Fourth East Asia Energy Forum

organised by
the Economic Research Institute for ASEAN and East Asia (ERIA)
the Energy Research Institute Network (ERIN)
the Ministry of Energy, Brunei Darussalam

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The Fourth East Asia Energy Forum (EAEF) was organised by the Economic Research Institute for ASEAN and East Asia (ERIA), the Energy Research Institute Network (ERIN), and the Ministry of Energy, Brunei Darussalam. EAEF is an annual event held in parallel with the ASEAN Energy Business Forum 2021. Brunei Darussalam co-hosted this year's edition titled 'The 4th East Asia Energy Forum: A Low-Carbon Energy Transition in the ASEAN Region.' The forum acts as a platform bringing together Ministers of Energy of EAS countries, industry experts, and organisations from across East Asia and beyond to address climate change and accelerate Southeast Asia's low-carbon energy transition agenda.

Event Overview

Availability, accessibility, and affordability of energy supply is the most fundamental requirement for the Association of Southeast Asian Nations (ASEAN) member countries in their energy policy planning and implementation. The East Asia Summit (EAS) Energy Outlook, updated by ERIA in 2019-20, suggested that ASEAN would still depend on fossil fuels by 2050 and the share of fossil fuels per total primary energy supply (TPES) in 2050 would be 87% in the Business-as-Usual (BAU) scenario and 82% under the Alternative Policy Scenario (APS) including aggressive energy efficiency and conservation (EEC) and variable renewable energy (vRE) targets. CO_2 emissions by ASEAN countries from 2017 to 2050 are expected to increase by 3.2 times in the BAU scenario and by 2.3 times under the APS.

As the Parties to the Paris Agreement, ASEAN countries need to pursue low carbon energy transition pathways aiming at carbon neutrality as their ultimate objective taking into account each country's specific national circumstances and ensuring other policy objectives, namely, availability, accessibility, and affordability. With the participation of policymakers, energy analysts, and private sectors in the EAS region, the Fourth East Asia Energy Forum will discuss feasible and ASEAN-specific pathways towards carbon neutrality as their ultimate objective.

The Fourth East Asia Energy Forum will consist of the following three parts: 1. Gas and vRE as low carbon transition energy towards carbon neutrality, 2. Hydrogen and Ammonia as energy technologies for ultimate carbon neutrality, and 3. Carbon Neutral Pathway for ASEAN. Carbon Capture Utilization and Storage (CCUS) is also one of the indispensable zero-carbon technologies. Since it was already taken up at the Third East Asia Energy Forum held in November 2020 and the First Asia CCUS Network Forum in June 2021, it will be discussed in part 2 together with hydrogen and ammonia.

Relive the 4th East Asia Energy Forum
https://bit.ly/4thEAEF-YT

Summary of Opening Remarks, Keynote Speeches, and Panel Discussions

Opening Remarks

The Fourth East Asia Energy Forum began with an Opening Remark by Minister of Energy, Brunei Darussalam His Excellency (H.E.) Dato Seri Setia Dr Awang Haji Mat Suny bin Haji Md Hussein. The speech emphasised the importance for ASEAN to cooperate with multisectoral stakeholders to realise its regional energy transition goals. As Parties of the Paris Agreement, ASEAN Member States (AMS) must substantially reduce their carbon emissions and develop a roadmap to achieve low-carbon emissions by 2050.

The COVID-19 pandemic helped reduce carbon dioxide (CO_2) emissions by two billion tonnes in Southeast Asia, however, H.E. Dato Seri Setia Dr Awang Haji Mat Suny warned that ASEAN's predicted rebound will result in the uptick of CO_2 emissions. As such, energy transition is the first step towards realising regional environmental and climate obligations. The integration of more renewable energy (RE) into power generation and strengthening energy efficiency and conservation practices are among the initial crucial steps ASEAN can undertake to collectively reduce CO_2 emissions.

The availability of emerging clean technologies including RE storage systems, hydrogen, natural gas, ammonia, and carbon capture, utilization, and storage can be further integrated into ASEAN's energy transition plans. Strategic and experienced partners in clean energy such as the United States and Japan have openly expressed their support to cooperate with AMS in its low-carbon energy transition move. In his closing statement, H.E. Dato Seri Setia Dr Awang Haji Mat Suny upheld the need to foster innovation and to leverage partnerships regionally and beyond to achieve the goal of a carbon-neutral world.

