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Review of the implementation of the 2030 Agenda for Sustainable Development in Asia and the Pacific and issues pertinent to the subsidiary structure of the Commission: Committee on Energy

Enhancing energy security in the context of the coronavirus disease pandemic for a greener, more resilient and inclusive energy future in the region

Note by the secretariat

Summary

The present document contains an overview of analytical work on energy security and resilience in the context of the coronavirus disease pandemic and its impacts. It includes a review of the current status of the energy sector transformation in the Asia-Pacific region in the context of the convergence of new technologies, platforms and frameworks for international cooperation and the new energy security and resilience challenges the convergence is producing. The analysis and review are used as a basis for identifying a pathway towards enhanced energy security and energy resilience in the region.

The Economic and Social Commission for Asia and the Pacific may wish to review the document and provide guidance on the future work of the secretariat.

I. Background

1. The Asia-Pacific region is embarking on an energy transition, driven by the increasing availability of low-cost clean energy options such as solar and wind power as well as the imperative to reduce greenhouse gas emissions and pollution.

2. Globally, renewable energy generation has expanded owing to sharply falling costs, particularly for solar and wind power. According to the International Renewable Energy Agency, between 2010 and 2019, the cost of utility-scale solar photovoltaic electricity fell by 82 per cent, the cost of onshore wind electricity by 39 per cent and the cost of offshore wind electricity by 29 per cent. The shift to renewables in most national contexts represents a diversification of energy supplies but also a lowering reliance on imported fossil fuels. New geopolitical dependencies can be expected to emerge as a result of the expansion of renewable energy technology. With the advent of new

* ESCAP/77/L.1.

technologies and business models in the region's energy systems, traditional concepts of energy security and energy resilience may also have to evolve.

3. The coronavirus disease (COVID-19) pandemic has raised awareness about the critical role the energy system, and particularly the electricity supply, plays in sustaining health care, information and communications technology, the water supply, logistics, education and other sectors that are critical to the overall functioning of societies and economies. At the same time, the pandemic has brought into focus the risks posed by energy supply interruptions and the cascading impact on other systems.

4. In this context, emerging concerns and external threats to energy systems must be considered. Reliance on fossil fuel imports remains the biggest threat, not only because of climate change impacts but also because of the potential for Governments of producer countries to make unilateral policy decisions to restrict supplies. However, the growth of the clean energy sector is also dependent upon the supply of critical raw materials, and new geopolitical dependencies can be expected to emerge. Combating the threats posed by pandemics, cybersecurity and climate change will require awareness, planning and greater expertise, particularly as energy systems diversify, decentralize and digitize.

II. Aligning the recovery from the coronavirus disease pandemic with the energy transition in Asia and the Pacific

5. Since it emerged, COVID-19 has exacted a heavy toll throughout the region. To date, Asia and the Pacific has fared better than other parts of the world, with lower infection rates and faster economic recoveries. For the energy sector, the principal impacts have been the dramatic decline in energy demand that resulted from lockdowns and travel restrictions in the first months of the pandemic. The decline was observed principally with regard to oil and gas and, to a lesser extent, electricity. Notably, the power generation sector continued to operate in all countries without interruption. By the end of 2020, energy demand had recovered in several of the region's major developing economies.

6. In the initial response to the crisis, measures were largely focused on emergency funding for health care and vulnerable economic sectors. However, longer-term economic recovery plans will set the direction of development. Through several mechanisms, the recovery from the COVID-19 pandemic offers an opportunity to accelerate the energy transition towards cleaner and more efficient energy systems. If properly guided, the recovery process can also build the resilience of the energy system and other critical systems so that they can continue to meet societal needs in an uncertain future. The pandemic has highlighted that resilience is critical, and energy systems must be able to offer flexibility and effective responses to demand shifts as well as other shocks that can disrupt supply chains, affect essential workers or close borders. However, achieving this resilience and flexibility is particularly challenging in the Asia-Pacific region, where the pandemic is playing out against a broader context in which hundreds of millions of people remain without basic, modern energy services, and climate change poses growing threats to societies and economies.

