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Known Knowns, Known Unknowns, Unknown Unknowns: A Framework for Navigating Energy Security in ASEAN

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SYNOPSIS

The author advances the view that energy security should be understood as the management of risk and uncertainty rather than the provision of energy supplies. Using former United States Secretary of Defense Donald Rumsfeld's framework of *Known Knowns*, *Known Unknowns*, and *Unknown Unknowns*, the author examines how ASEAN can navigate foreseeable risks, uncertainties, and unforeseen shocks affecting regional energy systems. He assesses that resilience, diversification, renewable energy deployment, energy efficiency, and regional electricity integration are essential for strengthening ASEAN's ability to withstand and adapt to a volatile and unpredictable energy landscape.

KEY POINTS

- **Energy security is fundamentally about resilience under uncertainty**, requiring policymakers to manage identifiable risks and unforeseen disruptions.
- **ASEAN faces a layered risk landscape**, including known threats such as fuel import dependence, known uncertainties such as technology and market evolution, and unknown shocks ranging from cyberattacks to disruptive technological breakthroughs.
- **Diversification, clean energy, energy efficiency, and the ASEAN Power Grid** are some of the policy tools for enhancing regional energy security and reducing vulnerability to future shocks.

INTRODUCTION

Energy security is often discussed in terms of fuels, infrastructure, and supply chains. Its central challenge is more fundamental: managing risk in a complex and interconnected world. Governments face an evolving risk landscape, shaped by geopolitical fragmentation, fraying of the rules-based international system, extreme weather events, supply chain disruptions, cyber threats, and the transformation of energy systems driven by decarbonisation. These developments have elevated energy security to the forefront of policy debates. The central challenge extends beyond ensuring the availability of adequate energy supplies. It lies in decision-making in an environment characterised by volatility, complexity, and rapid change.

A useful framework for understanding this challenge comes from former United States Secretary of Defense Donald Rumsfeld's distinction between *Known Knowns*, *Known Unknowns*, and *Unknown Unknowns*.[1] Although developed in the context of national security, the framework offers insights for energy policy. It reminds policymakers that resilient energy systems must be designed to manage risks that can be identified as well as to withstand disruptions that cannot yet be anticipated. The true test of energy security is not whether a system performs efficiently under expected conditions, but whether it remains resilient

[1] Rumsfeld, Donald H., remarks at Department of Defense News Briefing, Washington, DC, February 12, 2002; Rumsfeld, Donald H., *Known and Unknown: A Memoir* (New York: Sentinel, 2011).

when confronted with the unexpected. Contemporary energy security scholarship emphasises robustness, preparedness, and the capacity to manage systemic risks alongside traditional concerns relating to availability, affordability, accessibility, and acceptability.[2]

ANALYSIS

The Known Knowns: Risks That We Can See

The first category of risk comprises what Donald Rumsfeld termed the *Known Knowns*, threats that are visible and understood. These are risks that policymakers can observe, analyse, and prepare for, even if they cannot eliminate them entirely. In the energy sector, *Known Knowns* include geopolitical chokepoints, physical infrastructure vulnerabilities, fuel import dependence, and predictable climate-related stresses on energy systems. A clear example of *Known Knowns* is the risk of a blockade of the Strait of Hormuz, through which approximately 25% of global seaborne oil trade and 19% of liquefied natural gas (LNG) trade pass. Disruption to shipping through Hormuz could raise electricity costs, increase transportation expenses, exacerbate inflationary pressures, and weaken industrial competitiveness. Another example is vulnerabilities associated with extreme weather events. Rising temperatures, droughts, severe storms, and flooding pose challenges to electricity generation and transmission infrastructure. Hydropower output can be affected by changing rainfall patterns. Coastal energy facilities would be exposed to storm surges and sea-level rise. Electricity networks can experience outages resulting from severe weather events. None of these challenges are unknown. Policymakers may not know precisely when specific events will occur, but they understand the risks and the need to prepare accordingly.

