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## Economic and Social Commission for Asia and the Pacific Committee on Energy

### First session

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Items 2 and 5 of the provisional agenda\*

### High-level panel discussion on the theme “Opportunities and challenges of energy system transformation in Asia and the Pacific: how far and how fast can the region go?”

### Promoting energy connectivity in Asia and the Pacific

## Promoting regional energy connectivity in Asia and the Pacific

### Note by the secretariat\*\*

#### *Summary*

At its seventieth session, the Economic and Social Commission for Asia and the Pacific endorsed the Bangkok Declaration on Regional Economic Cooperation and Integration in Asia and the Pacific, which promotes a comprehensive view of regional economic cooperation and integration. Energy connectivity, with its specific focus on transboundary interconnection and power trade, can play an important role in overall regional economic cooperation and integration. It can have mutual benefits for member States and play a role in increasing the sustainability of energy sectors.

With energy demand in Asia and the Pacific forecast to increase by 60 per cent between 2010 and 2035, access to reliable and adequate energy services will remain a focus for the decades to come. The region is expected to account for more than 40 per cent of the \$68 trillion of cumulative global energy investments through 2040.

The present document addresses the challenges involved in meeting growing energy demand while promoting energy connectivity as a means to enhance the sustainability and lower the carbon footprint of the power sector, covering energy access, renewable energy and energy efficiency. Notwithstanding the forecast 60 per cent increase in energy demand, electricity demand is forecast to more than double, illustrating the increasing importance of electricity in the future. There is a large amount of knowledge and lessons learned on how increased sustainability of the power sector has been achieved in other regions. The present document focuses on the role that regional cooperation and energy connectivity will play and their potential and highlights opportunities and actions based on best practices. Furthermore, it contains a proposal on the creation of a regional mechanism to effectively address the multiple challenges in the energy sector.

The Committee on Energy may wish to consider and endorse recommendations contained in the present document to facilitate enhanced regional energy connectivity for the Asia-Pacific region.

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\* E/ESCAP/CE(1)/L.1/Rev.1.

\*\* This note was submitted late owing to the extensive research and internal consultation that was necessary.

## I. Introduction

### A. Energy demand will continue to increase in order to fuel economic growth

1. Countries in the Asia-Pacific region have transformed their economies, making remarkable progress in raising incomes and living standards, becoming a vibrant manufacturing hub for the world, creating millions of jobs and improving overall access to services. Rapid economic growth in the region has translated into rising energy demands. The overall demand for energy is expected to grow significantly for three reasons: economic growth, the expansion of the middle class and the provision of universal access to energy.

2. The region's energy imports have increased rapidly from approximately 920 million tons of oil equivalent in 1990 to 2,300 million tons of oil equivalent in 2014. Over the same period, the region's share of the global total of energy imports has substantially increased from 29 per cent to nearly 44 per cent. Overall exports have remained more or less stagnant at around one third of global energy exports since 1990.<sup>1</sup>

3. There are several projections of future energy consumption and though actual numbers may vary, their directions are very similar. The latest projections by the International Energy Agency under its new policies scenario predict global energy demand to grow 37 per cent by 2040, with the majority of this growth from the Asia-Pacific region. These projections foresee dramatic shifts in regional energy demand, with demand expected to remain flat in much of Europe, Japan, the Republic of Korea and North America and to rise in the rest of the Asia-Pacific region (60 per cent of the global total), while proceeding at a slower pace in Africa, the Middle East and Latin America. Thus, the region will be the frontrunner in global energy consumption. In absolute terms, China is expected to lead global energy consumption by 2030, and by 2040, India's energy demand is expected to be as large as that of the United States of America and to contribute approximately a quarter of the total projected rise in global energy demand, more than any other country.<sup>2</sup>

4. These demand forecasts are reflected in projections for energy investments. The region is expected to account for more than 40 per cent of the \$68 trillion of cumulative energy investment until 2040. Of this, \$22 trillion will be needed for investments in energy efficiency. It is expected that two thirds of projected investments will be in non-member countries of the Organization for Economic Cooperation and Development and in the Asia-Pacific region, and about half of this will be required in the power sector (that is, generation, transmission and distribution) to fill much needed demand and access gaps.