Secretary-General of ASEAN, H.E. Dato Lim Jock Hoi's opening remarks underscored the urgency to explore various decarbonisation pathways that are aligned with the region's diverse circumstances. For rapidly growing developing regions like Southeast Asia, climate action is a difficult task attempting to balance the people's needs for secure and affordable energy while contributing to the collective aim of lowering carbon emissions.

Although ASEAN has exceeded its 2020 energy intensity target and has reached more than half of its RE share, much work will need to be done. AMS's dependency on fossil fuels well into the foreseeable future will require more effort to guarantee a resilient, competitive, and sustainable energy future. H.E. Dato Lim Jock Hoi expressed additional hope that by improving the use of energy sources, technology, and expertise adapted to AMS's specific national conditions, the region can further accelerate its carbon neutrality initiatives.

Keynote Speeches

ERIA invited six government officials from ASEAN, Japan and the United States to deliver Keynote Speeches sharing their respective country's current and future carbon neutrality plans. H.E. Mr Suy Sem, Minister of Mines and Energy, Cambodia was the first to deliver his speech focusing on the country's success story as a low emissions emitter. Last year, Cambodia's primary energy supply consisted of 60% of fossil fuels with the remaining 40% of renewables such as hydropower, solar, and biomass; in terms of total installed capacity of power system, 45% came from fossil fuels and 55% from renewable sources.

Cambodia has demonstrated its contribution to decarbonisation by having a high share of RE in its primary energy supply. Going forward, its national government is confident that a wider array of new generation technologies will be available and can be included in the future energy mix. H.E. Mr Sem believes that combining clean fuels, renewables, and clean technologies will be required to spur and adopt new energy sources to continue Southeast Asia's energy transition to a low-carbon economy.

In his speech on the overview of carbon neutrality initiatives in Indonesia, H.E. Mr Arifin Tasrif, Minister of Energy and Mineral Resource, Indonesia explained that the country is to reach peak emissions around 2040 at about 686 million tonnes of CO_2 before gradually decreasing to 2060. The Indonesian government's aim of CO_2 emissions reduction will be carried out in six phases, the first starting in 2021 – 2025 where it strives to have 25% of its energy mix comprising of renewables. Between 2031 – 2035, sub-critical coal-fired power plants will be retired whilst power plants driven by nuclear, hydro, and geothermal power will be developed alongside continuous developments of solar power.

From 2036 – 2040, critical and super-critical coal-fired power plants will be retired together with the phasing out of diesel power plants. The government aims to end the sale of conventional vehicles in replacement of electric vehicles as well as have its RE be dominated by biomass and solar power between 2041 – 2050. In the final phase geared for 2051 – 2060, all fossil fuel power plants will be phased out as the country's total energy mix is entirely replaced by RE.

The feasibility of Indonesia's carbon neutrality goal significantly depends on access to financing and a strong regulatory framework. According to H.E. Mr Tasrif, Indonesia is poised to introduce its 'Energy Transitional Mechanism Financing Scheme', establish carbon reduction and clean energy funds, and is currently drafting a carbon tax law. These mammoth tasks are why H.E. Mr Tasrif calls for international cooperation to expedite the mission of a low-carbon economy and a greater RE share in the region.

H.E. Kiyoshi Ejima, State Minister of Economic, Trade and Industry, Japan reassured ASEAN MS to be involved in the region's energy transition to prevent being left behind in the move to a low-carbon society. H.E. Ejima stated that the different levels of development of individual ASEAN nations mean that there is no single pathway in the

journey towards net-zero. As such, stronger research and development will encourage the exploration of various low carbon energy sources and technologies such as CCUS that could effectively reduce CO_2 emissions. On financing matters, H.E. Ejima noted that ending financial support or investments for fossil fuels will pave the way to the introduction of innovative technologies. Furthermore, ASEAN will be required to initiate partnerships with Asian counterparts like Japan to support the capital-intensive aspect of the regional clean energy transition.