The Known Unknowns: Managing Uncertainty

More complex than *Known Knowns* are Rumsfeld's *Known Unknowns* – risks that policymakers can identify and recognise but cannot accurately predict nor forecast their exact manifestation. Governments recognise that geopolitical tensions can disrupt infrastructure, alter shipping routes, delay investment decisions, and trigger market volatility. What remains difficult to anticipate is not the possibility of disruption, but its timing, duration, and magnitude. One specific example is technology development. Policymakers know that renewable energy, battery storage, hydrogen, carbon capture, and advanced nuclear technologies will play important roles in future energy systems. However, questions remain regarding their costs, scalability, commercial viability, and deployment timelines. The energy transition itself is another source of *Known Unknown*.

The growing importance of critical minerals such as lithium, cobalt, nickel, graphite, and rare earth elements is creating new supply chain vulnerabilities and strategic dependencies. The concentration of mineral processing and clean energy manufacturing capabilities in a small number of countries raises questions about future resilience, geopolitical exposure, and market concentration. Policymakers understand that these developments could affect system reliability, but their precise implications remain difficult to assess.

Known Unknowns occupy the space between probability and unpredictability. This aspect is important in energy markets because expectations themselves influence outcomes. The 1973 oil crisis illustrates this dynamic. Beyond physical supply disruptions, much of the economic impact resulted from uncertainty, expectations, and behavioural responses. Fears of shortages led governments, businesses, and consumers to alter behaviour, amplifying market pressures and contributing to price volatility.[3]

The same phenomenon is relevant today. Energy prices respond not only to actual supply disruptions but also to perceived risks. Markets can react sharply to reports of escalating tensions, threats to maritime routes,

[2] Cherp, Anton and Jessica Jewell, "The Concept of Energy Security: Beyond the Four As," *Energy Policy* 75 (2014): 415-421; Yergin, Daniel, "Ensuring Energy Security," *Foreign Affairs* 85, no. 2 (2006): 69-82.

[3] Beasley, B. Alex, "Overview: The Oil Shocks of the 1970s," *Energy History Online*, Yale University, 2023; Bordoff, Jason, "The 1973 Oil Crisis: Three Crises in One and the Lessons for Today," *Center on Global Energy Policy*, Columbia University, 2023.

infrastructure attacks, or policy announcements, even before any physical interruption occurs.

The Unknown Unknowns: Preparing for Shocks

The most difficult category of risk consists of what Rumsfeld termed the *Unknown Unknowns* – events that policymakers have not anticipated and, ordinarily, cannot imagine. These are the disruptions that fall outside prevailing assumptions and planning frameworks. History teaches that the most consequential shocks often emerge not from known risks, but from developments policymakers fail to anticipate. Few policymakers anticipated the global impact of the COVID-19 pandemic on energy demand, supply chains, labour markets, and investment flows. Likewise, not many would have predicted the speed at which digital technologies have transformed economies, or the extent to which cyber threats would emerge as a national security concern.

Energy systems are exposed to *Unknown Unknowns*: Future shocks could arise from cyberattacks targeting electricity grids, LNG terminals, or market operators. They could also emerge from unforeseen surges in electricity demand driven by the rapid expansion of artificial intelligence, data centres, and other digital technologies, placing unexpected pressures on generation capacity, transmission networks, and fuel supply chains. Advances in quantum computing may introduce risks and opportunities that are difficult to assess today, including the possibility of undermining existing cybersecurity architectures that protect critical energy infrastructure.

Unknown Unknowns may also take the form of disruptive technological breakthroughs. Unexpected advances in fusion energy, long-duration energy storage, advanced nuclear technologies, clean hydrogen, or carbon removal could rapidly reshape energy markets, investment flows, and geopolitical relationships in ways that are difficult to foresee. Conversely, technologies currently expected to drive the energy transition may fail to mature as anticipated, creating new vulnerabilities and adjustment challenges. Climate tipping points could alter hydrological patterns in ways that significantly affect regional hydropower production, creating new and largely unanticipated implications for energy security.

