

APEC Workshop on Sustainable Energy Transition: Opportunities and Challenges

Summary Report

23 – 24 November 2023

APEC Energy Working Group

February 2024



**Asia-Pacific
Economic Cooperation**



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APEC WORKSHOP ON SUSTAINABLE ENERGY TRANSITION: OPPORTUNITIES AND CHALLENGES

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Summary Report

I. INTRODUCTION

On 23 and 24 November 2023, the APEC Workshop on Sustainable Energy Transition: Opportunities and Challenges initiated by Viet Nam and co-sponsored by China; Hong Kong, China; Chinese Taipei; Thailand; and USA was held in Ha Noi, Viet Nam. Speakers and participants came from global organizations and research institutions and representatives from APEC member economies' relevant Ministries and government's agencies, companies and business associations that relates to energy in APEC economies and across the APEC region.

The Workshop aimed to help APEC and non-APEC economies and stakeholders to share about opportunities and challenges on energy transition towards a low carbon economy.

II. BACKGROUND

It is commonly accepted that the world has been facing unprecedented challenges posed by the impacts of climate change. In such a process, it is critical to transit to a climate-resilient future global economy and appreciate net zero or carbon neutrality commitments with energy transition playing an important role. The energy transition is a pathway toward transformation of the global energy sector from fossil-based to low-carbon by the second half of this century. At its heart is the need to reduce energy-related CO₂ emissions to limit climate change¹.

In the 2021 APEC Economic Leaders' Declaration, it is stated that "APEC has made some progress in strengthening the region's capacity to adopt renewable energy and other environmentally sound technologies, as part of sustainable energy transitions that reduce our dependence on fossil fuels. In this context, we will continue to work together to support energy resilience, access, and security in the region. We acknowledge the importance of stable energy markets, and supporting clean energy transitions. Building on this, we commit to leverage APEC's role as an incubator of ideas and capacity building to tackle

¹ [Energy Transition \(irena.org\)](https://www.irena.org)

climate change. We will further integrate action on climate change across relevant APEC workstreams.”

This project aims to help APEC and non-APEC economies and stakeholders to share about opportunities and challenges on energy transition towards a low carbon economy.

III. OPENING REMARKS

In the opening remarks, Mr Pham Nguyen Hung (Deputy Director General, Electricity and Renewable Energy Authority, Ministry of Industry and Trade, Viet Nam) highlighted that energy transition is the gradual transition from an exhaustible primary energy state to a clean, continuous, infinitely reusable form of energy, with a larger ratio to ensure sufficient electricity and climate change requirements. Many economies have soon realized that this is an inevitable path of development and have undergone a strong shift. Mr Pham Nguyen Hung observed that the global energy transition process is tending to accelerate rapidly in the recent period. The prospect that the world's economies can be powered entirely from renewable energy sources, vehicles instead of running on gasoline will run on electricity, or other forms of energy stored from energy sources. The speaker also mentioned that renewable energy is gradually becoming a reality in the coming decades. This process helps mitigate the impact of climate change, works towards more sustainable development, is more equitable for all, and creates more opportunities for current and future generations.

However, Mr Pham Nguyen Hung recognized that opportunities always come with challenges, the transition to clean energy is not easy, especially in developing economies. Building a clean energy supply system requires large investments. Along with that, technology in producing and storing renewable energy still has many limitations, making it difficult to ensure stable energy supply. In particular, it is necessary to have appropriate support policies to encourage businesses and people to participate in the production and use of clean energy. This requires careful consideration and calculation from the Government to create a favorable business environment, while ensuring consumer benefits.

With that meaning, the Workshop was organized with the desire to provide an overview and evaluate the results achieved in ensuring APEC's energy security. At the same time, the Workshop is expected to discuss the opportunities as well as the challenges being faced, and sought solutions to promote the transition to clean energy in the APEC region in the coming time. This is also the contribution of the Vietnamese Government to the common effort towards achieving the common goals of the APEC region: doubling the proportion of renewable energy in the total primary energy supply by 2030 (compared to the level of 2010) as directed by APEC Economic Leaders.

IV. KEY ISSUES

1. OVERVIEW ON ENERGY TRANSITION

There were two speakers in the Session, namely: Ms Ju-Min Jheng, Deputy Director, Energy Administration, Ministry of Economic Affairs, Chinese Taipei and Ms Letty G. Abella, OIC-Supervising Science Research Specialist, Energy Policy and Planning Bureau, Department of Energy, the Philippines.

- To begin the session, **Ms Ju-Min-Jheng** delivered a presentation on Chinese Taipei's Energy Transition Towards Net Zero. Her presentation covered the energy situation, Net zero transition, and key highlighted strategies in Chinese Taipei. Regarding the energy situation, Chinese Taipei relied heavily on imported energy sources, where 97.3% of energy was imported in 2022, of which fossil fuels accounted for 92.4%. Among the renewable energy (RE) types, solar power is the main source of renewable energy, which were followed by hydro, waste, and wind power. In May 2016, Chinese Taipei announced Energy Transition policy to focus on energy security, green economy, environmental sustainability, and social equity as the core values of energy policy to facilitate energy sustainability development. Chinese Taipei also set the goal of achieving energy transition by 2025. For the energy transition pathway, the plan is to increase the share of renewable energy and gas-fired power, while reducing coal-fired power. Regarding the Net Zero Transition, Chinese Taipei is plotting the pathway to achieve net zero emissions by 2050. They are seeking out opportunities to cooperate with other economies and create mutually beneficial outcomes. In align with the Net Zero target, Chinese Taipei is undergoing amendment of "The Greenhouse Gas Reduction and Management Act", which set a more challenging reduction goal by 2050. Lastly, regarding the key highlighted strategies, the speaker said that the first key strategy of Chinese Taipei is acceleration of wind power. To conclude, the speaker reiterated that confronting with the highly dependence on import energy, a net zero transition plan help boosts energy independence was crucial. Energy transition was at the central of Chinese Taipei's net-zero transition, zero carbon strategies in energy-related sectors would range from acceleration of renewables to adoption of advanced clean energy technologies (for example: hydrogen), as well as electrification and carbon capture and storage (CCUS).
- **Ms Letty G. Abella** delivered presentations on the Sustainable Energy Transition in the Philippines. She first mentioned about the total primary energy supply (TPES) of the Philippines in 2022. More than half of the Philippines energy are imported, making it vulnerable to geopolitical conflicts. There are 4 types of energy