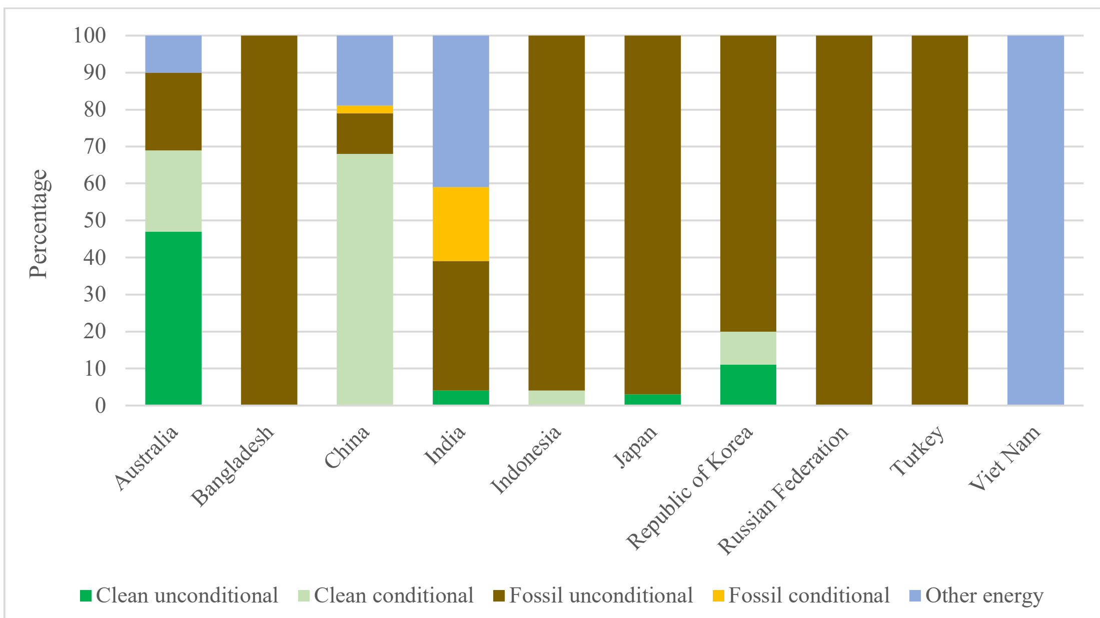
7. Together, these challenges call for integrated and holistic national and regional approaches. Before the emergence of COVID-19, progress on several of the targets under Sustainable Development Goal 7 relating to renewable energy and energy efficiency was falling behind the pace needed to achieve the Goals and the climate objectives of the Paris Agreement. However, addressing these changes also calls for a shift toward expanded, digitized, decentralized and technology-dependent systems. This shift, in turn, increases the number of

vulnerabilities for national energy systems and energy sector actors, including cyberattacks and the vulnerabilities posed by growing reliance on critical raw materials.

8. Economic stimulus packages, aimed at reinvigorating growth, are an important component of the recovery. However, to date, neither the environment nor climate change has been a primary driver for many national economic recovery plans in the region. Some Governments have also made use of the pandemic to roll back environmental and climate regulations as well as to bail out their fossil fuel industries, leading to a net negative climate impact in all of the Asia-Pacific countries surveyed in the Economic and Social Commission for Asia and the Pacific (ESCAP) analysis shown in figure I.

9. To date, a strong green focus in the regional COVID-19 recovery and response efforts has not yet emerged. Beyond assuring reliable and affordable supplies for populations and businesses, energy-related policy responses have emphasized domestic energy production, which has had both positive and negative impacts on the energy transition. Numerous recovery plans are boosting renewables and energy efficiency, but they are countered by plans for greater reliance on domestic fossil fuels. The national energy policy commitments announced in 2020 by the Governments of a selection of major Asia-Pacific economies demonstrate a greater emphasis on fossil fuels, with Australia and China standing out as exceptions (see figure I). This trend stands in contrast to the many national net zero emissions commitments announced in the same year.

