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Committee on Energy**Second session**

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Implementation of the outcomes of the Second Asian and Pacific Energy Forum: regional road map on energy connectivity**Draft regional road map on power system connectivity: promoting cross-border electricity connectivity for sustainable development****Note by the secretariat*****Summary*

At its seventy-third session, held in May 2017, the Economic and Social Commission for Asia and the Pacific adopted resolution 73/8 on strengthening regional cooperation for sustainable energy development in Asia and the Pacific, in which it established the Expert Working Group on Energy Connectivity. In its Ministerial Declaration on Regional Cooperation for Energy Transition towards Sustainable and Resilient Societies in Asia and the Pacific, the Second Asian and Pacific Energy Forum, held in April 2018, recognized the role of energy connectivity in attaining Sustainable Development Goal 7 (Affordable and clean energy) and called for greater regional cooperation to improve energy connectivity. The Forum also expressed its support for the work of the Expert Working Group on Energy Connectivity and requested it to submit its work to the Committee on Energy.

The Expert Working Group developed a draft regional road map on power system connectivity, entitled “Promoting cross-border electricity connectivity for sustainable development”, which its members reviewed on 29 August 2019. Member States recognized the need for a road map to accelerate power system connectivity, based on subregional experiences as well as studies, and to align power system connectivity with the Sustainable Development Goals, in particular in meeting the Goal 7 targets. Member States have noted the need for a more standardized approach, agreed by member States, towards promoting power system connectivity, which is detailed in the road map.

The present document also contains a discussion of the need for appropriate institutional arrangements as well as capacity needs to support a more standardized approach.

The Committee may wish to review the document, provide guidance for the future work of the secretariat and endorse the draft regional road map for submission to the Commission at its seventy-sixth session.

* ESCAP/CE/2019/L.1.

** The present document was submitted late owing to the need for extensive consultation with members of the Expert Working Group on Energy Connectivity.

I. Introduction and background

1. The Economic and Social Commission for Asia and the Pacific (ESCAP) is promoting energy connectivity through regional cooperation. The draft regional road map for energy connectivity in Asia and the Pacific contained in the present document is intended to provide an agreed framework for regional cooperation towards achieving power grid integration over the period 2020 to 2035.

2. The Commission places priority on enhancing regional energy connectivity, with a focus on power grids as a means of enhancing the sustainability and security of the region's energy supply. This can help countries to manage electricity surpluses and deficits in a mutually beneficial way and open up opportunities for the large-scale development of renewables. This not only supports economic growth but also provides countries with greater opportunities to formulate more ambitious emission reduction strategies under the Paris Agreement and to combat air pollution. Internationally, there is a growing focus on enhancing power grid connectivity to address multiple objectives, including power system reliability, cost-effectiveness, security and decarbonization, as well as sustainability. There are many successful examples of power system integration in other regions of the world which provide useful reference points and guidance for the region.

3. In 2017, the Commission adopted a resolution to establish an Expert Working Group on Energy Connectivity. At the first meeting of the Expert Working Group, held in Bangkok in December 2017, members proposed developing a regional road map on energy connectivity. Following this, the region's energy ministers, through the Ministerial Declaration on Regional Cooperation for Energy Transition towards Sustainable and Resilient Societies in Asia and the Pacific of the Second Asian and Pacific Energy Forum, decided to support the work of the Expert Working Group. Following the mandate provided in the Ministerial Declaration, ESCAP initiated four subregional status reports on energy connectivity covering the following subregions: South-East Asia; South and South-West Asia; North and Central Asia; and East and North-East Asia. These reports provided an overall analysis for the implementation of energy connectivity in the Asia-Pacific region. In the reports, ESCAP provides a review of the role of interconnectivity in each subregion and its potential benefits for sustainable development while looking at challenges to further cross-border power interconnectivity. The Commission also highlights steps that each subregion needs to take in order to establish the policy, regulatory and institutional arrangements needed to integrate the power grids of the four subregions and the wider Asia-Pacific region.