used in the Philippines: coal, renewable energy, oil-based and natural gas. The Philippines continues to utilize a significant amount of fossil fuels (coal, oil, natural gas) accounted for 67% of the TPES. Oil makes up the largest portion of the energy supply with a share of 32%, closely followed by coal at 31%. Natural gas, which is mostly used for electricity generation accounts for 4%. The aggregate share of renewable energy (RE) was 33% of the TPES, mainly from geothermal at 14.6%, biomass at 12.6%, hydro at 4.1%, and other RE at 1.4%. In terms of energy demand, the Philippines continued reliance on oil and petroleum products at 51% of the total final energy consumption (TFEC) in 2022. It was followed by electricity at 22%, biomass at 20%, coal at 5.4%, and biofuels at 1.6%. Transport is the most energy-intensive sector at 34% followed by the household sector with 29%, industry sector with 20%, and services sector with 12.4%. In terms of power generation, more than half or 60 percent of the total power generation was supplied by coal. Followed by renewables at 22 percent and natural gas at 16.0 percent. Households, industry, and services sectors will continue to account for the bulk of electricity consumption. Further, Ms Abella discussed the projected installed generating capacity, by technology; power generation, by fuel; total primary energy supply, by fuel in the Philippines by 2028, 2040 and 2050. In the Philippines, there are some major challenges in the energy sector such as (i) electrification of unserved and underserved rural areas, (ii) delays in transmission projects that hamper attainment of the RE targets, (iii) threats to energy resiliency, (iv) impending depletion of Malampaya resources, (v) heavy reliance on imported and conventional fuels, among others. Next, Ms Abella presented some strategic priorities which are designed to continue the economy's energy transition ensuring energy security and sustainability, ultimately leading us toward climate-responsive and economically, socially and environmentally responsible energy sector: (i) Access to energy, (ii) Reliable and resilient energy supply, (iii) Clean, sustainable and climate-centered energy resources, (iv) Affordability of energy, and (v) Cross-cutting measures. Lastly, she emphasized that generating critical investments in the energy sector serves as a driving force in energy development and transition. From 2022 to 2040, the total investment requirements of the Philippines are expected to be USD153 billion for upstream, downstream, and power sectors. The power sector accounts for majority of the total capital requirements with a share of around 80%, followed by the upstream (15%) and downstream (5.0%). Out of the USD115.3 billion that is needed for the construction of new power plants, the required investments on RE projects alone amounts to USD94.3.

2. OPPORTUNITIES FROM ENERGY TRANSITION

There were two speakers in the Session, namely: Dr Terrence Surles, Consultant, Hawaii Natural Energy Institute, United States and Mr Joachim Monkelbaan, Global Trade and Sustainable Development Advisor.

- Firstly, **Dr Terrence Surles** presented about the opportunities focused on new funding and technologies. In the USA, there are 3 new laws that have been enacted and industry has taken advantages of them (Bipartisan Infrastructure Law, Inflation Reduction Act, CHIPS²). The speaker highlighted that States remain in leadership roles to implement change. Technologies continue to improve which is shown by continued installations of clean technologies. Dr Surles observed that the investment in clean energy has significantly increased. There are some National Academy of Science Engineering, and Medicine (NASEM) recommendations for government efforts such as (i) Develop collaborative renewable energy deployment plans at the regional level; (ii) Support the expansion of the electricity transmission grid; (iii) Invest in energy efficiency and materials efficiency in buildings and industry; etc. Among other technologies, the speaker stated that the storage systems are becoming more common due to grid needs and their decreased costs; storage will become more important for ramping and load shifting. In addition, there was a change in direction of US Department of Energy (US DOE) in proposing over USD3 billion to connect renewable resources with load centers and US DOE investing in smart grid technologies. US DOE focused on numerous issues for deployment of variable renewables on grid such as (i) improvements in information technologies create opportunities for automation for interconnections; (ii) interconnection processes must continue to adapt to a changing generation mix and changing transmission technologies to right-size network upgrades; (iii) with a constrained transmission system, making use of available capacity will be critical for timely connection of new resources at low cost; etc. To conclude the presentation, Dr Surles shared some good news about government and private sector funding in which investment is spurred by continued improvements in solar, wind, and storage technology; There are some new developments in communications and information technology (IT) systems to support grid; Political will is present in many state governments and overall population; Growing awareness of climate problem is due to recent increases in natural disasters.
- **Mr Joachim Monkelbaan** provided information on the Energizing APEC Economies Towards a Low-Carbon Future. He shared that from the “Outlook for APEC Energy Demand” chart, it could be seen that the final energy demand rose

² CHIPS stands for "Creating Helpful Incentives to Produce Semiconductors"

32% from 2013 level by 2040. Mr Joachim Monkelbaan viewed that the sector that demand grew the most was the industry and transport. As transport is very important in discussion in term of electrification of transport. For example, many economies decided to move to electric cars and uses more renewable energy which is solar panel. Next, the speaker discussed about carbon neutrality and pathways. He gave definition of carbon neutrality and explained how the zero carbon pathway look like in a timeline. For example, in 2050, more than 85% of buildings are zero carbon ready and almost 70% of electricity generation globally from solar PV and wind. There are many obvious opportunities in energizing APEC economies: renewable energy development; energy efficiency; innovation and technological advancement; green job creation; investment opportunities. There are also many less obvious opportunities such as improved public health; enhanced energy security; climate resilience; policy and regulation changes; consumer awareness and demand. Dr Monkelbaan then discussed on some specific opportunities such as Chemical Looping Combustion (CLC); CCUS going beyond gas, the pipe dream of energy transition. At the end of the presentations, he suggested some strategies, policies and recommendations relating to climate resilience and investment, regional cooperation in regulatory frameworks and advances in renewable energy technology

3. OBSTACLES IN ENERGY TRANSITION – PERSPECTIVE OF THE PRIVATE SECTOR

There were two speakers in the Session, namely: Mr Kang Taeil, Founder and CEO, One Energy Island Co. Ltd, Korea and Mr Vu Quang Dang, Independent Energy Specialist, Viet Nam.

- The presentation of **Mr Kang Taeil** was divided into 3 parts: (i) the Republic of Korea's Energy Transition Requirement; (ii) Energy Transition Challenges; (iii) Implications for Asian Economies. Regarding the Republic of Korea's Energy Transition Requirement, the speaker emphasized that Korea is the 8th largest energy user in the world with 94% of its energy consumption relying on imported fossil fuels. Korea is among economies with the highest energy-intensive industry. Mr Kang Taeil pointed out some driving factors for energy transition of the Republic of Korea, which are (i) respond to climate change; (ii) energy security; (iii) create a new growth engine. The electricity generation mix strategy of the Republic of Korea is to (i) expand and extend nuclear power plants; (ii) short-mid term use of coal and liquefied natural gas (LNG) for stable electricity supply; (iii) in the long run, renewable and hydrogen as the main source of energy. The Republic of Korea runs among the most efficient power systems in the world. Regarding the energy transition challenges, the speaker discussed about the energy transition tasks,

which are: (i) Power system infrastructure upgrade; (ii) Change to power market and (iii) Building social consensus. In terms of power system infrastructure upgrade, Mr Kang Taeil highlighted the RE integration problems at each phase of RE penetration and the equivalent measures to address those problems as well as some key considerations to be taken at the early stage of variable renewable energy (VRE) deployment. In terms of change to power market, the expected power system landscape with energy transition is about 10 million electricity providers by mid of 2030's. Eventually, RE should be invited to compete in the electricity market as a dispatchable generation source. On building social consensus on energy transition, Mr Kang Taeil suggested ways to design and manage the transition process effectively. They were (i) not to incur delayed and costly transaction and (ii) create a win-win for society as a whole. At the end of the presentation, the speaker showed some implications for Asian economies. He recommended to take a proactive approach in power system infrastructure upgrade and the policy makers should change from players to play makers, upgrade the power system infrastructure and build social consensus.