H.E. U Aung Than Oo, Union Minister of Electricity and Energy, Myanmar underscored the importance of ensuring energy security, accessibility, affordability, and sustainability for all AMS. The country has further accelerated its RE policy to reduce carbon emissions through reliable and cost-effective means and to minimise energy security risks. Previous assessments list natural gas, vRE, and liquefied natural gas as strong contributors to low carbon emissions. The government is also moving forward in implementing the initiatives listed in the 'Myanmar Sustainable Development Plan' from 2018 including providing affordable and reliable energy to society and industries.

Myanmar further strives to gradually reduce coal consumption from 2030 and phase out coal by 2050. Currently, there are 29 ongoing projects on solar power generation amounting to 1,030 megawatts and in May 2021, the government issued another international bid to add an extra 320 megawatts of solar energy. With the rapid development of clean energy, Myanmar is confident that natural gas and variable RE have integral roles in carbon neutrality pathways.

H.E. Mr Jesus Cristino P. Posadas, Undersecretary of Department of Energy, Philippines began his speech noting the country's rank as a low emitter of greenhouse gas (GHG). However, the Philippines is highly vulnerable to climate change as demonstrated by its ninth-ranked position according to 'The World Risk Index' in 2019. Among the negative effects of climate change on the Philippines include GDP losses, changes in rainfall patterns, sea-level rise, drought, increased public health risks, and endangerment of indigenous peoples.

To significantly reduce GHG emissions, the Philippines has determined a national goal of 75% reduction in CO_2 emissions by 2030. It also strives to speed up the development and utilisation of RE resources, implement green policy mechanisms, and explore hydrogen fuel cells for power generation possibilities and applications in the transportation sector. H.E. Mr Posadas expressed the government's interest in CCUS technology and called for cooperation among AMS to green the regional economy and environment.

Dr Jennifer Wilcox, Acting Assistant Secretary of Fossil Energy and Carbon Management, Department of Energy, United States reasserted the US' commitment to working with ASEAN to develop and deploy CCUS technologies in the leadup to 2050. Under the Biden administration, the US aims to cut emissions by 50% by 2030, produce 100% clean energy by 2035, and reach a net-zero carbon economy by mid-century. Similar

to ASEAN, the share of fossil fuel in US power generation is high at over 50% thus in the coming decades, CCUS and carbon dioxide removal technologies will have a significant role in decarbonisation. Dr Wilcox concluded her Keynote Speech by adding that deepening collaboration between governments, industries, and academia across international borders is integral to decarbonisation.

Panel Discussion

This year's EAEF brought together several notable speakers representing the government, public and private sectors, and research organisations to provide their insight on the state of climate crisis mitigation across ASEAN and East Asia. They additionally shared their assessments regarding Southeast Asia's future strategy for the expansion of clean technology. Prof Jun Arima, Senior Policy Fellow, ERIA set the stage for the Panel Discussion where he gave an overview of Asia's position in realising its carbon neutrality goals.

The current global emissions pathway and the desirable pathway leave a gap of 29 – 32 gigatonnes of CO_2 emissions or equivalent to three times the annual emissions released by China. For a net-zero scenario to happen, developed economies must decarbonise their energy systems or the entire economy before 2050; emerging markets and developing economies must begin slashing CO_2 emissions immediately until 2050. Prof Arima's assessment found that solar, wind and energy efficiency will be crucial to lowering emissions between 2020 – 2030 whilst innovative technology will be essential to meeting mid-century goals.

Asia's role will be significant in the path to 2050 as India and AMS are expected to see CO_2 emissions rise beyond 2030 under the BAU scenario. In addition, no ASEAN country listed climate change as the number-one priority in their Sustainable Development Goals plan. Moving forward, AMS will be required to undertake extensive measures aiming for carbon neutrality by mid-century while also ensuring the availability, accessibility, and affordability of energy supply.

Panel Session 1: Natural Gas and vRE as Transition Energy

The first speaker of the panel session was Dr Dmitry Sokolov, Head of Energy Economics and Forecasting Department, GECF who shared a promising outlook for natural gas in ASEAN's energy transition journey. Dr Sokolov stated that the future of incorporating natural gas in ASEAN's energy mix is encouraging and will spur a wider array of RE sources. Energy demand in ASEAN in the coming 30 years is expected to triple while gas power plants serve as one potential in the transition away from coal-fired power generation.