Beyond these challenges lies the possibility of *black swan* events: rare, high-impact disruptions that fall outside prevailing expectations. The next major threat to system reliability may therefore arise from unexpected technological, environmental, geopolitical, financial, or societal changes. [4] *Unknown Unknowns* cannot be predicted. This reality poses an important challenge for energy security policy. The objective cannot be to anticipate every possible disruption. This may not be possible. Rather, it must be to build energy systems that are durable and responsive to absorb shocks, recover from disruptions, and continue functioning effectively under conditions of disruption.

The Dynamic Nature of Uncertainty

The distinction between *Known Unknowns* and *Unknown Unknowns* should not be viewed as a fixed or immutable categorisation. The boundary between these categories is dynamic and evolves as knowledge accumulates. Risks that fall outside prevailing analytical frameworks may become recognised possibilities through advances in research, technological development, or policy experience. Several examples characterised as *Unknown Unknowns*, including disruptive technological breakthroughs, cyber threats, or emerging patterns of energy demand, may therefore be more appropriately understood as low-probability, high-impact *Known Unknowns*. Policymakers recognise these possibilities, even if their timing, scale, and consequences remain highly uncertain. In this sense, uncertainty exists along a continuum, with risks progressively migrating from the

[4] Taleb, Nassim N., *The Black Swan: The Impact of the Highly Improbable* (New York: Random House, 2007); Walker, Warren E., Rogert J. Lempert, and Jan H. Kwakkel, "Deep Uncertainty," In S. I. Gass & M. C. Fu (eds.), *Encyclopedia of Operations Research and Management Science* (3rd ed.) (New York: Springer, 2013). They define situations in which analysts cannot confidently characterize future states, probabilities, system models, or outcomes.

realm of the unknown into the domain of analysis and policy planning. This highlights the importance of resilience and adaptive governance, which seek to manage identifiable risks and enhance the capacity of energy systems to withstand unforeseen shocks.

Table 1 in the Appendix summarises illustrative examples of *Known Knowns*, *Known Unknowns*, and *Unknown Unknowns*. The boundaries, especially between *Known Unknowns* and *Unknown Unknowns* are dynamic and may evolve as knowledge, technological capabilities, and policy experience accumulate. Uncertainty exists along a continuum, with risks progressively migrating from the realm of the unknown into the domain of analysis and policy planning.

Pre-emptive Cooperation

The Intergovernmental Panel on Climate Change (IPCC) emphasises that resilience and climate-resilient development require anticipatory action, institutional capacity, and cooperation established before crises occur rather than responses developed during crises themselves. This insight is relevant to contemporary energy systems, where geopolitical uncertainty, market volatility, climate risks, and the complexities of energy transitions create vulnerabilities that frequently extend beyond national borders.[5]

Recent developments illustrate the importance of this approach. The energy market disruptions that followed the Russia-Ukraine conflict exposed the risks associated with concentrated supply dependencies, geopolitical tensions, and disruptions to international fuel trade. Sharp increases in oil, natural gas, and electricity prices demonstrated how energy security shocks can rapidly propagate across regions and economies. Similarly, concerns over the availability, processing, and geographic concentration of critical minerals such as lithium, cobalt, nickel, and rare earth elements have highlighted emerging vulnerabilities linked to the deployment of clean-energy technologies. As energy systems become dependent on global supply chains for renewable energy equipment, batteries, electric vehicles, and other advanced technologies, new forms of strategic dependence and potential bottlenecks are becoming apparent.

These developments demonstrate that energy security risks are systemic, interconnected, and transnational in nature. They originate beyond the jurisdiction of any single country and require collective responses that complement national energy security strategies. In this context, *pre-emptive cooperation* provides a pertinent framework for strengthening energy security and energy-transition outcomes. Such cooperation may include diversifying energy and critical-mineral supply chains, expanding regional power interconnections and cross-border electricity trade, coordinating strategic reserves and emergency response mechanisms, and fostering collaboration in technology development, innovation, financing, and infrastructure investment.