- **Mr Vu Quang Dang** focused his presentation on Urban Lighting in the Energy Transition in Viet Nam. He provided information that in Viet Nam, there were 3 pillars in lighting development transition which are (i) Domestic Lighting Development Strategy to 2025 and Urban Lighting Management Decree; (ii) Smart and Green Urban Development, and Green and Night-time Economy; (iii) Net Zero Emission target by 2050, Domestic Programs on Climate Change, Green Growth, and Energy Efficiency. There are some main transitions of the smart and energy-efficient lighting system, which are transition from traditional lamps to energy efficient lamp; energy saving by switching off to dynamic dimming; cabinet-base control to lamp-based control; simple lighting control center to smart lighting control center; lighting pole to smart poles. Next, the speaker discussed about the private investment in urban lighting in Viet Nam. He observed that in Viet Nam, high interest from the private sector in the PPP³ urban lighting projects to the local government; however, no PPP project has been implemented because of lack of legal framework and regulations. However, Mr Vu Quang Dang emphasized many barriers for the private sector such as PPP Law excluded street lighting/urban lighting from the eligible project list for PPP; No legal framework for energy performance contract (EPC), energy service company (ESCO) etc. To conclude the presentation, the speakers shared some recommendations and lesson learned on the lighting development. Some of the recommendations were developing a domestic urban lighting development program (TA⁴ and investment).

³ PPP stands for public – private partnership

⁴ TA stands for technical assistance

4. OBSTACLES IN ENERGY TRANSITION – PERSPECTIVE OF THE ACADEMIC SECTOR AND INTERNATIONAL ORGANIZATIONS

- **Dr Terrence Surles** made a comprehensive presentation on some challenges that must be overcome in extensive development of clean energy systems: institutional issues, grid issues, resources issues, and financial issues. The institutional, technological, cultural, and social issues are really challenging. There is difficulty in expanding transmission. The challenge is how to serve all the energy uses that will be electrified. The transmission issues as highlighted by the US National Research Council (NRC). New transmission will be needed to access many clean energy resources. The interconnection and transmission development process can drag on for years. He informed that in the USA, clean energy developers can face a long wait for interconnection. Regarding the grid issues, the speaker listed out some existing and future grid operations and planning issues in the US. Some of them were: (i) Retiring so much dispatchable, inertia-providing generation while bringing on lots of less-dispatchable inverter-based resources. Thermal units are needed for grid stability; (ii) Changing requirements for resource adequacy and resilience; (iii) Need for better modeling and planning tools; etc. There are also reliability and resilience challenges due to high percentages of variable renewables on the grid coupled with possibility of “overbuild” costs. He specified this challenge by showing the case of energy in California. Another issue is critical material and supply chain issues, which will continue to hinder development. Critical materials are not evenly distributed around the world. Recent events in supply chains have led to cancellations of approved projects. Also there are many elements necessary for green technology that have limited supplies. The speaker concluded his presentation by talking about the financial issues. According to the speaker, financial issues would need to be seriously considered as the cost of many renewable technologies is starting to rise and the goal of “electrify everything” will require huge build-out of the grid.

5. CASE STUDIES IN SOME APEC MEMBER ECONOMIES

There were three speakers in the session, namely: Ms Letty G. Abella, OIC-Supervising Science Research Specialist, Energy Policy and Planning Bureau, Department of Energy, the Philippines; Mr Thanatat Soponananchai, Development Director, HDF Energy, Thailand; Mr Vu Quang Dang, Independent Energy Specialist, Viet Nam.

- **Ms Letty G. Abella** discussed the renewable energy (RE) transition in the Philippines. She introduced briefly about the background of the Philippines renewable energy shares in terms of energy supply and demand. In 2022, the Philippines’ RE share was about 29% of the total installed capacity. On the other hand, the RE share of the total power generation was 22%. The Philippines sets targets for accelerating renewable energy: 35% share of RE in the power generation

mix by 2030 and increase to 50% by 2040 to 2050. The renewable energy program of the Philippines aims to achieve energy security, sustainable development, inclusive growth, mitigate climate change and provide RE capacity building activities. RE incentives include fiscal and non-fiscal incentives. The capacity of RE is largely comprised of biomass, geothermal, solar, hydropower, ocean and wind. Regarding the offshore potential, there are six (6) potential offshore wind (OSW) development zones identified in the Philippines. The Philippines has implemented many renewable energy policy mechanisms and incentives such as (1) renewable energy market which serves as the venue for trading Renewable Energy Certificates (RECs) equivalent to an amount of power generated from RE resources; (2) renewable portfolio standards which requires all load-serving entities (distribution utilities) to source a minimum percentage of RE in their respective power supply portfolios; (3) green energy auction program which provides additional RE market through a competitive electronic bidding of RE capacities; (4) green energy option program which allows electricity end-users with 100kW and above demand to source their electricity supply from renewable energy sources through RE suppliers; and (5) net-metering program which allows end-users to generate electricity from RE-based systems up to 100kW for their own use and sell the excess to the grid. It allows end-users to be a prosumer (both a consumer and producer). Ms Abella then discussed the mechanisms in details in terms of status of implementation and their respective accomplishments. The Philippines will further develop its waste-to-energy resources that is vital not just for electricity generation but for waste management as well, expand the roof-mounted solar program for supply augmentation, facilitate the commencement of ocean and tidal energy utilization, and accommodate the development of energy storage systems for RE integration and grid stability. Currently, the Philippines allows full foreign ownership of RE power plants which will help in accelerating the development of the RE sector in the economy. The Preferential Dispatch of all RE-generating plants to the Wholesale Electricity Spot Market (WESM) encourages additional investments because of guaranteed dispatch in the grid at their full available capacity, allowing recovery of investments. Under the Policy and Administrative Framework for the Efficient and Optimal Development of the Economy's Offshore Wind Resources", studies such as Marine Spatial Planning, Grid Readiness, and Permitting and Consenting were conducted to hasten the development of OSW resources. Next, the speaker mentioned about the ways to achieve inclusive clean energy transition in Philippines, example of support infrastructure for clean energy and streamlining the permitting process. Specifically, the Philippines has taken the initiative to formulate a Smart and Green Grid Plan (SGGP) that will establish a robust policy and mechanism that promotes the timely implementation of transmission projects, while ensuring the efficient operation of the transmission system. The Energy Virtual One-Stop Shop (EVOSS) Act, an online platform, aims to facilitate and streamline business processes of power generation, transmission,

and distribution energy projects. At the end of the presentation, the speaker mentioned the RE issues and challenges in the Philippines and the picture of future energy scenario in capsule envisioned by the energy sector, to achieve – energy security, sustainable energy, resilient infrastructure, competitive energy sector, smart homes and cities, and empowered consumers.

