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The Energy Trilemma in 2024: Trying to strike the Balance



In 2024, the World Energy Council's concept of the 'energy trilemma' – balancing energy security, energy equity, and environmental sustainability – served as the focal point for discussions hosted by Stephenson Harwood's international Energy Transition Group. These discussions with our clients and contacts, held in Singapore, London, and Jakarta, highlighted the unique challenges and pathways for energy transitions in different regions, emphasising the role of renewables, biofuels, nuclear, carbon capture, and government policies. Below we explore the issues raised in these discussions, the similarities and differences between the UK, EU, Singapore, Indonesia and the wider ASEAN region.

Understanding the Energy Trilemma

The energy trilemma involves three core dimensions:

- **Energy Security:** The ability to meet current and future energy demand reliably and recover swiftly from system shocks.
- **Energy Equity:** Providing universal access to affordable and abundant energy.
- **Environmental Sustainability:** Transitioning energy systems to mitigate environmental harm and climate change impacts.

Regional Approaches to Energy Transition

United Kingdom (UK)

The UK has made significant strides in its energy transition by shutting down its last coal-fired power station in 2024 and developing large-scale offshore wind projects. The UK benefitted from coal-fired power for 142 years and has financially supported the offshore wind industry through incentives. The government has also backed the Northern Endurance Partnership CCS projects, showcasing leadership in commercial carbon capture and storage (CCS).

European Union (EU)

The EU faces pressure on all three pillars of the energy trilemma due to its rapid move away from coal and natural gas, early decommissioning of Germany's nuclear power plants, and the expansion of the Emissions Trading Scheme (ETS) to shipping and aviation. The war in Ukraine has exacerbated these challenges. The EU's mixed response includes recognising natural gas as a transitional fuel and grappling with differing attitudes towards nuclear power. The "dunkelflaute" events in Germany, characterised by a lack of sun and wind, have highlighted the need for integrated grids and dispatchable power sources.

Singapore

As a microstate with limited natural resources, Singapore relies heavily on energy imports. Decarbonising its energy mix requires cross-border collaboration for renewable energy imports (including the establishment of the ASEAN grid), CCS for greenhouse gas export, and waste storage for potential nuclear programs. Singapore's Energy Market Authority (EMA) has successfully tendered for 4GW of imported renewable power and is exploring options such as building a hydrogen economy, exploring nuclear power (fission), and ambitious projects like Suncable, which aims to import solar power from Northern Australia.

Indonesia

Indonesia's energy transition is slower due to its reliance on coal-fired power, projected to peak in 2030 and decline by 2050. The country faces unique challenges due to its geography, demography, and economic constraints. Indonesia will need support from the \$300 billion Climate Fund established at COP29 and the \$20 billion Just Energy Transition Partnership (JETP) agreement. The government is enacting legislation and negotiating cross-border agreements for CO₂ movement to support CCS projects for both domestic and important CO₂.



Similarities and differences



Energy Security

- **UK and EU:** Both regions have moved away from coal and are focusing on renewables and CCS. The UK has developed large-scale offshore wind projects and building new nuclear, which the EU is dealing with the impact of the war in Ukraine and the decommissioning of nuclear plants in Germany.
- **Singapore and Indonesia:** Singapore relies on energy imports and cross-border collaboration, while Indonesia continues to depend on coal-fired power, with plans to transition to renewables and possibly nuclear.



Energy Equity

- **UK and EU:** Both regions are leaders in environmental sustainability, with significant investments in renewables and CCS. The UK's offshore wind projects and the EU's ETS expansion demonstrate their commitment to reducing carbon emissions.
- **Singapore and Indonesia:** Singapore's small population and limited resources make energy imports crucial, while Indonesia's subsidies for energy costs aim to support its large population. Both countries face challenges in providing affordable energy while transitioning to cleaner sources.



Environmental Sustainability

- **UK and EU:** Both regions are leaders in environmental sustainability, with significant investments in renewables and CCS. The UK's offshore wind projects and the EU's ETS expansion demonstrates their commitment to reducing carbon emissions.
- **Singapore and Indonesia:** Singapore's focus on cross-border renewable energy imports and CCS projects highlights its commitment to sustainability. Indonesia's slower transition from coal to renewables and nuclear reflects its economic constraints and need for international support.