5. The largest growing markets, China and India, will require more than 60 per cent and 70 per cent respectively of their total energy investment to be

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<sup>1</sup> Organization for Economic Cooperation and Development, International Energy Agency, World Energy Statistics and Balances database. Available from [www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances\\_enestats-data-en](http://www.oecd-ilibrary.org/energy/data/iea-world-energy-statistics-and-balances_enestats-data-en) (accessed 10 October 2016). The data for the Pacific subregion cover only Australia and New Zealand.

<sup>2</sup> International Energy Agency, *World Energy Outlook 2016* (Paris, 2016).

made in the power sector. A significant divergence from this general trend is projected for North and Central Asia, where countries such as the Russian Federation are expected to focus 40 per cent of investments in developing natural gas markets, with a similar outlook for Australia. The power sector is therefore expected to become a key focus for new infrastructure in the coming years, and opportunities for maximizing long-term efficiencies in development and cooperation are more likely to emerge in this sector.<sup>2</sup>

6. The region is expected to remain dependent on oil in the medium term, as the mobility and transport of goods and people are critical for economic development. Currently, transport is heavily dependent upon oil and is the fastest growing source of global carbon emissions.<sup>2</sup> With the growing middle class in the region and rapid urbanization, overall oil demand for personal mobility and transport of goods is expected to rise significantly.<sup>3</sup>

## **B. Energy connectivity as a means of meeting the growing energy demand and enhancing energy security within the region**

7. As energy demand rises and new sources of renewable energy generation emerge, regional energy connectivity will take on an increasingly important role, enabling countries to meet increasing demand, enhance energy access and improve the sustainability and emissions profile of the energy sector. Energy connectivity is strongly linked to resolution 70/1 of the Economic and Social Commission for Asia and the Pacific (ESCAP) on the implementation of the Bangkok Declaration on Regional Economic Cooperation and Integration in Asia and the Pacific. The Declaration focused on the four pillars of regional economic cooperation: (a) moving towards the formation of an integrated market; (b) the development of seamless connectivity across the region in the areas of transport, energy and information and communications technology, inter alia, including through the full realization of key regional initiatives; (c) enhancing financial cooperation for, inter alia, closing infrastructure gaps across countries in the region and exploring the possibility of providing liquidity support; and (d) increasing economic and technical cooperation to address shared vulnerabilities and risks.

8. Energy connectivity, which comprises power grids as well as gas and oil pipelines, is an important aspect of seamless regional connectivity in the region. It also contributes to Sustainable Development Goal 7, by increasing access to energy services and facilitating the move to a low-carbon energy system. The exchange of energy, mainly electricity and natural gas, could greatly increase the sustainability of power generation within the region by assisting a transition away from traditional coal-fired generation, which accounted for approximately 55 per cent of the Asia-Pacific region's electricity generation in 2014,<sup>1</sup> towards low and zero emissions electricity. Energy connectivity can also contribute to meeting the growing energy demand and enhancing energy security within the region.

9. Given the large number of people in the region without access to modern energy services, access to reliable and sufficient energy services will remain a focus for decades to come. Energy sector development must focus

<sup>3</sup> The global middle class will increase to 3.2 billion persons by 2020 and 4.9 billion persons by 2030. The bulk of this growth will come from the Asia-Pacific region. By 2030, 66 per cent of the global middle-class population and 59 per cent of global middle-class consumption will be from the region, compared to 28 per cent and 23 per cent, respectively, in 2009. This will have a major impact not only on energy consumption, but also on other goods that have a high energy and carbon content.

on affordability, efficiency and environmental soundness, while the policies that promote these outcomes must maintain a focus on sustainable and equitable development.