4. Following this, the third meeting of the Expert Working Group on Energy Connectivity was convened in Bangkok on 29 August 2019 to review the draft regional road map. Experts provided detailed feedback on the proposed strategies, drawing on subregional and national perspectives. These deliberations have resulted in a consensus on the draft regional road map, which will be presented to the Committee on Energy at its second session, in October 2019, for endorsement by member States.

II. Vision and principles

5. The overall objective of the road map is to eventually create a pan-Asian interconnected grid that offers a more reliable, affordable and sustainable electricity supply. This will underpin the region's social and economic development and assist the move to a low-carbon energy system.

6. The potential for enhanced power grid connectivity and cross-border electricity trade in the Asia-Pacific region is significant. Connecting power grids of adjoining countries and subregions can capitalize on complementarities between countries in terms of energy demand and energy resource availability, particularly with regard to wind, solar and hydro potentials. This requires an evolutionary process, moving from the bilateral exchange of electricity to multilateral trade and eventually the creation of an integrated power market. Achieving power grid connectivity can enhance the availability and affordability of electricity and accelerate the utilization of renewables. It therefore contributes to the decarbonization of the energy sector while advancing Sustainable Development Goal 7 and other Goals.

III. Building blocks of the regional road map

A. Regional framework

7. The realization of a vision of an interconnected regional power system requires the development of a regional framework and appropriate institutions to support and coordinate the system. By building upon and providing impetus for existing subregional initiatives, the road map is intended to enable coordination among various institutions and to progressively remove barriers to energy interconnection.

B. Institutional arrangements

8. Because the electricity sector is highly regulated, the process of integrating national power grids requires enhanced regional energy cooperation between member States. Hence, the creation of regional institutional governance is essential in guiding the progress of energy connectivity and integration. This requires a transformative partnership between member States, with support from regional and subregional institutions, to create a regional institutional architecture that can guide the process. The experience from other subregions has underscored the central role that these institutions play in the integration process.

IV. Draft regional road map on energy connectivity in Asia and the Pacific

9. The following draft road map on energy connectivity is based on the status reports developed by experts for the four subregions and the deliberations of the Expert Working Group on Energy Connectivity. The road map proposes nine detailed strategies for regional stakeholders to address and suggests key milestones, time frames and responsible entities for realizing each strategy. The time frames for each strategy are defined as short term (1 to 3 years), medium term (4 to 7 years) and long term (7 to 15 years).

A. Strategy 1: building trust and political consensus for cross-border electricity trade

10. Geopolitical issues and lack of trust among many of the countries in Asia and the Pacific are major challenges for enhancing connectivity and establishing cross-border electricity trade. Overcoming this requires a process of continuous trust-building, which must be supported by independent intergovernmental organizations such as ESCAP, subregional cooperation organizations and multilateral banks. There is a need to build consensus among member States for the long-term vision of energy connectivity in the Asia-Pacific region and to overcome the principal barriers to energy connectivity.

11. To create trust and to promote political consensus, it is important to promote continuous dialogue among the decision makers and stakeholders of member States in each subregion. The Commission and subregional intergovernmental institutions, such as the Association of Southeast Asian Nations (ASEAN), the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation, the Eurasian Economic Cooperation Organization, the Eurasian Economic Union, the Greater Mekong subregion, the Greater Tumen Initiative, the Lancang-Mekong Cooperation, the South Asian Association for Regional Cooperation (SAARC) and the Shanghai Cooperation Organization, can play a vital role in building trust and political consensus by utilizing their platforms to convene stakeholders such as policymakers, decision makers, think tanks, regulators, financing organizations and private developers. To achieve progress on this strategy, these intergovernmental institutions need to develop coordinated action plans on power grid connectivity.

12. Building trust for cross-border energy connectivity should also be pursued with countries regardless of whether they are export, import or transit countries. This process is needed to promote the understanding of benefits among different sectors of society and ensure support for the interconnection process.

13. The Commission needs to play a central role in building trust and political consensus with the objective of enhancing grid connectivity in the Asia-Pacific region, by organizing focused regional meetings, such as a summit on grid integration in Asia and the Pacific, for the promotion and coordination of region-wide connectivity efforts. Furthermore, multilateral institutions, such as the Asian Development Bank (ADB), the International Energy Agency, the International Renewable Energy Agency and the World Bank, as well as specialized institutions working in the various subregions, also need to coordinate and align their activities with those of ESCAP and the subregional intergovernmental institutions to avoid duplication and maximize impact.