- In this session, **Mr Thanatat Soponananchai** introduced about the case study of green hydrogen developmet in Thailand. He firstly mentioned about the power business structure in Thailand. The current power business structure in Thailand is an enhanced single buyer, meaning that EGAT⁵ is the sole buyer of all electricity generated in Thailand, except for electricity generated by Very Small Power Producer (VSPPs) which can sell directly to the distribution system. He continued to share information about the installed generation capacity is 49,304MW with 212,050GWh energy production, the MW share are mainly from EGAT and IPP at 31% and 30%, while the rest are Small Power Producers (SPP) (19%), VSPP (8%) and import from neighbouring economies (12%). Mr Thanatat continued to give information about the source of fuel supplies and renewable energy sources. Mr Thanatat gave an example of Centrale Electrique de l'Ouest Guyanais (CEOG) Project. This is the world first MV-Scale power plant delivering 24/7 carbon-free and non-intermittent electricity. Power Purchase Agreement (PPA) guarantee 10MW daytime and 3MW night time. To conclude, he summed up that there was no permitting allowed to build any factories or powerplant within the forest are nor along the coastal area, including islands. Fuel cells and electrolyze are not on the purchasing list of Ministry of Finance, Thai Government should subsidy green hydrogen project with special import tax or higher Feed-in-Tariff for special carbon offset projects.
- **Mr Vu Quang Dang** gave an example of the First Pilot Battery Energy Storage System (BESS) Project in Viet Nam. Viet Nam installed power capacity in September 2023 and has the future installed capacity targets under PDP VIII until 2050. According to a PECC2 study in 2021, BESS demands are 1230MW/3460MWh for power supply in the North in 2025 and 732MW/5096MWh for RE integration and grid congestion release in the South Central and Highlands in 2030. There are Two BESS proposals from EVN in 2021 and 2022. In November 2023, a Draft PDP8 (Power Development Plan 8) Implementation Plan has a target of 50MW of BESS in 2025 without specific energy (MWh) and purposes/use case. The pilot BESS project in Viet Nam of

⁵ EGAT stands for Electricity Generating Authority of Thailand

50MW/50MWh by EVN has multiple purposes including ancillary service (frequency control and regulation), peak shifting in the North of Viet Nam, and others. At the end of the presentation, he also gave some business model recommendations and some recommendations for 2023-2025 pilot, 2026-2030 scale-up and expansion after 2031. He suggested that in 2023-2025 (pilot period), this time is for test “use case” and define services to be procured by EVN from private BESS and is the “sandbox” time to identify and make revisions to regulations. This time will need around \$50 million and other financial sources. For the period of 2026-2030, he said this was the time for scale up BESS to PDP 8. This time will need around USD250 million and other financial sources (EVN equity, non-sovereign loan, etc). From 2031 is the time for large scale expansion. This time will have market participants and need owner equity and commercial loans

6. DISCUSSIONS

- In the Philippines the government has some initiatives to secure investments for nuclear energy in the future and provides favorable conditions for the investors in this area.
- Unconditional emission reduction is not a simple solution. Therefore, economies need to promote both energy efficiency and conservation in all sectors.
- Chinese Taipei shared that biomass sources mainly came from agricultural by-products and household waste from biogas production.
- Despite efforts to promote net zero, currently LNG still accounts for a large proportion and is expected to increase even more, from two to five terminal ports. In 2022, the contribution of LNG is 38%. In the expected composition from 2040 to -2050, the proportion of electricity using LNG will be about 60-70% and Chinese Taipei is trying to modify the pathways.
- Regarding the issue of importing hydrogen, by 2050 Chinese Taipei is expected to be able to produce hydrogen on its own at about 9-12%.
- In Viet Nam, LNG accounts for a large proportion of the period 2030-2035, which affects investments, especially in the oil and gas sectors. In the short term, expanding LNG ports takes time to ensure profitability of capital investment. However, in the 2040-2050 period it is important to reduce net zero emissions. In Chinese Taipei the economy continues to invest in expanding LNG ports to decarbonize this energy source and Chinese Taipei has also applied Carbon Capture and Storage (CCUS) to help address the risks of climate change and reduce emissions.

- The CCUS technology in Chinese Taipei has a demo project. Its capacity is expected to be 50,000 tons by 2040-2050. The storage roadmap is under planning.
- To ensure the engagement of all companies and the private sector in the energy sector, in the Philippines the government set goals to collaborate with departments to make relevant policies that go together with application of information technology and capacity building for such businesses.
- Regarding the major island interconnection, the Philippines through the National Grid Corporation of the Philippines programmed a significant upgrade in its facilities to expand the transmission systems to meet the forecasted demand, entry of new and various generating facilities that will allow market competition. In fact, there are on-going projects on the interconnection of the three major islands as reported in the economy's transmission development plan. There are power plants put in operation to generate electricity and distribute it to consumers in the islands. However, it was noted that the interconnection is quite expensive considering it is an island to island underwater interconnection.
- In the Philippines, in order to promote sustainable development and to sustain the supply of natural gas considering the domestic/indigenous natural gas supply is will not be able to sustain its usual production rate and/or depleting) that will be needed by existing and proposed natural gas power plants, the economy continues to promote and encourage private sector investment in liquified natural gas (LNG) receiving terminals and other downstream gas related facilities by creating an investor-friendly environment. Thus, the importation of LNG is one of the strategic solutions the government identified and initiated to ensure supply continuity. Currently, the Philippines government through the Department of Energy has approved seven (7) LNG projects.
- Regarding the plan to connect all islands in the Philippines, there is a project on the interconnection of the three major islands. A power plant has been put in operation to generate electricity and distribute to consumers in the islands. However, the interconnection is quite expensive because it has to go underwater from island to island.
- In the Philippines, in order to promote sustainable development and prevent natural gas from depleting, the economy has initiated some modifications with seven large natural gas power plans to reduce the dependency on this energy source.
- Sustainable energy transition is a trend that people cannot go against. However, to achieve a sustainable energy transition, the world faces a number of challenges. For example, with wind power, Viet Nam is currently developing offshore wind power on a large scale by 2050 and facing difficulties and challenges, including: (i) huge

wind power investments; (ii) complex connection systems; (iii) no available IPA⁶ mechanisms for wind power or other renewable energies; and (iv) offshore wind power manufacturing and installation technology does not meet planning for foreign projects.

- Regarding the investment in sustainable energy solutions, a speaker suggested taking into consideration not only investors and the amount of money but also domestic investment institutions and policies. It is a significant challenge. To address this issue, a speaker proposed that it is necessary to develop a system of power purchase agreements or interconnected standards. A lot of work has been done in the United States at the state level on development of the power purchase agreements to be eligible for getting financing for the program. But this is a challenging task for all economies in the world. Once power purchase agreements are developed between the utility and the independent power producer, the regulator can agree on the reasonable rate speed that will be charged to consumers.
- The Atlantic Seaboard and the Gulf of Mexico are favorable locations due to their favorable continental shelf configurations. For the oil industry, they have tethered platforms in the Gulf of Mexico and other parts of the world and they are economically viable right now to put an offshore wind platform that is tethered to the floor. However, this technology is not yet economically viable for off-shore wind..
- Despite that Viet Nam is one of the most promising economies in the world for investment, it faces the huge challenge of fast-growing energy demand. It will be difficult to meet all that demand just with renewables. However, to attract investment for renewable energy, a report to the World Forum has been published on different ways in which investment promotion agencies can better attract climate financing. Some of them are to put in place a supplier database, to intensify international cooperation among investment promotion agencies, etc. So, it requires the government's efforts to build good collaboration between ministries, institutions, and investment promotion agencies.
- In Europe, some economies have grown strong with the power sector. Examples are Denmark, the UK, and the Netherlands. They have quite different economic structures, especially the financial markets. There are a real opportunity to develop capital markets, for example, by issuing bonds for power development.
- Other economies could consider working with Korea and Japan which have more similar geographies to develop their wind power.