Figure I
Quantified national energy policy commitments by category share, 2020

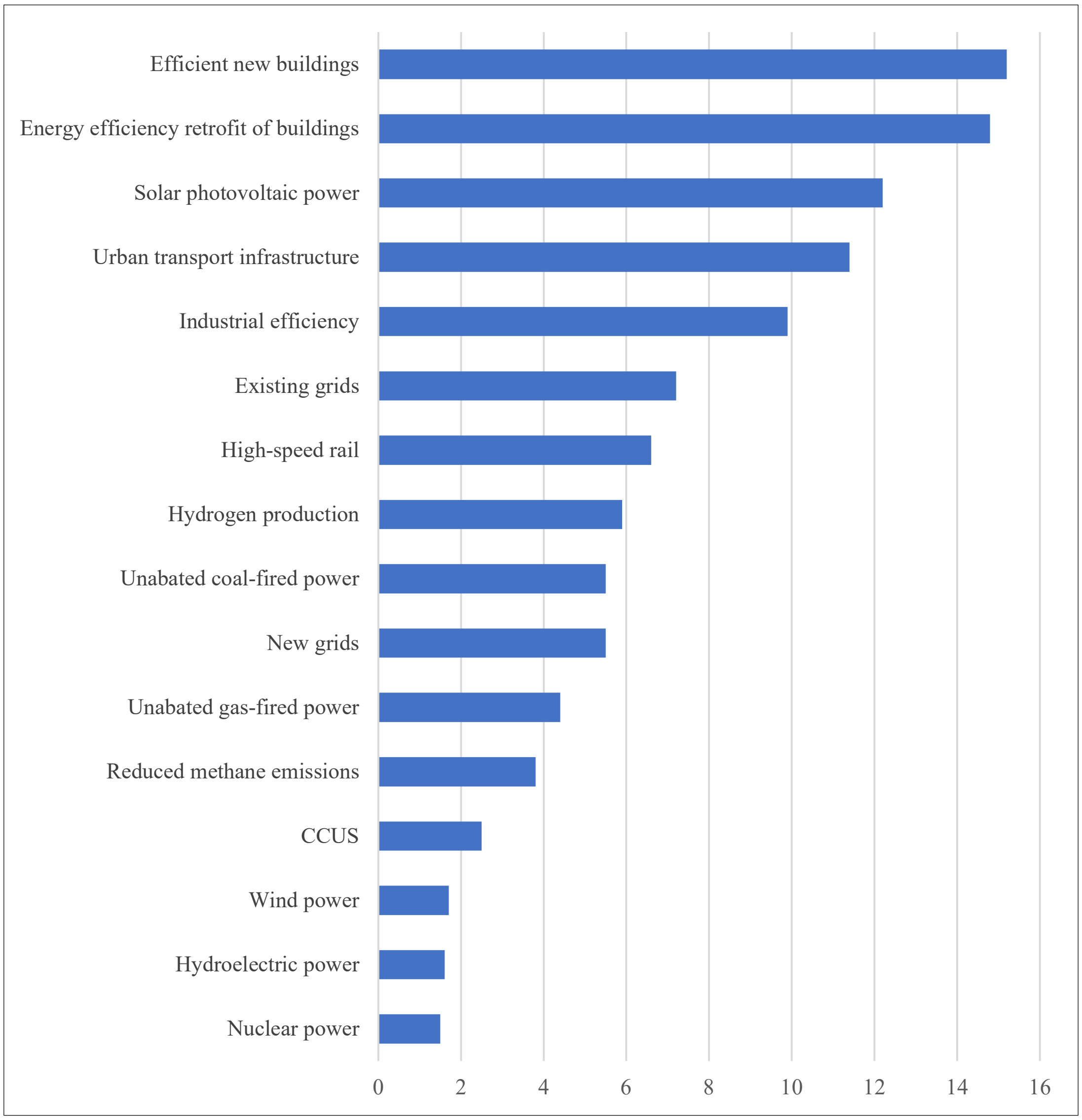


Source: Economic and Social Commission for Asia and the Pacific (ESCAP) compilation of data from the Energy Policy Tracker database. Available at energypolicytracker.org (accessed 3 January 2021).