Key milestones

A regional meeting on grid integration convened annually from 2021 onwards.

Time frame

Short-, medium- and long-term.

Key implementers

Member States, with support from the secretariat, subregional organizations, intergovernmental institutions, multilateral development banks and other relevant international organizations.

B. Strategy 2: development of a regional cross-border electricity grid master plan

14. Today, grid interconnectivity in the Asia-Pacific region operates on a bilateral basis and is limited in its extent. To promote connectivity for the broader region, it is important to develop and agree upon a grid master plan for the interconnection of the region's power grids. The grid master plan is envisaged as an agreed blueprint for interconnection among and within the subregions that will identify current and planned cross-border transmission and generation assets. It will build upon and integrate existing or future subregional

grid master plans. The development of the grid master plan should adhere to the principle of inclusiveness, by reflecting the concerns and demands of relevant stakeholders.

15. To support this, there should be greater networking of subregional intergovernmental institutions, including multilateral institutions. This will enable member States to identify and enhance the economic, social and environmental benefits of cross-border electricity trade and agree on the architecture of a regional cross-border grid.

16. The Commission can convene member States and the subregional intergovernmental institutions to develop the grid master plan for the interconnection of the region's power grids. It can also provide technical support through the mapping of high voltage transmission lines near borders. Multilateral institutions such as ADB and the World Bank can also support ESCAP in these efforts.

Key milestones

Regional grid master plan agreed by member States by 2025 and mapping of the region's high voltage transmission network by 2022.

Time frame

Medium-term.

Key implementers

Member States, with support from the secretariat and subregional institutions.

C. Strategy 3: develop and implement intergovernmental agreements on energy cooperation and interconnection

17. Political commitment in the form of various treaties, agreements or memorandums of understanding among the member States in each subregion is critical for enhancing energy connectivity. International examples of successful power pools highlight the importance of agreements signed by the participating countries to signal each country's political commitment to promoting energy cooperation and integration within a specific time frame.

18. In North-East Asia, there is no intergovernmental institution or existing agreement signed by the member States on interconnection. The current trade is limited and based on bilateral agreements. In ASEAN, SAARC and the Greater Mekong subregion, member countries are following strategic processes, such as signing agreements on energy cooperation and grid connectivity and constituting ministerial committees and working groups to promote energy cooperation and integration. The Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation countries have also recently signed an agreement on grid interconnection.

19. Where agreements are already in place, it is important that member countries ratify and expedite their implementation. For subregions where the process of signing these agreements has yet to be initiated, it is important to learn from the experiences of ASEAN, SAARC, the Greater Mekong subregion and other successful power pools in the world. This will help in adopting a strategic approach to enhance energy cooperation and connectivity in the subregions.

20. Intergovernmental institutions working in each Asia-Pacific subregion, such as the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation, the Eurasian Economic Cooperation Organization, the Great Mekong subregion, the Greater Tumen Initiative, SAARC and the Shanghai Cooperation Organization, need to develop action plans to make concerted efforts to sign and implement agreements among member countries for power grid interconnection within a specified time frame.

21. For North-East Asia, ESCAP should facilitate the creation of a subregional body dedicated to realizing interconnection with the support of multilateral financial institutions.

22. The Commission, with the support of intergovernmental institutions and multilateral development institutions such as ADB and the World Bank, needs to support members States in developing and formalizing grid connectivity integration agreements to enhance energy connectivity in the region.

Key milestones

Subregional body for North-East Asia connectivity established by 2022 and grid interconnection agreements in place for all subregions by 2025.

Time frame

Short- and medium-term.

Key implementers

Member States, with support from the secretariat and subregional organizations.

D. Strategy 4: coordinate, harmonize and institutionalize policy and regulatory frameworks

23. Policies, regulations and standards for power grids may differ among countries in each subregion. As the electricity sector is highly regulated and grid stability is a critical priority, aligning policies, regulations and standards with respect to cross-border electricity trade is vital.