⁶ IPA stands for Independent Project Analysis

- The USA are making efforts to reduce greenhouse gas emissions, particularly within the states in the Northeastern US, such as Virginia, Delaware, Pennsylvania, New York, Connecticut, Vermont, New Hampshire, and Massachusetts. There is an initiative within those states to terminate coal, which is primarily produced in the Northeast in Pennsylvania, and to replace it with renewable energy alternatives, including wind and solar power. However, there is opposition from fishermen and environmental groups against offshore wind since it may cause impacts on whale migration, may impede fisheries economies, and also create aesthetic issues..
- Raw materials will be a growing challenge because global competition is growing without global solutions for this problem. Sourcing critical materials may help economies enhance their independence on the global supply chain.
- Regarding localization, the trend of localization is going down because it requires expensive technologies. When the USA is trying to open a semiconductor factory in Arizona, it is difficult to find a suitable workforce to implement the project despite that a subsidy of USD80 billion is made available.
- Economists are against low-content localization requirements because such requirements distort the market. The politicians, on the other hand, look at other angles to support the public and create jobs for the local communities. However, in view of WTO requirements, application of localization content is not allowed.
- To support the global transition to clean energy, economies are trying to collaborate in the flow of technologies, research, development, capital, etc. There is also a need to promote free flow of information technologies and materials to create global markets.
- Regarding solar energy technologies, 30% of the value added from the solar comes from solar panels and 70% of the benefits are gained in services, especially local services, because of local installers, local marketing, and local finance.
- Regarding solar panels and energy storage systems (solar + storage), there is usually some limitation in the area of land to set up those energy projects. The other problems with lithium-ion systems are the spent systems are not really spent and there is a possibility for them to catch fire. For recycling those materials, the Department of Toxic Substances Control in California, is now drafting regulations on recycle of these materials.
- In the EU, legislation has been put in place on importation of electric cars that are not produced efficiently to ensure environmental protection for the global population, to disincentivize inefficient production of batteries, and to encourage more efficient production.

- Regarding the environmental impacts between LEDs and older incandescent light bulbs, there are different impacts on the nightlife of bats or other animals. LEDs are more friendly as compared to traditional lamps, and on the other hand, they discontinue the use of mercury content that is very dangerous for human beings. Besides, LEDs can save energy and the LED industry has provided better services for people and helped improve the business environment.
- In Viet Nam, PPPs are not allowed for street lighting. According to the Ministry of Planning and Investment, PPP should be used for big projects such as bridges, roads, or thermal plants, etc. Street lighting projects, on the other hand, are of too small size to apply the PPP. This is the reason why PPP has been excluded from street lighting projects.
- Overall, it is estimated that currently there are about 1.7 million lighting points in Viet Nam, 67% of which are non-LED. If converting all lights to LEDs, the installation capacity could be saved significantly because it does not need big power plants and LEDs can reduce energy consumption by up to 65% of the total 614 million kilowatt hours.
- In addition, the investment in street lighting projects in one province in Viet Nam may range from USD20 million to 30 million or less. Overall, this capacity is still insignificant to apply PPP. However, the speaker still proposed that PPP should be applicable for street lighting projects as it may offer opportunity to gain a big amount of savings and to apply simple technology for implementation. Thus, the replacement of traditional lamps with LEDs is considered as a good deal.
- Another speaker mentioned that the three main challenges for energy are infrastructure, power market, and social consensus. To address those challenges, the government plays an important role in supporting the power market to attract more private sector investments, and to facilitate public-private partnerships for improving and further developing sustainable development of renewable energy.
- In the Philippines, the government work with the local government to set up lighting requirements of the respective jurisdiction to address emerging issues in the energy and renewable energy sector.
- In Viet Nam, there are different government levels. At the central level, the Prime Minister takes responsibility of the entire economy. At 2nd level, provincial or city agencies are in charge of provinces and cities. At the third level, the district agencies are in charge. Accordingly, the central government only supervises important electrification projects that serve the entire economy. Related to such projects the central government, led by the Prime Minister, provides legal framework, policies, and investments for the economy, not only for the lighting. Investment in lighting

is decided by the provincial government, which processes the public procurement contracts. At lower levels in Viet Nam's provinces, the district government, namely the district People's Committee, makes investment and one company can provide the lighting service for several districts, which is in compliance with the legal framework. However, one problem is that the legal framework is not clear enough when it comes to private investment in street lighting. Therefore, in the future private companies can be exposed to risks of being investigated by the police on their investment. That is why the private sector is not yet interested in making investment such public lighting projects.

- About research on lifecycle of renewable energy generation technologies and resources, including biofuel, a speaker shared one of the issues to be taken into consideration was the lifecycle analysis in terms of carbon emissions from the use of fossil fuels for the mining, manufacturing, and transportation of these technologies.
- Carbon savings are of high importance. In the EU, there is a lot of biomass and they are added as a feedstock for power generation. It is a sustainable fuel for sustainable development, even if it is not that efficient in terms of energy generation.
- In Malaysia, the government is making efforts into the application of solar energy. It is important to take into account the viability of solar versus that of coal in terms of costs. An important consideration is how the costs of those energies are going to change over time because most solar and wind systems cost large investment than coal-fired generation projects. The coal-fired power plant is the cheapest source of electricity now.
- Regarding the carbon neutrality goals by 2050, a speaker informed that economies should opt for setting a realistic goal in preference to aggressive but unrealistic ones. The later will lead to disappointment of the public. Governments need to be honest about this goal because now it seems to be unable to achieve such net zero goal. For Asian economies, it is very important to have an open dialogue to lower the ambitious goals. Free Trade Agreements can be taken advantages of as platforms for further discussion on this issue.
- Another speaker indicated that one of the measures for greenhouse gas emission reduction and cost-effectiveness is to promote energy efficiency. In the Philippines, it took years to study and pass the energy efficiency and conservation (EE & C) Act, wherein a series of consultations with various stakeholders that would implement such measures were conducted. The EE & C Act aims to reduce the whole government's electricity and fuel consumption by at least 10% through energy efficiency and conservation (EE&C) strategies. EE & C measures include retrofitting of air-conditioning units with inverter type units and lighting systems to

LED-type units, and regular monitoring and documentation of energy consumptions in building sector, among others.

- Even though some measures had been put in place to achieve the energy goal, some buildings and enterprises still do not implement these measures due to the lack of finance. The Philippines then coordinated with energy service companies to facilitate financial requirements for those buildings to support them in reducing 10% of energy consumption.
- In Viet Nam, when investors would like to invest in energy projects, they must use the unused land which is not allocated for commercial or agricultural purposes. However, the challenges is that the land available for use is limited and rather small. Besides, there are requirements for hectares of land per megawatts. No more than 0.3 hectares per megawatt can be used for wind power, and the requirement for solar power is no more than 1.2 hectares per megawatt. Additionally, in Viet Nam the government encourages people to use land on multiple purposes, meaning not only for renewable energy but also for agriculture. This aims to save land as much as possible and at the same time, similar to using the reservoir for dual purpose of agricultural production and hydropower generation.

V. RECOMMENDATIONS

During the final session, there were 4 panelists in this Session: Ms Ju-Min Jheng, Deputy Director, Energy Administration, Ministry of Economic Affairs, Chinese Taipei; Dr Terrence Surles, Consultant, Hawaii Natural Energy Institute, United States; Mr Thanatat Soponanchai, Development Director, HDF Energy, Thailand; and Mr Joachim Monkelbaan, Global Trade and Sustainable Development Advisor.