Pre-emptive cooperation is particularly valuable in an era of deep uncertainty, where future energy security challenges are often difficult to predict with precision. By establishing cooperative frameworks before disruptions occur, countries can improve their capacity to anticipate, absorb, and adapt to shocks arising from geopolitical conflict, market volatility, technological change, climate impacts, and supply-chain disruptions. Resilience, therefore, is not solely a function of domestic preparedness or self-sufficiency. It also depends on the strength of the regional and international partnerships, institutions, and networks that enable countries to coordinate responses, share risks, mobilise resources, and maintain access to essential energy services during periods of stress. *Pre-emptive cooperation* should therefore be understood as an investment in resilience and a foundation for a more secure, reliable, and orderly transition to a low-carbon energy future.

[5] Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2022: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Chapter 18, "Climate Resilient Development Pathways," (Cambridge: Cambridge University Press, 2022).

ASEAN's Energy Security Challenge[6]

ASEAN's energy landscape is diverse, encompassing major fossil fuel exporters, rapidly growing energy importers, hydro-dependent economies, and countries pursuing ambitious transitions to renewable energy. The region's diversity is both a strength and a challenge. While this multiplicity creates opportunities for complementary regional cooperation and energy trade, it also creates differentiated energy security risks and policy priorities.

Known Knowns in ASEAN include exposure to global fuel markets, growing electricity demand, infrastructure vulnerabilities, and climate-related disruptions. ASEAN's energy demand is projected to continue rising significantly because of economic growth, urbanisation, industrialisation, and expanding access to modern energy services, placing increasing pressure on regional energy systems and infrastructure. Singapore's dependence on imported natural gas, the continued role of coal in a number of ASEAN countries, and emerging climate-related stresses on hydropower production in parts of mainland Southeast Asia illustrate some of the region's well-understood energy security challenges.[7]

Known Unknowns include the future pace of economic growth, technological deployment, electricity demand from digitalisation, future LNG prices, and the evolution of international climate policies, *Unknown Unknowns* could originate from unexpected technological disruptions, large-scale cyberattacks, simultaneous climate shocks across multiple countries, or unforeseen geopolitical developments.

ASEAN may be particularly vulnerable to *Unknown Unknowns* due to its reliance on maritime energy trade, fragmented energy systems, uneven levels of development, and dependence on imported fuels and technologies. These characteristics create a complex and interconnected energy landscape in which unforeseen disruptions can emerge from multiple directions and spread rapidly across borders.

An Agenda for Strengthening ASEAN's Energy Security[6]

How can ASEAN strengthen its capacity to withstand both foreseeable and unforeseeable risks?

First, diversification must remain a central pillar of energy policy. Diversification of fuels, technologies, suppliers, and import routes reduces exposure to disruptions affecting any single source. More than a century ago, Winston Churchill observed that "safety and certainty in oil lie in variety, and variety alone." That insight remains relevant today. In a geopolitical environment marked by ambiguity, diversification is not merely an economic strategy; it is a security imperative.

Second, greater deployment of domestic renewable energy should be viewed as both a climate and security objective. Renewable energy helps reduce dependence on imported fossil fuels while strengthening national energy autonomy.

Third, governments should accelerate investments in energy efficiency. Energy efficiency is often described as the "first fuel" because reducing demand is frequently the cheapest and most secure way of enhancing energy security. Every unit of energy saved reduces exposure to volatile international energy markets.

Fourth, ASEAN should expedite regional electricity integration. The ASEAN Power Grid (APG) is a cornerstone of ASEAN's long-term energy security. It enhances energy security by diversifying electricity sources, supporting renewable energy integration, and strengthening regional cooperation in responding to disruptions and emerging risks. The APG has been a core component of

[6] A comprehensive assessment of the region's energy security challenges, vulnerabilities, and policy options can be found in the International Energy Agency (IEA), *ASEAN Energy Security Review* (Paris: IEA, 2026).