24. It is important to identify gaps in policies, regulations and standards in each subregion, by conducting in-depth research and analysis, and to identify where amendments need to be made upon notification by the regulators of each country.

25. Moreover, efforts need to be made to develop model or common frameworks for policies, regulations and standards in support of cross-border electricity trade.

26. Integrated markets require integrated institutions for the transparent, smooth trade of electricity in each subregion and for a unified Asia-Pacific region.

27. Regulators in each subregion, with the support of intergovernmental institutions and/or multilateral institutions, should establish forums or associations of national regulators in each subregion to enable the harmonization of regulations, capacity-building and knowledge-sharing.

International experience also suggests that multilateral institutions such as ADB and the World Bank play key roles in creating these structures.

28. Forums or associations of regulators in subregions where these have not already been formed can also facilitate the development of a common set of regulations for cross-border electricity trade such as on licensing, open access, the harmonization of grid codes and the establishment of subregional transmission pricing frameworks that could eventually cover the entire region.

Key milestones

Analysis of gaps in grid policies, regulations and standards in each subregion by 2023, subregional associations of national regulators formed by 2025 and common regulations for subregional cross-border electricity trade developed by 2025.

Time frame

Short- and medium-term.

Key implementers

Member States, with support from the secretariat and subregional organizations.

E. Strategy 5: move towards multilateral power trade and create competitive markets for cross-border electricity

29. Transitioning from bilateral to multilateral electricity trade is a challenge in the Asia-Pacific region. Existing cross-border electricity trade remains limited and is conducted on a bilateral basis. Moving to a multilateral mode will help countries to optimize overall regional energy resources, enhance economic growth, expand the use of renewables, lower costs and contribute to the decarbonization of the power sector. It is important to continue to promote bilateral power grid connectivity as a building block of a multilateral system. However, there is a need to encourage member States to transition to multilateral trade to realize the full benefits of connectivity.

30. Linked to this is the need to create transparent, fair, competitive, balanced and unified electricity markets with fair pricing mechanisms. This is vital for the success of regional power connectivity. Market integration can take advantage of diversity among countries, enhance competitiveness and reduce costs for consumers. In other regions, experiences with cross-border electricity markets have been positive, but they highlight the need for strong institutional frameworks. With each country having its own tariff pricing mechanism and differing commercial agreements and payment security mechanisms, a secured payment mechanism is critical for enhancing trade of electricity across borders.

31. The development of common or model power purchase agreements, transmission service agreements and payment security mechanisms acceptable to member States would be an important enabling step for electricity trade. Furthermore, implementing transparent and attractive transit fee frameworks in all the member States, which allows for corridors for the wheeling of electricity between countries, will help to expedite cross-border interconnection and trade.

32. The forums of subregional regulators can support the development of a unified electricity market by creating standard contractual documents, such as power purchase agreements, transmission service agreements, transit fee frameworks, subregional pricing frameworks, payment security mechanisms, competitive bidding and market rules for electricity trade on power exchanges. The experiences of international power pools also highlight the importance of comprehensive, well-drafted standard contracts that fully incorporate the consequences of contractual defaults and emergency events.

33. Intergovernmental and multilateral institutions working in the subregions should make concerted efforts with governments, regulators and decision makers to promote moving towards multilateral cross-border electricity trade and the development of competitive markets for cross-border electricity. Large countries such as China, India, the Russian Federation and Thailand can play a leading role in promoting this shift.

34. The economic, social and environmental benefits of the electricity trade and relevant international experiences, including regional examples, need to be shared with relevant stakeholders, including national policymakers, to build the case for multilateral electricity trade.

Key milestones

Development of subregional and Asia-Pacific studies to evaluate the social, economic and environmental benefits of multilateral electricity trade and competitive markets by 2023.

Time frame

Short-, medium- and long-term.

Key implementers

Member States, with support from the secretariat and subregional organizations.