- **Ms Ju-Min Jheng** delivered presentation about the Chinese Taipei's Energy Transition towards Net zero. Chinese Taipei relies heavily on imported energy sources, where 97.3% of energy was imported in 2022, of which fossil fuels accounted for 92.4%. The energy of Chinese Taipei is classified by form of energy, crude oil & petroleum products contributed 43.6%, coal contributed 29.7%, LNG shared at 19.1%, and nuclear constituted 4.9%. Regarding the indigenous sources, 44.4% came from biomass and wastes, 35.5% from solar PV and wind, and 14.6% from conventional hydro. The best energy mix in net zero energy transition is to maximize renewable energy, which includes grid transmission, power system flexibility, demand side management and energy storage equipment. The energy mix also continue to use nuclear energy.

- To begin the presentation, **Dr Terrence Surles** asked a question “Do we want clean energy or carbon neutrality?” (In other words, achieving 100% renewable energy or is carbon neutrality what we want?) To answer the question, he said that political will must be consistent, while considering the various attributes of different policies. There must be clear pathways for technology deployers and financiers to make decent returns on investment. There are some new economic policies which are critical for energizing technology development. The government funding is necessary. Government must work in its regions and technologies must continue to improve. Regarding water resources, the speaker briefly talked about the interconnections between water and energy. Large volumes of water are required to generate energy. Large amounts of energy are required to pump, treat, heat and distribute water for urban, industrial and agricultural use and to collect and treat the resulting wastewater. Together, the two sides of the water-energy nexus are generating new research, policy proposals and public dialogue as society struggles to address the intersecting challenges of climate change, energy security and increasing water scarcity. The speaker then talked about some opportunities for non-lithium-ion technologies. Non energy technology uses for rare earth are increasing. To conclude, when he was Administrator for the Hawaii State Energy Office, he gave some advice to governor such as to retain flexibility in regulation and utility business practices as key to adjusting to technological innovations and changes in technology prices etc.
- In this Session, **Mr Thanatat Soponananchai** shared some thoughts about to achieve the net zero in low cost and how we implement in small scale before we go into larger scale. The electricity is over supplied and there is no new PPA scheme that would buy in more renewable energy. There are some challenges towards Carbon Neutral/Net Zero. The regulation and law still not fully open to encourage new developers. The speaker shared that Thailand energy regulators should be looking at the long run, must not focus on the cheapest sources of electricity generated by private sector. The speaker also captured some main points in Session 6: (i) The investor must be ensuring that there is a market for return of investment; (ii) We need to consult also the indigenous people, and don't forget to ask about other resources such as the water resources and land; (iii) The competition of technology can cause the delay in the development of renewable energy because we spent too much and don't know how to address the problem and we need to solve the problem of too much solar PV and combine the solar PV with farm.
- **Mr Joachim Monkelbaan** showed some barriers and solutions for transition. The barriers are challenge in shifting to renewable and improving energy efficiency (EE), policy and regulatory hurdle; investment and technology limitations. The

solutions and opportunities are policies frameworks for renewable energy, EE and other elements of low carbon pathway; investment and trade incentives; technological advancement. He also noted that the public awareness, education and internal collaboration (in APEC) were very important. Non-tariff barriers (NTBs) increase the cost and complexity of trade. According to some estimates, when combined with tariffs, the effect of NTBs could result in average levels of protection ten times greater than tariffs alone. That can affect the trade and availability of climate-related goods. Although the market for sustainable energy services in value terms for example is twice bigger than the market for related goods, and such goods and services are often traded in tandem, services related to sustainable energy are largely neglected in both domestic policymaking and international negotiations. At the end of the presentation, he suggested that there should be a list of indispensable climate services, it should be linked to key mitigation sectors (buildings, transport, CCUS, refrigerant management, renewable energy, energy efficiency, grid); Links demonstrated between service provision and mitigation impacts and Regulatory cooperation re. both goods and services (in interest of developing economies)

Participants also shared overall views and recommendations on (i) take-aways from the Workshop, (ii) what economies/ APEC should do in term of policies and actions.

(i) Share what they've achieved from Workshop sessions

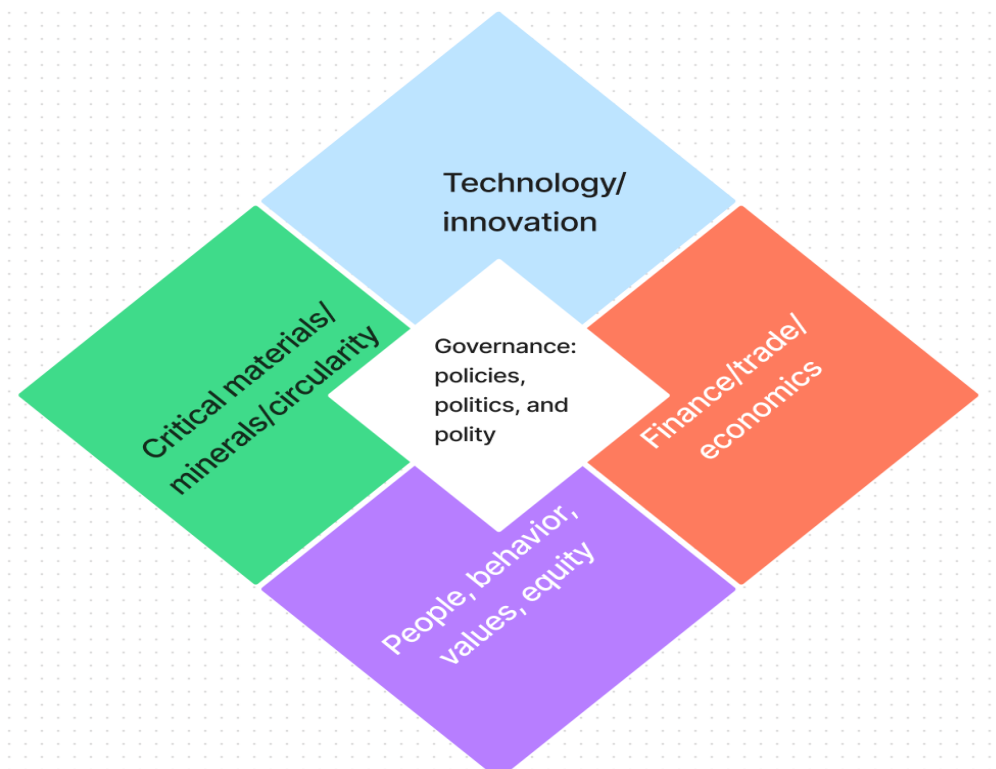
- One group shared that they were able to see that different economies in different sectors and their unique circumstances can go different ways for energy transition and each of them face unique challenges of their own. For example, Malaysia is going for solar energy. Some economies may not be interested in onshore and offshore wind energy due to their geographical conditions, but it is highly recommended and seriously considered by Chinese Taipei and the Philippines.
- Policies and regulations could be useful factors to help address challenges brought by the energy transition process for sustainable development. Net zero is still an ambitious goal for economies.

(ii) Brainstorm/ explore possible ways and suggest recommendations to APEC and member economies and application actions or requirements on necessary resources to implement such recommendations.