GECF's findings reveal that the global gas trade will reach 1,990 BCM by 2050 with natural gas making up 25% of primary energy demand along with CCUS, hydrogen, and

ammonia. Dr Sokolov believes that ASEAN and East Asia will be key destinations for energy in the foreseeable future where AMS will become a net importer of natural gas in the next five to six years. To ensure a successful energy transition, Dr Sokolov advised ASEAN countries to secure strong policy developments and warned of price sensitivity in the energy transition process.

The second speaker, Mr Beni Suryadi, ASEAN Center for Energy reminded the audience that each ASEAN country has specific national conditions and moves at its own developmental pace hence it will be necessary to explore different types of fuels. In 2020, the share of RE in Southeast Asia totalled 33.5% driven mostly by hydro and bioenergy; therefore, AMS is only 1.5% away from fulfilling its 2025 target of ensuring a 35% share of RE in installed regional power capacity of energy supplies. Mr Suryadi is optimistic that AMS will surpass its 2025 target.

H.E. Mr Victor Jona, Undersecretary of State, Ministry of Mines and Energy, Cambodia informed of the milestone developments of his country's clean energy journey in which the share of RE, hydro, solar, and biomass is the majority representing 43% of total energy. The Cambodian government found that gas and hydropower plants play a vital role in power generation and supply but has also turned to solar power to aid with national energy security objectives. As such, the country has integrated 500 megawatts of solar farms to its grid and a remaining 150 megawatts is slated for completion in 2022. The government believes that national energy efficiency measures will significantly contribute to low carbon emissions in Cambodia.

Dr Norasikin Ahmad Ludin, Assistant Professor, Solar Energy Research Institute (SERI), Malaysia National University offered her expertise on biomass as an energy source in Malaysia and Southeast Asia. Through her research, biomass is found to have immense RE potential in ASEAN, however, its use in power generation is low at 3.5%. Malaysia's biomass can contribute between 2,400 – 7,460 megawatts to installed capacity potential and 400 – 480 megawatts for biogas derived from palm and mill effluent. Dr Ludin believes that biomass can contribute at least 50% of the Malaysian government's aim to have 70,000 megawatts of installed capacity deriving from RE.

On biomass-Carbon Capture and Storage (CCS), Dr Ludin explained that the biggest challenge for this innovative technology in Malaysia is funding. As such, there are three fundamental policy recommendations to support its development: (1) Mandating Bio-CCS such as imposing carbon taxes; (2) Funding Bio-CCS such as offering a higher price to bio-CCS energy producers; (3) Persuasion of Bio-CCS where the Malaysian government applies a multi-stakeholder approach for CCS transition. Dr Ludin stated that other factors such as location, supply chains, research, and state support and supervision are equally important to accelerating CCS in ASEAN.

Before closing the panel, the moderator Dr Han Phoumin, Senior Energy Economist, ERIA praised ASEAN's progress in achieving regional RE targets. He reiterated the crucial role of natural gas in supporting the region's energy transition and how current

gas-exporting countries are as committed as governments in decarbonising gas. Noteworthy improvements from Cambodia and Malaysia in developing RE further demonstrate AMS's commitment to net-zero while also showcasing how solar energy and biomass can be applied to Southeast Asia's energy systems.

Panel Session 2: Hydrogen and Ammonia as Supreme Energy, and role of CCUS Technologies

Ms Ayaka Jones, International Technical Advisor, Strategic Engagement, Office of Carbon Management, Office of Fossil Energy and Carbon Management, US Department of Energy began the panel discussion by presenting the US perspective on CCUS. The US has years-long experience in CCUS development and has one of the world's largest research and development programmes for this technology. The government's experience found that the private sector has a fundamental role in large-scale CCUS deployment.

Ms Jones stated that significant cost reduction is necessary for wider deployment adding that for the US to scale the technology, it will need to work with the private sector and adopt effective policy tools. To lower the cost, Ms Jones explained that working with international partners and joining multilateral initiatives will be imperative. In this regard, the US is open to working with AMS where it has the toolset to help ASEAN identify promising CCUS projects and determine the optimal configuration for this technology.

Mr Osamu Ikeda, Leader of Business Development Section, Deputy General Manager of Hydrogen Business Department, Chiyoda Corporation presented on hydrogen production and transportation during the session. In 2030, most hydrogen-producing countries will offer hydrogen for less than US$2 per kilogram and added that it will be a pivotal year to ensure that green and blue hydrogen are of the same costs.