10. While overall energy demand in the Asia-Pacific region is forecast to increase by 60 per cent from 2010 to 2035, electricity demand is predicted to more than double, illustrating the increasing importance of electricity.<sup>4</sup> For many countries, meeting this future power demand using domestic energy resources will become increasingly challenging. As the cost of power generation from wind and solar power continues to fall and financing for renewables expands, the need for increased transboundary energy trade is becoming increasingly clear, as interconnected grids are more flexible, better able to integrate variable sources of energy and can connect regions with surpluses and deficits of energy.

### **C. Energy connectivity as the way towards sustainable energy development**

11. The current share of renewable energy in the Asia-Pacific energy mix remains low, and progress in most countries has been insufficient to achieve the goals set forth in the Paris Agreement or the 2030 Agenda for Sustainable Development, the latter of which calls for a substantial increase of the share of renewable energy in the global energy mix by 2030 under target 7.2. Between 2000 and 2014, total renewable energy production (including hydropower) in Asia and the Pacific nearly tripled, from approximately 800,000 gigawatt hours to 2,200,000 gigawatt hours. Within the region, however, the share of renewables in total electricity production from 2000 to 2014 only marginally increased, from approximately 15 to 18 per cent, with coal still accounting for the bulk of 2014 generation at approximately 55 per cent.<sup>1</sup> While positive, these trends are not compatible with attainment of Sustainable Development Goal target 7.2, and as such there is a need for the region to embrace renewable energy as a strategic option that reduces emissions and enhances environmental sustainability.

12. The present document focuses on the potential of regional energy connectivity to meet broader energy goals within the framework of sustainable development. It outlines challenges in meeting the growing energy demand while still addressing the sustainable development agenda, encompassing the efficiency of energy used, the expansion of renewable energy and universal energy access. Since, in today's connected world, no country alone can address its energy challenges, the present document focuses on the role that regional cooperation can play in meeting this challenge.

## **II. Benefits of increased energy connectivity**

13. The need for energy trading and connectivity emerges from the fact that large energy generation sources are often geographically separated from demand centres, in some cases by international borders. Seasonal hydroelectric production may not match demand in generating countries but can complement seasonal demand in other countries in the region. Newer forms of renewable energy, such as solar and wind, also exhibit seasonal as well as diurnal variations. Because of this variability, regional trading can especially benefit countries with diverse generation sources. Transboundary

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<sup>4</sup> Asian Development Bank, *Energy Outlook for Asia and the Pacific* (Manila, 2015).

power trade can be used to reduce thermal generation while maximizing renewable generation.

14. In order to attain the long-term goal of a sustainable and low-carbon power generation sector, near-term benefits of transboundary connectivity initiatives need to be demonstrated, including increased adequacy, reliability and flexibility of electricity, and economic gains associated with lower prices, reduced need for generation reserve margins and increased economies of scale with regard to generation through access to larger markets. The following are examples of the benefits attainable through increased interconnection:

(a) **Economies of scale and scope.** The European Union and large countries such as the United States, China and India have integrated their power networks, leading to augmented national supplies and significant cost savings in the energy system owing to economies of scale and scope. Major cost savings are made as a result of avoided generation capacity through complementary demand profiling across countries, a lower reserve margin, improved load factor of generators, increased load mix and coordinated maintenance schedules. Overall resource pooling affords complementarities and comparative advantages with regard to fuel sources used for power generation, thus lowering overall costs;

(b) **Universal access to modern energy services.** Regional energy connectivity has the potential to contribute to the achievement of Sustainable Development Goal target 7.1 on universal energy access. New renewable energy capacity for power generation has begun to outpace additions to fossil fuel capacity, while the costs of renewable energy options continue to decline. Increasing connectivity can reinforce this transition because it enhances the viability of renewable energy projects by connecting them to markets, even in other countries. For countries that have low energy access rates, regional energy connectivity can increase energy supply and present opportunities for connecting individuals, households and remote regions to modern energy, leading to job creation, advancing economic growth and development and helping to meet other Goals;