F. Strategy 6: coordinate cross-border transmission planning and system operation

35. Wheeling of electricity across different national grid networks requires transmission systems to be physically interconnected. To interconnect two separate national power systems, it is important to harmonize technical standards such as grid codes encompassing frequency, voltage and thermal limits. Furthermore, metering connection, protection schemes, transmission planning and scheduling need to be coordinated among the technical institutions and power utilities of member States in each subregion for the safe and reliable flow of electricity.

36. To encourage the development of cross-border power generation projects, power utilities should plan and develop adequate electricity transmission infrastructure to allow open access for developers to transmit power.

37. System operators, transmission utilities and technical institutions in each country, with the support of ESCAP, subregional institutions, Governments and multilateral institutions, should create associations in each subregion for coordinated transmission planning and system operation of the

interconnection system network. It is important that national transmission plans and cross-border transmission plans be compatible with one other.

38. These bodies can facilitate the development of common sets of grid codes and technical regulations, grid master plans, protection schemes and scheduling, along with feasibility studies for the smooth interconnection of power systems in each subregion.

Key milestones

Development for each subregion of common grid codes, technical regulations, subregional grid plans and feasibility studies for interconnection completed by 2025.

Time frame

Short- and medium-term.

Key implementers

Member States, with support from the secretariat, subregional organizations, multilateral development banks and specialized institutions, such as the International Energy Agency and the International Renewable Energy Agency.

G. Strategy 7: mobilize investment in cross-border grid and generation infrastructure

39. As the power sector is capital intensive and associated with large risks and long gestation periods, mobilizing investment is a challenge. Funding for cross-border power projects has largely been done through international financial institutions, multilateral development banks and national contributions. Considering the scale of investment required to realize the large-scale integration of the region's power grids, there is a need to develop innovative financial instruments and mechanisms in each subregion to mobilize financing.

40. To attract investment, it is important that investment-friendly policies, guidelines and frameworks be in place. These include the removal of barriers to private sector and foreign investment, smooth land-acquisition, resettlement and relocation processes, and planning clearances. These policies, guidelines and frameworks need to be developed in each subregion to attract developers and investors to finance the infrastructure underpinning interconnection.

41. To lower risk and facilitate investment, it is necessary to have strong, swift and clearly defined dispute-resolution procedures to support electricity trade agreements. The repercussions of such disputes can lead to a temporary or permanent discontinuation of electricity supply, leading to substantial financial losses and a demand-supply imbalance. Presently, sellers and purchasers involved in cross-border trade need to resolve their disputes based on the power purchase agreements. Apart from amicable settlement, these dispute resolution procedures also provide for arbitration in a third country. Intergovernmental institutions, governments, regulators and appellate tribunals need to develop transparent dispute-resolution mechanisms and frameworks and establish a common institution for resolving any disputes on cross-border electricity trade in each subregion. In South Asia, the SAARC Arbitration Council has been formed to resolve any disputes between the member countries, instead of resolving disputes in a third country.

42. Uncertain taxes and duties also deter investment. In Asia and the Pacific, currency is very volatile, which presents a challenge for developers who wish to invest in cross-border power projects and associated transmission infrastructure.

43. To encourage investment, ESCAP, in association with other intergovernmental institutions, should organize focused group meetings, workshops and conferences, inviting representatives from various financial institutions and governments, private and public developers, and policymakers to participate in one platform for each subregion, where they could discuss investment-related issues and address barriers to investment in the power sector.

44. It is proposed to create associations of financial institutions, multilateral institutions, representatives of the chambers of commerce of member countries, multilateral financial institutions and think tanks in each subregion to help policymakers of member countries to develop investor-friendly policies and frameworks to encourage private investment. These bodies may facilitate the development of transparent policies and regulations on taxes and duties and adopt a common currency acceptable to all member countries to encourage developers to invest in the sector.

45. These forums or associations can also facilitate research studies on issues such as financing instruments for renewable energy, developing capital markets and assessing energy investment risks. The forums or associations can facilitate the tapping of funds at competitive rates from ADB, the Asian Infrastructure Investment Bank, the New Development Bank or the World Bank for cross-border generation and energy connectivity infrastructure projects.

46. Further, instruments such as green bonds, blended financing or renewable energy certificates can be tailored to finance specific cross-border projects, including for the development of renewable energy projects.