- Greater collaboration among economies, especially APEC members, is desirable. Each economy has its own policies. While some are in the process of moving forward, other may still be at the starting point. Therefore, lessons

could be learned as well as practical solutions for technical issues can be shared from one to another

- A clear framework could be a good dimension for economies to move towards sustainable energy transition. Regarding carbon credits, several economies are still doing it domestically, some intend to do it across borders. So there should be general frameworks for implementation.
- Ensure financial sources for implementation by finding support from or partnerships with international organizations, for example the Asian Development Bank (ADB) or public-private partnerships, to facilitate the market.
- It is proposed to provide more incentives for sustainable energy projects, initiatives and proposals as a way to encourage people and facilitate energy work.
- Other important dimensions that should be considered to facilitate sustainable transition in energy sectors are: (i) Technology for storage and smart grids; (ii) Resources including critical materials for renewable energy development (iii) Human resources with cultural, behavioral and psychological values, and skills and education to shape the capacity of human capital for sustainable energy transition. The government is recommended to make laws, regulations, policies, and good governance to promote the development of human resources in energy sectors.
- With idea from Mr Joachim Monkelbaan and Dr Terrence Surles and contributions of Workshop participants, a graph summarized above dimensions is described below:



VI. CONCLUSIONS

In her closing remarks, Ms Pham Quynh Mai (Viet Nam’s Senior Official to APEC) observed that as people are more aware of the importance and necessity of sustainable energy transition in response to climate change and increasingly depleted non-renewable resources like oil, natural gas, coal, etc. economies in general and businesses in particular are more aware of adapting to the energy transition from fossil-based systems of energy production and consumption to renewable energy sources. The transition is expected to reduce energy-related greenhouse gas emissions through various forms of decarbonization, addressing climate change, thanks to structural and permanent changes to energy supply, demand, and prices.⁷ According to the International Energy Agency’s forecasts, the world’s total renewable-based power capacity will increase 50% between 2019 and 2024,⁸ which is expected to be boosted by a societal push toward sustainability and technological advancements. In that sense, the sustainable energy transition presents both opportunities and challenges.

Through the sharing and discussion of our speakers and experts on policies, best practices, case studies and experiences from member economies, a number of key findings and recommendations have been highlighted to promote the transition for sustainable growth and development. Those might include, but not limited to the followings:

⁷ <https://www.spglobal.com/en/research-insights/articles/what-is-energy-transition>

⁸ <https://www.spglobal.com/en/research-insights/articles/what-is-energy-transition>

- It is important to raise public awareness and education on the benefits of a low-carbon economy, impacts of their energy consumption as well as promotion of sustainable lifestyle choices.
- Energy transition is at the central of net-zero transition, zero carbon strategies should focus on development of renewables and innovative energy technologies.
- Strong efforts should be made to develop policy frameworks for renewable energy, investment and trade incentives, as well as technological advancements and collaboration to promote the sustainable energy transition.
- Public and private investment and public/private partnerships (PPPs) can help attract capital and harness resources for the transition to a low-carbon economy.
- Support the development of an energy systems education network and skill-building programs.
- Invest in connecting people to high quality jobs.
- APEC should lead an active role in promoting international and regional cooperation through sharing knowledge and best practices, working together to develop global solutions to climate change, supporting international agreements and initiatives; promoting trade; and so on.

In that sense, through the sharing, each and every member economy's participants could have a more in-depth knowledge of the issues, hence promoting further efforts to realize green economy, subject to our specific domestic circumstances and long-term development strategies.

By hosting this Workshop, Viet Nam wishes to join and strongly support APEC's common efforts in pursuing green economy, sustainable and inclusive growth and development.

VII. ANNEX 1: RESULTS OF THE PRE-WORKSHOP SURVEY

1. Do you think sustainable energy transition is important? Is your economy performing energy transition? If Yes, please answer the next questions.

Indonesia

Yes, Indonesia has committed to achieve net zero emissions in 2060 or sooner through energy transition. One of the indicators for this commitment is the efforts toward higher renewable energy share in the domestic energy mix. Also, various forms of economic support and funding mechanisms in Indonesia that can be applied to help accelerate this energy transition are as follows:

- Blended finance, such as grants, soft loans with favorable terms, and joint investments.
- Public-Private Partnerships, which involve collaboration between the government and the private sector.
- Utilization of International Funding, such as climate change funds that can be used for the development of clean energy resource potentials.

Malaysia: Yes

New Zealand

Aotearoa New Zealand has legislated requirements to prepare for, and adapt to, the effects of climate change, and was one of the first economies in the world to refer to the goal of limiting global warming to 1.5°C in primary legislation.⁹

Aotearoa New Zealand has now set a series of successive (5-year) “emissions budgets” and prepared its first Emissions Reduction Plan (ERP) under this legislation, which is available at: <https://environment.govt.nz/what-government-is-doing/areas-of-work/climate-change/emissions-reduction-plan/>

Aotearoa New Zealand’s energy transition has already begun. The Energy and Industry and Transport chapters of the ERP plan set out why this is important, and the potential contribution the energy transition can make to meeting Aotearoa New Zealand’s legislated target of a net zero carbon economy by 2050.

Viet Nam: Yes

⁹ Through amendments made to the Climate Change Response Act 2002 by the Climate Change Response (Zero Carbon) Amendment Act 2019

2. Can you share some opportunities in performing sustainable energy transition in your economy?

Indonesia

- Various opportunities to enhance sustainable energy transition in Indonesia can be seen from the vast energy potential in the economy. Indonesia's renewable energy resources (NRE) are abundant, diverse, and spread across the economy. Currently, only 0.3% of the total potential has been utilized. Indonesia has a solar energy potential of 3,294GW, with only 323MW utilized, a hydro energy potential of 95GW, with only 6,738MW utilized, a wind energy potential of 155GW, with only 154MW utilized, and many other untapped energy potentials.
- Certainly, this presents an excellent opportunity for Indonesia to expedite and effectively create a sustainable energy transition, considering the abundant and untapped potential. Furthermore, many economies and international organizations are keen on assisting Indonesia in achieving this goal. This aligns with the goal of major economies to facilitate sustainable development goals (SDGs), prompting them to explore international funding scenarios, such as climate change funds, that can be utilized for the development of clean energy resource potentials, among other innovative schemes.
- Renewable energy potentials: Indonesia has abundant renewable energy resources, amounting to more than 3,680GW, which come in various form, namely geothermal, hydropower, solar, wind, ocean, and bioenergy. Moreover, other mineral resources, such as uranium, rare minerals, nickel, and so on, are available.
- Regulation and Fiscal Incentives: To pursue renewable energy deployment, the government has launched Government Regulation Number 112/2022 which concerns renewable energy electricity tariff. We expect that this tariff can accommodate more renewable energy investment, which is directed towards the domestic utility company (PLN) and independent power producers. In addition, Indonesia has been providing fiscal and nonfiscal incentives for renewable energy projects.

Malaysia

The opportunities include:

- 310,000 job creations for the people;
- Up to MYR1.2 trillion investment opportunities across the energy transition value chain; and
- Cleaner energy mix.

New Zealand

The ERP sets out how a well-planned transition can help reduce energy costs for businesses and New Zealanders, increase energy independence and create high-wage jobs in areas such as hydrogen, bioenergy and electrification. It can also be an opportunity to improve our productivity as we adopt clean technologies and improve energy efficiency.

Viet Nam

Rural areas in Viet Nam are areas that contain great renewable energy deposits such as bioenergy, hydroelectricity, solar energy, wind or geothermal energy. The value of these sources can be enhanced thanks to the equipment having appropriate scale to adapt to the needs of the community and can be exploited under good technical and economic conditions to meet the needs of people and businesses.