Financing the Energy Transition

Financing remains a critical issue across all regions. While there is significant private capital interest in energy transition projects, technology risks and limited early-stage funding pose challenges, leaving many 'unbankable'. Private equity has also started to review investment in renewables as certain projects are not as profitable as anticipated and/or unable to easily (and profitably) divested. Governments have used small mandatory usage requirements, such as Sustainable Aviation Fuel (SAF) mandates, to nudge markets towards development. The creation of energy transition hubs, which share common infrastructure, is an emerging trend to reduce costs and enhance energy efficiency.

Carbon Credits and Carbon Markets

The finalisation of the Article 6.4 mechanism at COP29 in 2024 marks a significant step towards global carbon credits markets. Countries will need 18-24 months to implement local laws and regulations. Article 6.4 carbon credits will help many jurisdictions finance energy transition. However, in connection with carbon taxes and emissions trading schemes, in regions with energy subsidies, like Indonesia and Malaysia, adding a carbon price may not make sense for subsidised users. In markets where there is a carbon price, Article 6.4 can help offset carbon taxes. Singapore's Carbon Pricing Act allows some offset set of carbon tax with international credits. With the planned increase to its carbon tax Article 6.4 may become an important mechanism for businesses in Singapore and in jurisdictions with similar offset opportunities.

Renewables

Renewables are essential for the energy transition, but inflation and interest rate increases have pressured new developments. Integrated grids and dispatchable power sources, such as gas or nuclear, are necessary to address intermittency issues. The mix of renewables varies by region, with the EU and the UK focusing on offshore wind and solar, while ASEAN countries emphasise solar, geothermal, and hydro, and some APAC states with the benefit of reliable wind, also capitalising on wind power. Singapore's lack of space for large-scale solar has led to successful tenders for imported renewable power.

Carbon Capture and Storage (CCS)

CCS projects like the Northern Endurance Partnership in the UK and Greensand Carbon Storage in Denmark are milestones in global carbon reduction efforts. Early projects require government support, but economies of scale and carbon markets will enhance viability. ASEAN countries, including Indonesia, Singapore, and Malaysia, are actively developing CCS programs and legal frameworks. We are yet to see the government support mechanisms for ASEAN. The UK financial support model will be looked at closely, together with the JETP and the potential for cross-border structures. Bilateral G to G agreements on the transboundary movement of CO₂ are expected to progress in 2025 and anticipated to help facilitate the first CCS projects in ASEAN.

Hydrogen

Hydrogen remains part of the energy transition conversation but concerns about supply and demand have tempered enthusiasm. Government mandates may help resolve this dilemma. In Singapore, the EMA is requiring hydrogen-ready power plants, and pilots for green ammonia and methanol bunkering are underway. Indonesia is exploring green hydrogen for local markets and green ammonia for shipping and power station co-firing.



Biofuels

Biofuels are seen as a key component of the energy transition, particularly for hard-to-abate sectors like aviation. SAF mandates in the UK, EU and parts of ASEAN aim to increase the use of biofuels over time. Other biofuels, such as biomethane from agricultural waste, are being explored globally. Local supply chains influence biofuel production, with examples like Neste's SAF plant in Singapore (from used cooking oil) and bio-ethanol production (from heat, corn, or sugar cane) in Brazil and the USA.

Nuclear

Nuclear power is experiencing a renaissance, driven by the need for low-carbon, baseload power. The UK is leading with plans for grid-scale nuclear power and small modular reactors (SMRs). In ASEAN, countries like Indonesia, the Philippines, Malaysia, Vietnam and Singapore are considering nuclear power to meet surging demand. Indonesia has announced plans to construct 20 nuclear power plants, with the first project awarded to US developer ThorCon.

Conclusion

The energy trilemma in 2024 highlights the diverse challenges and approaches for energy transitions across different regions. While each country faces unique circumstances in trying to strike the balance, common themes include the need for financing, integrated grids, and a mix of energy sources. Renewables, CCS, hydrogen, biofuels, and nuclear power all play crucial roles in the global energy transition. But in essence, there is no 'one size fits all' so each state is expected to adopt or pursue a variety of energy sources moving forward.

Get in touch



Nick Dingemans

Partner

T: +65 6622 9652

E: nick.dingemans@shlegal.com



John Zadkovich

Partner

T: +65 6622 6239

E: john.zadkovich@shlegal.com

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