Note: Definitions for the terms used in the legend are available at www.energypolicytracker.org/methodology/#fossil-unconditional-anchor.

10. To drive a more comprehensive pandemic recovery and build back better, the COVID-19 recovery agenda must be aligned with the clean energy agenda. For example, investments in energy efficiency and renewable energy offer greater returns than fossil fuels in the form of job creation while also targeting key areas for carbon emissions reduction, helping to advance climate objectives. Stimulus spending directed towards these sectors can have a multiplier effect, yielding higher economic returns, increased job creation and reduced greenhouse gas emissions (see figure II).

Figure II
Number of construction and manufacturing jobs created per million dollars of capital investment by sector, 2018



Sources: International Energy Agency, "Construction and manufacturing jobs created per million dollars of capital investment in the Sustainable Recovery Plan", 2 December 2020. International Energy Agency, *2019 Global Status Report for Buildings and Construction: Towards a Zero-emissions, Efficient and Resilient Buildings and Construction Sector*.

Abbreviation: CCUS, carbon capture utilization and storage.

11. The greatest job opportunities can be found in the clean energy sector. Energy efficient new buildings offer the highest job creation coefficients: approximately 15 jobs created per million dollars of capital investment. The region is lagging behind in efficient new buildings, which is a key sector for meeting climate objectives. In 2018, 39 per cent of global energy-related emissions came from buildings and construction. Not only can improving energy efficiency in buildings reduce energy consumption, operating costs and emissions, but it also provides approximately three times the employment benefits per dollar spent as compared to new fossil fuel power generation.

12. Similarly, renewable energy provides strong employment opportunities. Solar photovoltaic technology, which is also rapidly becoming the most widely available and lowest cost new energy technology in many contexts, creates between two and three times the number of jobs as conventional power generation. Strong employment creation is also associated with investing in power grids, which is an important enabling factor in providing energy access and accommodating variable renewable energy supplies.

13. Investment in industrial efficiency not only drives job growth and lowers emissions but also increases economic competitiveness by reducing energy and production costs. At the same time, the more efficient transport of people and goods entails construction activities that provide short-term job creation, and the interconnectivity of existing and new economic zones provides long-term benefits. Several member States have already taken advantage of this opportunity by building high-speed railways and drafting and approving plans for a number of pipeline projects.

14. The region has a significant opportunity to align its COVID-19 response with the sustainable energy and low carbon transition. While it may be too early for a definitive assessment, early information indicates that this opportunity is not being realized. The recovery offers the opportunity for the energy sector to consider the balance between energy security, energy equity and environmental sustainability and pivot accordingly while at the same time building capacities to resist and respond to the growing number and severity of hazards brought on by internal sectoral shifts and external factors. These issues are outlined the following section, together with some priority areas that member States may wish to consider in the development of their recovery efforts.

III. Energy security, energy resilience and the energy transition

15. In developing an optimal path for a transition to a low carbon energy system, each individual member State faces distinct circumstances. Each its own energy sector structure and is at a different stage of the energy transition. Some are working towards the expansion of basic energy services to households and industries, while others are seeking to optimize their existing structures.

16. Most member States are in the initial phase of the energy transition, working to secure sufficient and sustainable energy supplies and achieve universal access to modern energy. However, the Governments of several major economies, including China, Japan, New Zealand and the Republic of Korea, have raised their ambitions to achieve a full energy transition with pledges to achieve net zero emissions.