(c) **Energy security.** One of the largest benefits of energy connectivity is enhanced energy security for the region as a whole. By connecting resources with production and imports with regional supplies, it is possible to diversify overall sources of energy. Through the integration of power markets across borders, risks and vulnerabilities become shared, and their potential impacts on any single country are thereby lessened;

(d) **Expansion of renewable energy use.** Connecting the electricity grids of adjacent countries and subregions can play a supportive role in the expansion of renewable energy. Variable renewable energy technologies such as solar and wind, if connected to larger or multi-country grids, can achieve higher penetration and their economic and environmental benefits can be fully captured. Creating larger demand pools through interconnection and hence capturing more diverse generation sources, including renewables, can lower system peaks, reduce costs and increase reliability for all consumers. In the Asia-Pacific region, a large number of countries have hydropower potential but lack the financial resources and domestic demand to justify investment. Energy connectivity will thus afford possibilities for many countries to diversify sources of power generation and allow the region's vast solar and wind resources to be tapped;

(e) **Addressing social and environmental concerns.** The region has yet to create a large part of the future energy infrastructure that it will need. It is therefore possible to address social and environmental concerns in the overall planning process. Most energy infrastructure is path dependent

and difficult to change because of technology lock-in effects. Hence, developing countries establishing greenfield infrastructure have opportunities to leapfrog directly to clean technologies with the right support, including through regional cooperation;

(f) **Trade and investment opportunities.** The 2008 financial crisis highlighted the role of infrastructure investments in stimulating growth and job creation. This is particularly true for distributed and renewable energy systems. The existing generation and network capacities are often constrained, meaning that large potential exists for enhancing regional energy trade and investments. The greatest challenge is streamlining processes and removing barriers to energy trade, which can emerge as a major source of economic growth;

(g) **Resource diversity.** The disparity between energy demand and resource endowment means that there is significant potential to reduce overall energy costs in the region by exploring energy supply options beyond national borders. The region's diversity in terms of energy resource endowment provides opportunities if connectivity is established between resources and demand centres. The economic and political opening up of two countries in the region, the Islamic Republic of Iran and Myanmar, is important as they are strategically located as land bridges for energy connectivity, especially given their rich energy resource base. Third-country access rights can enhance energy availability for the third country and, through transit fees, provide possibilities to increase government revenue;

(h) **Dynamic competitiveness.** As the experiences of Europe and large countries indicate, regional integration helps to enhance the efficiency of the economies that are currently facing large deficits. Improved energy availability attracts private investments and opens up new business opportunities. It is expected that this would lead to enhanced dynamic efficiency;

(i) **Learning and knowledge-sharing.** The Asia-Pacific global production network has shown that it is possible for economies to learn and, through shared knowledge, create prosperity in the entire region. The region has created successful clusters with virtuous cycles and has become the "factory of the world". It is possible to replicate such success in the energy supply chain.

15. Regional integration will not solve all energy challenges, but smart region-wide energy connectivity can play a valuable role in improving energy supply and minimizing the environmental impact. It is possible for the Asia-Pacific region to expand supplies, reduce the overall cost of energy produced and consumed, lower environmental and social costs, and reduce energy insecurities if energy networks are connected.

### III. Barriers to energy connectivity

16. The dynamism of the Asia-Pacific region stems from an intricate web of regional supply chains and global production networks. For the past four decades, the Asia-Pacific region has transformed itself into a global manufacturing hub, which has been possible because of its success in connecting to global production networks and supply chains, which has been largely driven by advances in information technology, declining transport costs and falling trade barriers across countries. Most of the process was market-driven, where major relocation of production capacity took place to take advantage of lower labour costs enabled by foreign direct investment. These Asia-Pacific production networks essentially became self-reinforcing and bolstered investments and fostered technology transfer. The diversity of

the region emerged as its main strength and the resulting production integration provided it with a vital new comparative advantage in the global economy. These production networks have become a major force in integrating the region's markets.