[7] Ministry of Trade and Industry (MTI) Singapore, "Natural Gas," https://www.meti.gov.sg/energy-and-carbon/energy-supply/natural-gas/; Mekong River Commission (MRC), *Basin-Wide Assessment of Climate Change Impacts on Hydropower Production* (Vientiane: MRC, 2018); ASEAN Centre for Energy (ACE), *Assessment of the Role of Coal in the ASEAN Energy Transition and Coal Phase-Out* (Jakarta: ACE, 2024).

ASEAN's regional energy strategy for more than two decades and remains central to efforts to strengthen cross-border electricity trade and regional energy integration.[8] While its potential is significant, realising these benefits will require ASEAN to address financing constraints, regulatory barriers, sovereignty concerns, and uneven levels of market liberalisation across member states.

CONCLUSION

Energy security is ultimately a question of preparedness in a world of imperfect foresight. The central lesson from Rumsfeld's framework is clear: policymakers should not build energy systems solely for the future they expect, but for the futures they cannot yet foresee.

Known Knowns can be planned for. *Known Unknowns* can be monitored, analysed, and incorporated into adaptive strategies. *Unknown Unknowns* will remain beyond prediction.

For ASEAN, this means investing in diversification, strengthening regional cooperation, accelerating clean energy deployment, and augmenting system robustness through initiatives such as the APG. These measures will not eliminate volatility or unpredictability, but they can improve the region's ability to bear shocks and adapt to change.

In an era defined by surprises, the capacity to absorb and recover from unfavourable impacts would be ASEAN's most important energy asset. The essence of energy security is the strength to anticipate, withstand, and navigate an evolving risk landscape shaped by foreseeable and unforeseen challenges.

WHAT TO LOOK OUT FOR

- Evolving geopolitical risks and energy market volatility
- Emerging technological and cybersecurity risks on energy systems
- Progress in regional electricity integration

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[8] ACE, *ASEAN Plan of Action for Energy Cooperation (APAEC) Phase II: 2021-2025* (Jakarta: ACE, 2024). The APAEC identifies the ASEAN Power Grid as a flagship initiative for regional energy integration.

Appendix

Table 1. Illustrative examples of energy security risks through the lens of *Known Knowns*, *Known Unknowns*, and *Unknown Unknowns*

	Known Knowns	***Known Unknowns***	***Unknown Unknowns***
Characteristics	• Threats that are visible and understood. • These are risks that policymakers can observe, analyse, and prepare for, even if they cannot eliminate them entirely.	• Developments that occupy the space between probability and unpredictability. • Risks that policymakers recognise but cannot accurately predict. • Policymakers can identify the categories of risk but cannot forecast their exact manifestation.	• Events that policymakers have not anticipated and ordinarily cannot imagine. • These are the disruptions that fall outside prevailing assumptions and planning frameworks.
Illustrative energy security issues	• Exposure to global fuel markets and associated price volatility • Growing electricity demand driven by economic growth, urbanisation and higher standards of living • Infrastructure vulnerabilities across energy systems • Climate-related disruptions, including rising temperatures, droughts, severe storms, flooding and sea-level rise • Dependence on imported natural gas • Continued role of coal in a number of countries • Climate-related stresses on hydropower production	• Future pace of economic growth • Future electricity demand arising from digitalisation and technological change • Future costs and deployment of renewable energy technologies, battery storage, hydrogen, carbon capture and storage, and advanced nuclear technologies • Future LNG prices • Evolution of international climate policies • Strategic implications of critical minerals and clean energy supply chains • Concentration of processing and manufacturing capacity in segments of the clean energy economy	• Cyberattacks targeting electricity grids, LNG terminals or market operators • Unforeseen surges in electricity demand driven by the rapid expansion of artificial intelligence, data centres and other digital technologies • Advances in quantum computing that disrupt cybersecurity systems protecting energy infrastructure • Breakthroughs in fusion energy, long-duration energy storage, advanced nuclear technologies, clean hydrogen or carbon removal technologies • Climate tipping points that fundamentally alter hydrological patterns and the viability of hydropower resources • Large-scale cyberattacks • Simultaneous climate shocks across multiple countries • Unforeseen geopolitical developments