The potential for biogas energy is approximately 10 billion m³ per year through agricultural activities. The technology of a small hydroelectric plant can only yield about 30MW, much lower than the existing hydroelectric potential of 4,000MW and Abundant solar energy with average solar radiation of 5kWh/m² per day throughout Viet Nam. Viet Nam's geographical orientation with about 3400km of coastline also provides abundant wind energy with an estimated 500-1000 kWh/m² per year. The value of this resource can be enhanced by investing in appropriate infrastructure that corresponds to the needs of the community.

3. Can you share some challenges in performing energy transition in your economy?

Indonesia

- Access to clean energy: not all citizens in Indonesia have access to affordable, reliable, sustainable, and modern energy. This aligns with the goal of SDG number 7, which is, affordable and clean energy, aims to ensure access to affordable, reliable, sustainable, and modern energy for all.
- Funding: The huge investment of Renewable Energy development to realize Indonesia NZE 2060 requires substantial support from stakeholders including private sectors and International parties.
- Support in technology and research: The effective utilization of technology and having dependable research support are vital in advancing the energy transition in Indonesia. Strategic application of technology can expedite achieving net zero emissions in 2060 and make the adoption of clean energy more feasible across the economy. Moreover, having a skilled and proficient workforce is of utmost significance in establishing a sustainable environment.

A workforce with strong expertise can significantly contribute to sustainable development, paving the way for an improved climate change.

- **Technology:** Technological advances in renewable energy and low carbon technologies are hugely desired for a successful transition to NZE.
- **Supply Chain:** Adequate supply chain to accelerate the development and utilisation of NRE and EC.
- **Infrastructure:** Expanding and upgrading existing energy infrastructure to be able to expedite large-scale NRE deployment while maintaining system security and safety
- **Funding and Incentives:** Providing access to "cheap" funding and incentives for NRE projects.
- **Just Energy Transition:** Ensuring a just and beneficial energy transition for all parties by strengthening coordination and collaboration between stakeholders.

Malaysia

The challenges include the need to ensure energy security, energy equity, economic development and environmental sustainability. Essentially, balancing the energy trilemma.

New Zealand

The Government's 2050 vision for energy and industry is for Aotearoa New Zealand to have a highly renewable, sustainable and efficient energy system supporting a low-emissions economy.

The Government's vision for transport is that by 2035, Aotearoa New Zealand will have significantly reduced transport-related carbon emissions and have a more accessible and equitable transport system that supports wellbeing.

Aotearoa New Zealand already has a high level of renewable generation, which means the electricity system is well positioned to help other sectors – such as transport and industry – move away from fossil fuels and reduce emissions. The challenge is how to:

- Accelerate development of new renewable electricity generation across the economy
- Ensure the electricity system and market can support high levels of renewables
- Support development and efficient use of transmission and distribution infrastructure to further electrify the economy.

At the same time, there is a need to ensure equitable access to affordable energy equity, and that energy supply is secure and reliable.

These challenges are being considered in the work programmes outlined below, and in the development of a broader Equitable Transitions Strategy (a commitment in the ERP).

Viet Nam

In addition to a huge consumption demand and abundant renewable energy sources, businesses investing in the energy sector in Viet Nam are facing many challenges.

- The biggest challenge is to strengthen public activities to encourage and support businesses to develop energy saving and renewable energy markets. Currently, there are problems in agriculture such as: Labor benefits very little, and not much profit is gained from the value-added chain.
- In addition, the difficulty for businesses, especially the private business sector in Viet Nam, is that there are no appropriate mechanisms and policies to encourage and create conditions for businesses to deploy models such as: Renewable energy projects, recycling household and agricultural waste into energy.
- Besides, in terms of scale, Vietnamese private enterprises are small, inexperienced, do not have specific consulting organizations to support market development, lack synchronous connection, etc and lack of capital. Many businesses have ideas and creative projects but do not have enough financial resources to implement them.

4. Please share some policies and/ or good practices your economy is applying to support sustainable energy transition. (You may share links of websites or written materials in English)

Indonesia

- Carbon Tax & Carbon Trade (Act 7/2021 and Presidential Decree 98/2021) about:
 - a) A carbon tax is imposed on carbon emissions that have a negative impact on the environment
 - b) The subject of the carbon tax is an individual or entity that purchases goods that contain carbon and/or carries out activities that produce carbon emissions
 - c) The imposition of a carbon tax is carried out by considering the carbon tax roadmap set by the Government and/or the carbon market roadmap
 - d) The carbon tax rate is set at a minimum of IDR30.00 per kg CO₂e
- Presidential Decree No.112/2022 on Acceleration of Renewable Energy Development for Electricity Provision

- a) Renewable Energy Development is carried out based on the RUPTL, which takes into account the target of the renewable energy mix, supply-demand balance, and the economic value of power plants.
- b) Price and procurement mechanism for Renewable Energy Power Plant
- c) Terms for the energy transition.
- Energy conservation: Indonesia has been conducting energy conservation programs, including energy management as well as MEPS and labelling. The implementation of the programs has successfully supported the energy transition through energy savings and GHG emission reduction.
- Biofuel Mandatory: Indonesia is a leader in biodiesel implementation through mandatory 35% blending (B35) program. This program decreases fossil fuel consumption which results in higher domestic trade savings, raising value chain of palm oil, and emission reduction.
- Solar PV Rooftop: After launching the regulation concerning solar PV rooftop, the deployment of the power station has been increasing steadily. Currently, the government is reviewing the regulation to further increase PV rooftop deployment in Indonesia.

Malaysia

Malaysia Energy Transition Roadmap (NETR) -

https://www.ekonomi.gov.my/sites/default/files/2023-09/National%20Energy%20Transition%20Roadmap_0.pdf

Malaysia Energy Policy, 2022 -2040 (DTN) -

https://www.ekonomi.gov.my/sites/default/files/2022-09/National%20Energy%20Policy_2022_2040.pdf

New Zealand

The ERP commits to the development of a domestic Energy Strategy by the end of 2024 with the following vision and high-level purpose:

- The vision is for a net-zero carbon economy in 2050, where energy is accessible and affordable, secure and reliable, and supports New Zealanders' wellbeing.
- The high-level purpose is to address strategic challenges in the energy sector, and signal pathways away from fossil fuels. The terms of reference for the development of the Energy Strategy are available here: <https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-strategies-for-new-zealand/new-zealand-energy-strategy/>.

Work is also underway to address short to medium term issues as follows:

- Gas transition plan: <https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-strategies-for-new-zealand/gas-transition-plan/>
- Hydrogen roadmap: <https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-strategies-for-new-zealand/hydrogen-in-new-zealand/roadmap-for-hydrogen-in-new-zealand/>
- Regulatory settings to enable investment in offshore renewable energy and innovation: <https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-generation-and-markets/offshore-renewable-energy/>
- Replacement New Zealand Energy Efficiency and Conservation Strategy: <https://www.mbie.govt.nz/#new-zealand-energy-efficiency-and-conservation-strategy>

There are also relevant funding programmes, such as:

- <https://www.eeca.govt.nz/co-funding/>
- <https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/low-emissions-economy/energy-efficiency-in-new-zealand/community-renewable-energy-fund/>
- <https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/low-emissions-economy/energy-efficiency-in-new-zealand/maori-and-public-housing-renewable-energy-fund/>
- <https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-hardship/support-for-energy-education-in-communities-programme/>