Energy Transition Partnership (JETP) and Vietnam's legal frameworks are two examples of case studies for equitable transitions which can potentially be adopted by the rest of ASEAN Member States.

Innovative policy analyses including Low Impact Development (LID) for urban planning, reutilisation of retired oil and gas platforms, and harnessing digital tools for greenhouse gas emissions prediction are proposed to enhance the region's climate resilience as well as to monitor the progress of energy transition efforts in the region.

Nonetheless, the implementation of these policies might be hindered by complexities in multi-stakeholder coordination, financial support mechanisms, and balancing energy demands with environmental conservation that could slow down the region to achieve a just and sustainable energy transition. Complementing these policy efforts, several studies highlight the role of renewable energy adoption in empowering communities through decentralised systems, such as micro-grids, which advance sustainable agriculture and rural development in isolated areas. Public-private partnerships are introduced as alternative funding mechanisms to address financial constraints in developing economies, while research on household rooftop solar systems in Southeast Vietnam stresses the importance of affordability, policy incentives, and public awareness in ensuring widespread adoption.

In the environmental context, some abstracts highlight the role of employing specific techniques to minimise risks of loss and damage associated with energy transitions. A study emphasised that developing internationally recognised standard codes is imperative to simplify Solar PV systems complexity and enhance safety and efficiency. Another study explores the conversion of agricultural residues into sustainable aviation fuel (SAF) and bioenergy as a means to reduce the region's carbon footprint from crop waste. In conjunction with these strategies, an abstract on mangrove ecosystems demonstrates the value of nature-based solutions by exploring their potential for carbon trading and coastal conservation. Additionally, as a lower number of environmental impacts is one of key indicators of successful decarbonisation initiatives, several studies suggest that disaster management, fire prevention, and biodiversity conservation are imperative approaches to complement clean energy shift pathway. This is also supported by another study highlighting the importance of addressing uncontrolled emissions, as they pose an interplay between health risks and productivity attributed to economic resilience.

In the inclusivity context, several abstracts that assesses the interrelation between the energy and Gender Equality, Disability, and Social Inclusion (GEDSI) followed by research in mainstreaming these principles within the project planning, implementation strategies, and outcomes aimed to be replicated to other member states. In addition, there are also studies that highlights youth view and participation. With the basis that energy transition to greener sources still experienced inequitable benefits. In the ASEAN energy sector, all of this may fall under the umbrella of just and inclusive energy transition that is recently being endorsed as the theme of the upcoming 2026-2030 regional energy blueprint, the APAEC.

Collectively, these findings emphasise the need for integrated policies, inclusive governance, and community-driven approaches to achieve a just, equitable, and sustainable energy transition across ASEAN.

4. Recommendations and Way Forward

Based on the synthesis of presentations, discussions, and interactive exchanges among conference participants, this policy briefs highlights several recommendations. Incorporating these actions under the forthcoming APAEC 2026-2030 will strengthen interconnectivity and resilience:

a. Address high initial costs and promote investment for emerging technologies

To foster the adoption of cost-effective technologies, it is essential to offer financial incentives such as grants, tax credits, or subsidies, alongside reducing tariffs on imported green technologies. In addition, encouraging foreign investment and establishing public-private partnerships will provide crucial funding for energy projects and initiatives, thereby supporting the growth and implementation of sustainable energy solutions across the region. Offering low-interest loans or risk guarantees will further support private sector investment in high-cost energy technologies, making them more financially viable.

b. Harmonise technical standards and regulatory frameworks to facilitate power interconnection

To achieve a more efficient and interconnected energy system, it is essential to strengthen regional standardisation across various energy sectors. This can be achieved through the establishment of a unified ASEAN regulatory framework, which would facilitate seamless cross-border electricity transmission. Furthermore, ensuring grid compatibility and interoperability among member states requires the standardisation of technical protocols and market codes. By leveraging lessons learned from successful global energy interconnection projects, such as those in the EU and Southern African, ASEAN can adopt best practices that support its own energy integration goals.

c. Promote energy efficiency in transportation and industrial sectors (garment and textile) for sustainable infrastructure

To create a sustainable and efficient energy ecosystem, it is crucial to establish supportive policy frameworks that promote energy-efficient technologies and address technical challenges within the energy sector, including the integration of energy with agriculture and waste management.

Encouraging the adoption of no-cost and low-cost energy - saving strategies within industrial operations, alongside enforcing policies that improve fuel economy standards, will further enhance energy efficiency. Additionally, investing in public transportation systems and incorporating green spaces around transportation hubs and stations will not only support sustainable urban development but also contribute to reducing carbon emission by serving as carbon sinks.

d. Strengthen financial mechanisms in support of carbon neutrality, including carbon markets, green bonds, and taxonomies

Explore innovative financing solutions such as nature-based approaches, carbon trading and pricing, and green bonds, which can be implemented within an enabling environment. This could include subsidies for such mechanisms that are gradually increased and tailored to each ASEAN Member State, with regional standardisation. Green investment should also be strengthened through the use of cutting-edge taxonomy and the reduction of investors' risks.

e. Foster the adoption of digital technologies in energy systems, including AI and Machine Learning

Address regulatory and technical barriers to enable the large-scale deployment of advanced digital infrastructure, including IoT, AI, and machine learning. Besides, there are Advanced Metering Infrastructure (AMI) and smart grid development in key sectors, such as smart offices, residential areas, and industrial parks. These technologies should optimise energy systems from technical operations to business intelligence in energy plants.

f. Integrate just and inclusive to address the multifaceted dimensions of the energy transition

Embed the principles of a Just and Inclusive Energy Transition into actionable milestones. This includes promoting gender equality, disability, and social inclusion (GEDSI), empowering communities, assessing impacts, and enhancing inclusive policymaking processes. Prioritise youth-oriented energy transition programmes and engagement with affected communities. In addition, there should be encouraged diversification of fuel sources, particularly for hard-to-abate transport modes such as aviation with sustainable aviation fuel.

g. Support Research and Development (R&D) and data-driven solutions for long-term energy planning by fostering knowledge sharing and collaboration

Invest in R&D and promote collaboration among academia, communities, policymakers, and the private sector. This includes streamlining partnerships between universities and financial institutions to drive innovation and discussion. Strengthening collaboration with universities offers mutual benefits, enabling academic institutions to stay abreast of emerging energy trends while empowering intergovernmental organisations like ACE to build their capacity. Through joint research and collaborative initiatives, such partnerships foster the creation of cutting-edge policies and strategies that more inclusive. Improve existing multi-period optimisation models, ASEAN Energy Outlook, to identify cost-effective decarbonisation pathways across sectors. While also enhancing capacity building for stakeholders to align energy strategies with national and international climate commitments.

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References

[1] ASEAN Centre for Energy (ACE), ASEAN Plan of Action for Energy Cooperation (APAEC) Phase II: 2021-2025. 2021.

[2] ASEAN Centre for Energy (ACE), 4th ASEAN International Conference on Energy and Environment Conference Proceeding Book. 2024.

[3] ASEAN, "Joint Ministerial Statement of the 42nd ASEAN Ministers on Energy Meeting (AMEM)." [Online]. Available: https://asean.org/joint-ministerial-statement-of-the-42nd-asean-ministers-on-energy-meeting-amem/

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