To keep production costs to a minimum, Mr Ikeda asserted the importance of determining critical factors like timeframe, location, and distance in future hydrogen transportation and production. Through his industry experience, Mr Ikeda stated that decarbonisation measures require 30 years to materialise to the market thus strong social commitment and urgent action are needed to urgently kickstart the plan.

Mr Yoshikazu Kobayashi, Senior Coordinator, Fossil Fuel Unit, Institute of Energy Economics, Japan shared his expertise on the future of ammonia as a clean energy source. The appeal of ammonia ranges from its carbon-free characteristic to the current availability of ammonia manufacturing infrastructure. To scale up, rapid infrastructure development to expand supply chain capacities encompassing production, shipping, receiving capacity, and consumption.

Although global demand for ammonia is large, the trade volume of this carbon-free fuel is relatively small. As such, Mr Kobayashi suggested that ASEAN and East Asian

governments determine a volume target to boost investor confidence and facilitate investment in ammonia production capacity and logistics. Furthermore, ammonia is more expensive than conventional thermal power generation thus it is imperative to lower transportation and productions costs. The future of hydrogen and ammonia co-firing with CCUS is inevitable thus Mr Kobayashi asserted that governments devote their resources to maximise the use of this innovative technology.

Mr Kazuki Ishikura, President Director, PT Mitsubishi Power Indonesia spoke on the future of hydrogen and how it can benefit AMS. Energy transition cannot happen overnight thus technology must evolve to support this continued journey. In his expert assessment, Mr Ishikura finds that hydrogen, especially in gas turbines, can make a large impact in decarbonising energy systems and society as it is carbon-free and can be used for long-term energy storage. For ASEAN, the advantage is that booming hydrogen demand will spur infrastructure expansion thus further reducing costs.

He also shared expert insights regarding the development schedule for hydrogen and ammonia co-firing as ASEAN intensifies its carbon neutrality efforts. He explained that based on PT Mitsubishi Power Indonesia's experience, the company can reach 100% hydrogen co-firing in gas turbines by 2025 and have it commercialised within another decade; the company is aiming to reach 20% ammonia co-firing in gas turbines by 2025. Mr Ishikura stipulated that technology is only one aspect of reaching the net-zero goal, but industries like PT Mitsubishi Power Indonesia are open to working with government entities and financial institutions to realise clean energy projects in Southeast Asia.

Mr Shigeru Kimura, Special Adviser on Energy Affairs, ERIA summarised the panel discussions stating how production and supply costs will be the biggest challenges to carbon neutrality in ASEAN, especially for ammonia and hydrogen. As such, technological development and government support will be influential in overcoming these obstacles.

Panel Session 3: Net Zero Emission Scenarios of ASEAN Countries

Dr Yuji Matsuo, Senior Coordinator, Energy Data and Modeling Unit, IEEJ kicked off the final panel session with his presentation on decarbonisation pathways for ASEAN. For the region to successfully decarbonise, it must turn to wide-ranging technologies like renewables, nuclear power, CCUS, and the import of hydrogen and ammonia, which altogether will make up 80% of ASEAN's primary energy supply in 2060. Based on his research findings, it is assumed that AMS will become carbon-neutral between 2060 – 2070 with solar photovoltaic (PV) being the cheapest energy source by 2050 – 2070. ASEAN can expect to see renewables become the main power source by 2060, comprising predominantly hydrogen and ammonia.

Dr Matsuo further shared how efficient gas-fired plants will slash CO_2 emissions from the power generation sector by 2030 – 2040; whilst beyond 2040, gas-fired plants

with CCUS, co-firing with ammonia or hydrogen, and 100% ammonia and hydrogen power will serve as optimal candidates in carbon reduction strategies. By turning to different mitigation technologies, ASEAN can significantly lower the costs of reducing GHG emissions thus better securing affordable energy. Solutions such as carbon tax are effective; however, they will not solve climate crisis problems and as such, should serve as an extra tool in reducing CO_2 emissions, not as a concluding remedy. Taking a similar stance as with previous speakers, Dr Matsuo necessitated regional and international cooperation to accomplish the collective goal of affordable decarbonisation.