17. Energy security forms the foundation of regional energy policymaking and the energy transition. Energy security is defined and interpreted according to national circumstances with regard to economic development and the structure of the energy system as well as perceived risks and geopolitical settings. It implies a situation in which the energy system has the capacity to meet current

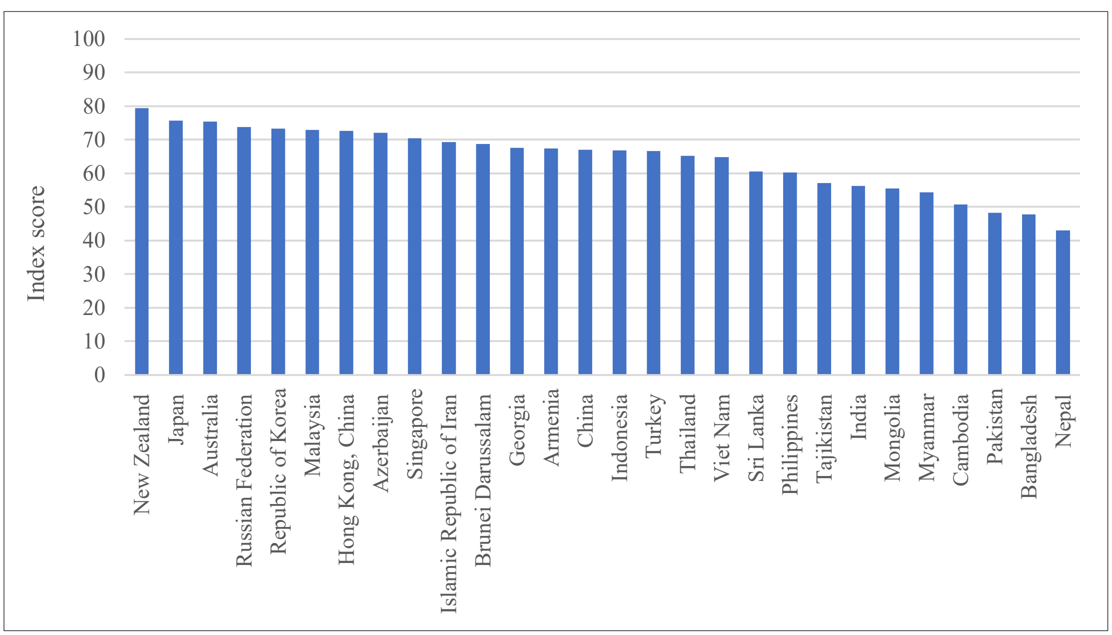
and future energy demand with reliable infrastructure that can withstand and recover from shocks. However, energy security in the traditional sense is insufficient to meet the requirements of the energy transition.

18. As the region's (and the world's) energy systems are undergoing technological transformation, energy security must be considered within a broader framework. To that end, the World Energy Council created the Energy Trilemma Index, a model in which traditional energy security is balanced with energy equity – defined as access to reliable, affordable and abundant energy for domestic and commercial use – and environmental sustainability. Striking the right balance among these dimensions is necessary in order to place economies on the path of the energy transition while meeting global sustainable energy and climate objectives.

19. According to a survey conducted by the World Energy Council in 2020, Asia-Pacific countries are widely distributed in their performance as measured by the Energy Trilemma Index (see figure III). New Zealand is rated first in the region and tenth globally. At the lower end of the Index are countries with high reliance on a single source of power generation, low levels of energy access and poor environmental performance.

20. Regional progress in addressing the energy trilemma has been largely based on the expansion of access to modern energy. In 2020, Cambodia, Myanmar and Bangladesh ranked first, second and fourth globally for improvement since 2000, owing to strides made in electrification. Environmental performance has also improved in parallel with increased clean energy deployment among Asia-Pacific countries, yet only New Zealand received an "A" grade for environmental sustainability. With regard to energy security, Asia-Pacific countries generally score below the global average. Little progress is being made in that regard, as surging demand has been met by increased fossil fuel imports rather than by a shift to renewables.

Figure III
Asia-Pacific World Energy Council Energy Trilemma Index scores, 2020



Source: World Energy Council, Energy Trilemma Index. Available at https://trilemma.worldenergy.org/ (accessed on 3 December 2020).