Key milestones

Subregional platforms, convening financial institutions, utilities and governments, created to advance financing of cross-border connectivity projects by 2023.

Time frame

Short-, medium- and long-term.

Key implementers

Member States, with support from the secretariat, subregional organizations, multilateral development banks and specialized institutions such as the International Energy Agency and the International Renewable Energy Agency.

H. Strategy 8: building capacities and sharing information, data, lessons learned and best practices

47. The Asia-Pacific region has a wealth of knowledge and experience in the energy and power sector. Some of the intergovernmental institutions have data and information on the power sector of member countries in their subregions, but the data are often not adequate and not updated regularly. In some countries, Governments are maintaining some power sector data in the

public domain, whereas other countries lack public data on the power sector. Furthermore, the subregions engage in limited sharing of data, information, lessons learned, best practices and new technologies.

48. Some countries in Asia and the Pacific have successfully implemented projects on smart grids, energy efficiency, and hybrid solar and wind power, but they engage in limited sharing of best practices and capacity-building. If the power sector is to grow and integrate more effectively across the region, it is important that there be increased sharing of information, data, lessons learned and best practices through capacity-building programmes among the member countries.

49. Intergovernmental institutions in each subregion and ESCAP should work together to develop and maintain data and information, lessons learned and best practices relevant to power grid interconnection. Together, they can create a centre of excellence covering knowledge on renewable energy, power markets and cross-border electricity connectivity. Intergovernmental institutions can develop and maintain data for their subregions, whereas ESCAP can cover the wider Asia-Pacific region. The existing Asia Pacific Energy Portal, operated by ESCAP, can be reinforced for this purpose, with more geospatial data on cross-border power infrastructure and energy data.

50. Intergovernmental institutions, Governments, power utilities and multilateral financial institutions can develop plans for capacity-building to share information and expertise in areas such as new technologies, energy efficiency, smart grid activities, electric vehicle charging infrastructure, large-scale solar power and competitive bidding. This would benefit all the member countries, helping them to successfully implement these plans and to improve efficiency and system operations.

Key milestones

Capacity-building, knowledge generation and data support plans developed and resources identified to support member States in their grid interconnection efforts by 2021.

Time frame

Short-, medium- and long-term.

Key implementers

The secretariat, with support from member States, subregional organizations, multilateral development banks, universities, research institutes and specialized institutions such as the International Energy Agency and the International Renewable Energy Agency.

I. Strategy 9: ensure the coherence of energy connectivity initiatives and the Sustainable Development Goals

51. Besides generating economic gain, enhanced energy connectivity can lead to many other positive externalities related to sustainable development, such as reducing greenhouse gas emissions, improving energy accessibility in remote areas and creating jobs. To ensure a strong synergy between energy connectivity projects and sustainable development, more focused attention should be placed on the social and environmental influences of these projects over the long term. Proactive and consistent measures countering social dislocation, biodiversity loss and climate change impacts should be taken. In

addition, it should be ensured that the economic gains of energy connectivity are evenly distributed to all participating countries and are translated into tangible benefits for all sectors of society within each country and for all genders.

52. The Sustainable Development Goals provide an agreed framework for countries to pursue national development that measures progress in social, economic and environmental terms. Developments in cross-border energy connectivity will offer more comprehensive benefits if they are aligned with the Sustainable Development Goals in the planning, implementation and operational phases.

53. Hence, each interconnection proposal should be developed in an inclusive manner that ensures a positive overall societal impact and environmental protection and meets economic criteria, with emphasis placed on stakeholder consultation and engagement. The Commission can support its member States in their efforts to follow this principle and implement cross-border connectivity initiatives in a manner that supports the Sustainable Development Goals, through its intergovernmental work and its research and analytical capacity.

Key milestones

A set of principles to enable the assessment of interconnection projects against sustainability criteria and to ensure coherence with the Sustainable Development Goals, agreed by member States by 2023.

Time frame

Short-, medium- and long-term.

Key implementers

Member States, with support from the secretariat, subregional organizations, multilateral development banks, universities and research institutes.