Dr Saleh Abdurrahman, Member of Committee for Downstream Oil and Gas Regulatory Body - former Senior Advisor for Environment and Spatial Planning, Ministry of Energy and Mineral Resources, Indonesia gave a detailed explanation on Indonesia's decarbonisation plans. To realise the country's 'Vision of Indonesia 2045', there are two scenarios in its future energy generation to support a growing economy and population. The first is the net-zero scenario which will see Indonesia become highly dependent on RE, increase its power generation to 600 gigawatts by 2060, and end the use of coal and gas in electricity generation by 2058.

The second is the BAU scenario where Indonesia continues to use coal and gas leaving behind CO_2 emissions hence necessitating CCUS and CCS in achieving net-zero targets in 2050 – 2060. Dr Abdurrahman believes that the best mix for primary energy is one that is diverse thus the Indonesian government is interested in working with METI, ERIA, and IEEJ to diversify its energy mix. On CCUS and CCS, Indonesia remains prepared to deploy the technologies, but due to its high costs, the country will also optimise hydrogen and ammonia. Dr Abdurrahman stated that technology and international collaboration must go hand-in-hand in the path to carbon neutrality.

Mr Takeshi Soda, Director for International Affairs, Commissioner's Secretariat, Agency for Natural Resources and Energy (ANRE), METI Japan began his presentation by explaining Japan's lack of potential in RE for solar and wind. Nonetheless, Japan is targeting to become carbon neutral by mid-century with plans to cut GHG emissions by 46% in 2030. To realise its 2030 goal, Japan will turn to nuclear power plants, maximise RE, thermal power, and boost energy conservation measures. Further, the Japanese government will intensively promote research and development and demonstration projects which can then be deployed to ASEAN.

It is additionally considering the launch of the 'Asia Energy Transition Initiative' (AETI) which includes various forms of support to realise Asia's energy transition plans; AETI encompasses five key pillars including (1) Financial support, (2) Support for development of technology development and demonstration, (3) Support for energy transition roadmaps, (4) Human resource development, and (5) Promotion of Asia's transition finance. On ASEAN, Mr Soda explained that leapfrogging over fossil fuels is unrealistic given that fossil fuels will still account for 80% of ASEAN's total energy demand in 2040. To alleviate the financial burden of attaining CO_2-cutting innovations,

Mr Soda advised all countries to proclaim their intention to become carbon neutral to attract foreign investment. He added that Japan stands ready to support ASEAN in its decarbonisation plans through schemes such as financing, technology, and human resources.

Dr Twarath Sutabutr, Chief Inspector General, Ministry of Energy, Thailand called on the importance of having a balanced policy on climate crisis mitigation issues. The Royal Thai government expects the country's peak CO_2 emissions level to happen in 2030 and will gradually reduce to net-zero level by 2060 – 2065. Between 2030 - 2060, Thailand will have a remaining 199 million tonnes of CO_2 which must be mitigated, especially in the energy and transportation sectors.

As such, Dr Sutabutr believes CCUS, as well as reforestation, will be critical for Thailand to meet its 2060 goal as both methods can absorb large volumes of CO_2. The Royal Thai government has three key policy considerations regarding clean energy, technologies, and market transformation as part of its carbon neutral pathways. Thailand will thus evaluate aspects including developing RE domestically, importing power from neighbouring countries, using biomass pellets to replace coal in industries, anticipating hydrogen to mix with natural gas, and optimising electric vehicles. Dr Sutabutr stipulated that there be strong leadership and collaborative effort in the lead-up to net-zero.

Dr Alloysius Joko Purwanto, Energy Economist, ERIA closed the final panel discussion encouraging intersectoral collaboration and the continued exchange of opinions and experience to advance net-zero goals. Areas of collaboration can range from technical know-how, financing mechanisms, and human resources development.

Closing Remarks

Prof Hidetoshi Nishimura, President, ERIA gave the closing remarks which focused on international collaboration and the availability, accessibility, and affordability of energy supply for AMS to implement its energy policies. AMS have declared their intention to become carbon neutral by mid-century, but a target announcement must be followed with effective decarbonisation pathways.

As Parties of the Paris Agreement, AMS must undertake carbon neutrality pathways in the second half of the century while addressing each country's specific conditions. To decarbonise the region's energy systems, Southeast Asian nations ought to pursue energy-saving measures and electrification in end-use sectors with low carbon power supply. RE, carbon-free technologies like CCUS, geothermal power, and biomass can further contribute to the region's objectives.