IV. New considerations for energy resilience

21. As Governments have been forced to respond to the array of impacts from COVID-19, the concept of resilience has come into greater focus. Definitions of resilience vary, but in general, resilience is the capacity and ability of a system to withstand attacks, to cope with diverse disruptions and to be restored rapidly to full functionality. Hence energy system resilience includes characteristics such as the robustness, adequacy, adaptability, flexibility and reliability of energy systems themselves as well as of resources and infrastructure.[1] In this sense, resilience is categorized as a precondition of energy security.

22. Decentralization, digitization, electrification of end uses, and growing supply chain interconnectivity are transforming the energy landscape, and new areas for consideration are emerging. At the same time, the intersections and interdependencies between energy and critical systems such as health care, transport and communications must be better understood. Cybersecurity is an area where many energy providers find themselves ill equipped to prevent and manage threats. The exponential growth of solar, wind and battery technologies brings with it concerns for the sustainable supply and life cycle management of the critical raw materials these technologies require as inputs.

23. In the present document, four frontiers in energy resilience are considered: global pandemics, cybersecurity, the supply of critical raw materials and climate change.

A. Global pandemics

24. Throughout the twentieth century, pandemics have affected the world or large regions thereof. Outbreaks of novel viruses from zoonotic origins are not a new phenomenon. However, COVID-19 differs from previous crises because globalization and the unprecedented mobility of populations have allowed it to spread to almost every country. As an unpredicted event without precedent in living memory, it has prompted the consideration of how the systems relied upon by modern societies can be made more resilient to these types of crises.

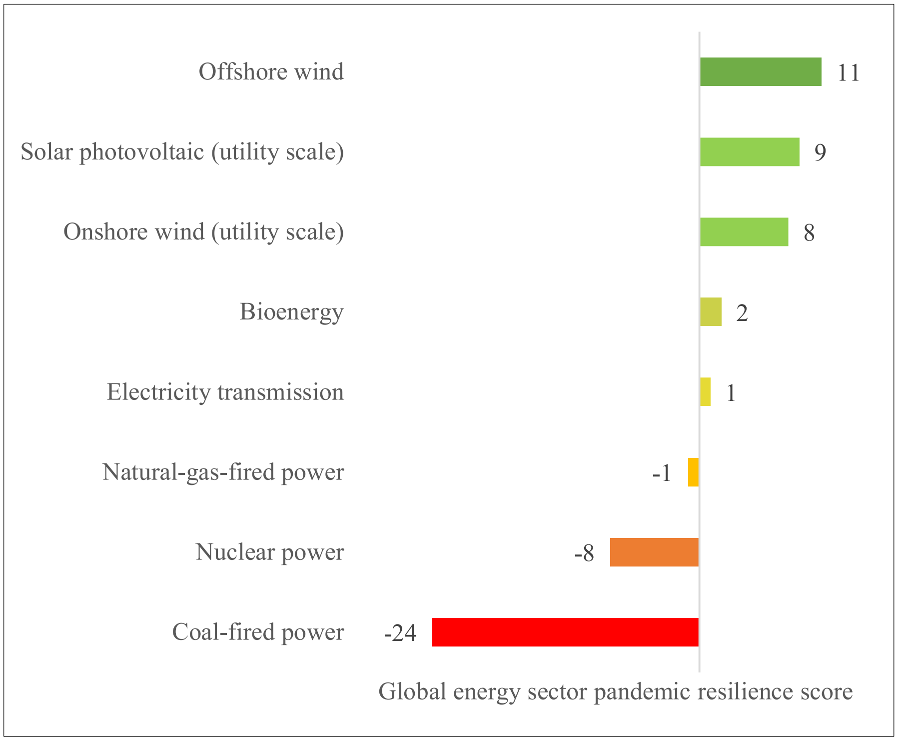
25. As more data become available, it is becoming clear that during the pandemic, most energy supplies and infrastructure have been largely resilient. Asia-Pacific countries have not experienced major disruptions to the supply of energy such as electricity, oil and gas during the pandemic, but energy demand has been reduced dramatically, and the disruption of revenue streams, project delays and operational constraints had significant impacts. Renewable power installations have been more resilient than conventional energy in the face of the pandemic. According to one global study of energy infrastructure, wind and solar have performed best, particularly as compared to coal and nuclear (see figure IV), with revenue resilience and operational complexities being key drivers.[2] Renewable energy infrastructure such as solar and wind infrastructure is relatively more resilient to the effects of these crises, because they do not rely on a supply chain of energy inputs. Owing to their capacity to generate energy at zero marginal cost, these types of infrastructure are more able to cope with reductions in demand than fossil fuel plants. As highly automated systems, they need little human intervention and are thus less impacted by lockdowns.