Note: We acknowledge that the boundaries, especially between *Known Unknowns* and *Unknown Unknowns* are dynamic and may evolve as knowledge, technological capabilities, and policy experience accumulate. Uncertainty exists along a continuum, with risks progressively migrating from the realm of the unknown into the domain of analysis and policy planning.

Select Bibliography

Cherp, Aleh, and Jessica Jewell. 2014. "The Concept of Energy Security: Beyond the Four As." *Energy Policy* 75: 415-21. (One of the most influential conceptual papers on energy security.)

Geels, Frank W. 2002. "Technological Transitions as Evolutionary Reconfiguration Processes." *Research Policy* 31 (8-9): 1257-74. (Useful for understanding how disruptive innovation can move issues from unknown unknowns to known unknowns.)

Geels, Frank W. 2019. "Socio-Technical Transitions to Sustainability." *Oxford Research Encyclopedia of Environmental Science*. (Demonstrates how transitions produce systemic and often unforeseen consequences.)

Helbing, Dirk. 2013. "Globally Networked Risks and How to Respond." *Nature* 497 (7447): 51-59. (Explains cascading failures in highly interconnected systems, directly applicable to energy security.)

International Energy Agency (IEA). 2024. *World Energy Outlook 2024*. Paris: IEA. (Demonstrates how energy planning increasingly incorporates multiple scenarios and uncertainty pathways.)

Klare, Michael T. 2019. *All Hell Breaking Loose: The Pentagon's Perspective on Climate Change*. New York: Metropolitan Books. (Explores climate-related shocks that challenge conventional security planning.)

Lempert, Robert J., Steven W. Popper, and Steven C. Bankes. 2003. *Shaping the Next One Hundred Years: New Methods for Quantitative, Long-Term Policy Analysis*. Santa Monica, CA: RAND Corporation. (Introduces Robust Decision Making, an approach for addressing known unknowns.)

Marchau, Vincent A. W. J., Warren E. Walker, Pieter J. T. M. Bloemen, and Steven W. Popper, eds. 2019. *Decision Making under Deep Uncertainty: From Theory to Practice*. Cham: Springer. (A reference on uncertainty management and adaptation.)

Rumsfeld, Donald H. 2011. *Known and Unknown: A Memoir*. New York: Sentinel. (The most direct exposition of the framework and its implications for decision-making under uncertainty.)

Taleb, Nassim Nicholas. 2007. *The Black Swan: The Impact of the Highly Improbable*. New York: Random House. (Essential reading on low-probability, high-impact events that challenge conventional risk assessment.)

Taleb, Nassim Nicholas. 2012. *Antifragile: Things That Gain from Disorder*. New York: Random House. (Relevant to energy systems seeking resilience and adaptability under deep uncertainty.)

Walker, Brian, Carl S. Holling, Stephen R. Carpenter, and Ann Kinzig. 2004. "Resilience, Adaptability and Transformability in Social-Ecological Systems." *Ecology and Society* 9 (2): 5. (A foundational treatment of resilience under uncertainty.)

World Economic Forum. *Annual. Global Risks Report*. Geneva: World Economic Forum. (Useful examples of risks migrating from emerging threats to recognized uncertainties.)

Yergin, Daniel. 2006. "Ensuring Energy Security." *Foreign Affairs* 85 (2): 69-82. (A classic statement of modern energy-security challenges.)

Yergin, Daniel. 2020. *The New Map: Energy, Climate, and the Clash of Nations*. New York: Penguin Press. (Examines how geopolitical shocks and technological disruptions reshape energy security.)