In the transition period, low carbon technologies can effectively slash CO_2 emission; thus, AMS can apply ammonia or hydrogen co-firing, switch from coal to natural gas, deploy more efficient turbines, and utilise CCUS with fossil fuel power generation.

Prof Nishimura explained how tech innovation, large-scale deployment, as well as regional and international cooperation can support the availability of affordable low carbon emissions technologies. With every ASEAN country at different progress levels of their carbon neutral journey, Prof Nishimura expressed ERIA's readiness to assist AMS to develop a country-specific scenario analysis.

Questions & Answers

How do natural gas industry players decarbonise natural gas in the upstream and downstream sectors? What happens if multilateral development banks stop the financing of upstream gas development?

Dr Sokolov explained how in the coming decades, the gas industry is poised to provide decarbonisation options for gas such as by utilising technology. His organisation, GECF, holds quarterly meetings to enhance their environmental knowledge and solutions as well as actively working with the G20. He asserted that it is a misconception to assume that gas exporters and producers do not support climate efforts as they provide practical solutions for present problems.

If banks stop financing the upstream gas sector, Dr Sokolov is confident that countries or regions will create their individual funds to finance these projects. However, he believes that there are many misunderstandings about the industry and the decisions arising from it may risk the availability of affordable energy.

How do we initiate behavioural change to encourage the switch from fossil-fuel-based energy to RE?

Dr Suryadi explained that citizen engagement begins by enhancing energy and climate literacy while increasing awareness in communities is carried out via dialogues and campaigns. It is equally crucial to improve every community's knowledge on the commodities, technologies, best practices, and new ideas of green technology. Dr Suryadi believes that well-informed citizens have the power to shift the perception of communities and ultimately increase public acceptance of RE and energy efficiency initiatives.

What is your recommendation to Asian countries to successfully deploy CCUS in the region?

With many CCUS projects happening in the US, Ms Jones reassures Asian countries that the technology is proven, but it comes down to supporting regulations and regulatory certainty on the surety of long-term storage. Asia must find policy tools to make projects financeable and successful and allow its private sector to scale deployment. Ms Jones added that having the right local policies and incentives in place will make CCUS projects more attractive to investors.

How should the East Asia Summit (EAS) countries address the challenges of ammonia as a future source of clean fuel?

Mr Kobayashi recommended that EAS nations equalise ammonia as a clean fuel and treat it as a clean energy source such as FIT (Feed In Tariff). Furthermore, EAS governments need to set a volume target for ammonia, given its low trade volume, which would send a positive signal to investors thus helping to spur investment in ammonia production capacity and logistics.

As an advanced country, how can Japan transfer its technology to AMS?

Mr Soda explained that Japan intends to set up its 'Green Innovation Fund' to develop decarbonisation technologies such as hydrogen, CCUS, and ammonia across Asia. The Japanese government can additionally promote research and development and demonstration projects. The results of these projects can then be swiftly deployed to ASEAN countries. Japan can also assist ASEAN draft roadmaps and engage in discussions with industries to share information on the latest technology results, trends, or prospects for future cost reduction.

Although importing electricity from neighbouring countries is intended to support carbon neutrality goals in Thailand, would the move make its national energy security vulnerable?

Dr Sutabutr believes that if ASEAN can establish a regional energy market that is seamless and integrated, energy security would not be compromised. He added that robust infrastructure like the ASEAN Power Grid can not only be an answer in the short and immediate future, but it can also act as an anchor of regional carbon neutrality policies.

If Thailand shifts to optimising electric vehicles, then the government can expect an increase in future electricity demand, therefore, more solar PV, hydrogen, and ammonia will also be needed. How is Thailand prepared to meet the potential demand?

Dr Sutabutr stated that Thailand will add solar rooftops and technology thanks to the country's frequent sunshine. The government also has plans to upgrade its infrastructure, particularly its low voltage distribution line to secure an active and adaptive grid and ultimately, it is already anticipating greater penetration of solar energy into its national grid. On the future of hydrogen, Dr Sutabutr explained how the Thai government has substantially invested in natural gas combined cycle power plants and is confident that hydrogen would later be used to bridge or mix between fossil fuels or RE.