[1] Frank Umbach, *Energy Security in the Context of COVID-19* (forthcoming).

[2] Foresight Group LLP, “Infrastructure pandemic resilience: a true test of infrastructure's defensive characteristics”, white paper, September 2020.

26. While other parts of the energy sector suffered significant setbacks under the pandemic, renewable power grew at a rate of nearly four per cent globally, setting new records in 2020, and is expected to increase by ten per cent in 2021. Asia-Pacific market expansion will largely drive this global trend.[3]

Figure IV
Global energy infrastructure: pandemic resilience scores



Source: Foresight Group LLP, "Infrastructure pandemic resilience: a true test of infrastructure's defensive characteristics", white paper, September 2020.

Note: Infrastructure's resilience to global pandemics is assessed on the basis of five investment fundamentals: revenues, costs, financial health, political and regulatory environments and operations. For each of the five investment fundamentals, infrastructure subsectors are scored on a scale from +6 (most resilient) to -6 (least resilient); these scores are added up to produce the overall subsector scores on a scale from +30 to -30.

27. The pandemic is testing the resilience of regional oil and gas industries and exporting countries, which have been buffeted by reduced demand and low prices. Global oil demand fell dramatically in 2020. While exporters faced shrinking markets and plunging revenues, importers in some cases were able to take advantage of the crisis and build up strategic reserves. The pandemic's shock to oil and gas industries has exacerbated financial and structural weaknesses against a backdrop of mounting pressure to move towards low carbon energy systems.

B. Cybersecurity

28. As the digitization of the energy sector has accelerated, a clear mutual dependence between the Internet and power grids has emerged. Energy system components such as smart meters, smart grids, control systems and blockchain

[3] International Energy Agency, "Renewables 2020: analysis and forecast to 2025", November 2020.

technology require the Internet to function. The resilience of the Internet is therefore a precondition for a resilient electricity sector. In turn, all these systems and the economies on which they depend will be increasingly vulnerable to cyberattacks if the right safeguards are not put in place.

29. Cyberattacks are increasing both in number and level of sophistication. The increasing reliance on digital systems creates systematic vulnerabilities to cyberattacks. Meanwhile, critical energy infrastructure is vulnerable to cyberattacks because it relies in many cases on outdated computer systems.[4] Electric utilities are vulnerable across all parts of the system, from generation and transmission to distribution and metering.

30. Building resilience to cyberattacks in combination with existing measures to protect physical assets is an increasingly important area for the energy industry. Cyberattacks are a dynamic and evolving threat that require enhanced capacity in several areas, including an understanding of the risks to physical infrastructure and operational activities, the technical capability to identify threats, and the ability to deploy defence and response measures. For the Asia-Pacific region, enhanced awareness and expertise are needed to counter this threat.

C. Critical raw materials

31. The manufacture of renewable energy systems relies on critical raw materials. These materials are elements such as rare earth elements, lithium and cobalt that are used in wind turbine generators, solar panels, batteries and electric motors in electric vehicles, and high-efficiency lights.[5] The accelerated adoption of these technologies to fuel the energy transition will create a spike in demand for these critical raw materials; this, in turn, might create bottlenecks and supply shortages in mining, processing, refining and manufacturing. The supply of critical raw materials at a stable price, therefore, is a precondition for a secure clean energy supply.[6] Even when these materials are not physically scarce, supply risks are posed by their production being centred in a few producer countries and companies.

32. With the boom in renewable energy and storage technologies, critical raw materials, including rare earth elements, are being consumed in larger quantities. Consequently, there are emerging sustainability issues with regard to potentially toxic mining practices and uncertain availability. The solar photovoltaic industry is giving rise to a growing waste problem, predicted to reach a cumulative 78 million tonnes globally by 2050, with Asia-Pacific economies contributing more than half of this amount.[7] Meeting the growing energy needs of the region in a sustainable manner requires comprehensive planning to strike a balance between increasing energy supplies and impacts on the climate, people and the environment.

33. As the clean energy sector continues its growth trajectory, the issues of critical raw materials supply and management will become more pressing and require appropriate policy and investment responses. Already, some sector actors are looking to lower dependence on critical raw materials, while reuse, substitution and recycling also offer opportunities. The application of these

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4 Frank Umbach, *Energy Security*.

5 Alexandra Leader, "Critical material supply risks and mitigation strategies in clean energy technologies", dissertation, Rochester Institute of Technology, 2020.

6 Frank Umbach, *Energy Security*.

7 International Renewable Energy Agency and International Energy Agency Photovoltaic Power Systems Programme, *End-of-Life Management: Solar Photovoltaic Panels* (2016).

strategies could enhance the security of the critical raw materials supply and contribute to the move towards circular economies.

D. Climate change

34. Climate change increases the likelihood of damage to infrastructure and of interruptions in the supply of energy due to more frequent and more intense weather events. However, catastrophic events that damage energy infrastructure are not the sole consideration in ensuring greater resilience. Changing weather patterns can affect rainfall, wind and solar patterns at the local level, reducing generation at certain locations. For example, low water levels from an extended dry season in 2020 in the Mekong River Basin led to power supply shortages. Higher temperatures and water shortages can also reduce the output of thermal plants, and extreme heat can stress power grids by pushing up demand for electricity and inducing equipment failures.

35. Climate resilience is essential to the technical and economic viability of the energy sector. It is critical to the sector's ability to meet growing energy demand. Therefore, climate models must be incorporated into the planning of energy infrastructure, which has a long design life and may be operating in a future environment of changed climate. Understanding the impacts of climate change on the energy system requires continued research and modelling to support effective decision-making.

V. Building a secure, resilient and sustainable energy system in the post-pandemic era

36. The pandemic has brought a new series of challenges for the region which require a re-examination of traditional frameworks for energy security and resilience. As Asia-Pacific Governments strive to manage an unprecedented pandemic, the uninterrupted supply of energy has been a fundamental element of national capacities to respond, ensuring the provision of energy services to hospitals and health-care facilities, to remote workers who are enabling businesses to continue to operate, and to students at home in remote learning environments.

37. In the wake of COVID-19, decisive policy interventions will be needed to simultaneously deliver on multiple priorities, including the recovery from the pandemic, the acceleration of the clean energy transition and the strengthening of the resilience of the region's energy systems. Well-targeted stimulus policies can have a multiplier effect, creating employment, enhancing productivity and reducing the impacts of energy on the climate system. In contrast, poorly allocated funds that support the continuation of business as usual may create negative economic returns. Experience from the 2008 global financial crisis can offer lessons for the present. At that time, green stimulus measures in the areas of clean energy and clean-energy-based infrastructure helped economies to recover and created jobs at a higher rate than spending on fossil fuels and traditional stimulus.

38. Greater investment is also needed in energy security, including in building infrastructure's resilience to climate change and in increasing cybersecurity capacities. To ensure the continuation of the energy transition, Governments will need to assess and manage future risks posed by the supply and life cycle management of critical raw materials.

VI. Issues for consideration by the Commission

39. The Commission may wish to provide guidance on the future work of the Committee on Energy and the secretariat with regard to enhancing regional energy security and resilience in the context of COVID-19.