17. Unlike the global production networks that created a positive force for reinforcing the bottom-up market integration process, efforts to connect the energy sector in the region have not yet been very successful, with the exception of some cross-border investments in energy projects. Trade and investments in regional energy networks remain low despite the high and growing demand for energy and the adequate beneficial opportunities waiting to be realized from regional energy trade. A number of factors are responsible for this disconnect:

(a) Energy networks, unlike commodities, have particular attributes that make energy more difficult to trade. Physical energy networks, such as gas pipelines or transmission grids, are capital intensive and generally subject to economies of scale. Most of these networks require significant upfront investment but are also of little use until the works are complete and unless they are maintained in good condition. With high sunk costs, energy networks present major challenges in financing and maintenance, especially when they traverse multiple countries. These capital attributes lead to many market and Government failures, and private investors may be reluctant to absorb this risk;

(b) Unlike normal goods or commodities, most networks are geographically specific: once a location is set, it cannot be moved. For example, once a gas pipeline is laid, its spatial dimensions will also impact the value creation for one group of people versus the rest. It is difficult to put in place compensation mechanisms even when the networks are within a single national boundary; when they are under different national legal and governance systems, political risks and aversion are created;

(c) Energy demands are relatively inelastic because it is difficult to find appropriate substitutes for power or transport fuel. Any disruption in service will impact a large population and may not be tolerated. Underlying domestic or local politics presents a strong influence and can translate into major challenges for promoting energy integration;

(d) When energy markets are dominated by state ownership, investments from private savings are difficult to come by. The underlying institutional, regulatory and policy frameworks are not conducive to large-scale private investments. There are large transaction costs in preparing and processing cross-border energy projects. It also takes a very long time for projects to move from the concept stage to the drawing board and then to actual implementation. Unless a level playing field is created, the private sector is reluctant to invest in such projects;

(e) Commodity trade has been largely initiated by multinationals with well-defined value chains for the entire production process, but the overall benefits of enhanced power connectivity, for example, remain unclear;

(f) With clear economies of scale and scope, regional commodity clusters have grown for most products and the stakeholders have benefited from such integration within a relatively short period of time. However, the payback period for energy connectivity is long and uncertain;

(g) Lack of physical capacity and creditworthiness of state enterprises also inhibits energy connectivity, as non-payment is perceived as a major risk by investors. Different legal and regulatory capabilities and lack

of transparent governance of the sectors pose a major challenge for cross-border investments;

(h) Since there are large positive and negative externalities inherent in energy connectivity, rules and regulations need to be in place to ensure not only that there is a fair distribution of costs and benefits amongst stakeholders but also that those who gain suitably compensate the losers in the global economic space. Invariably, there are problems relating to agreeing on measurements and designing policy regimes that can fully address those externalities, including determining compensation for those affected negatively and identifying benefits from large investments in energy networks. Moreover, the energy integration process is not just limited to the creation of physical links across the region, but requires a series of policies and regulations and governance to facilitate the different types of flows inherent in the process;

(i) Balancing the gains with overall costs between different groups of stakeholders requires a robust institutional mechanism. This in turn requires intervention and leadership by the participating Governments and by technical experts if regional energy connectivity is to proceed;

(j) Various existing subregional programmes supporting the energy integration process in the region show a lack of consensus on defining a comprehensive model of integration and satisfying the interests of the whole region, including States and stakeholder groups. To a great extent, this shows a lack of human and institutional capabilities, political leadership and market mechanisms.

18. Energy security issues are of prime importance to countries, many of which wished to avoid “compromising” national energy security by engaging in regional energy trade that creates import dependency on neighbouring countries. There was, and still remains to some degree, a tension between perceived political goals and regional energy connectivity. With the changing global socioeconomic conditions, there is enough momentum in the region to move forward in promoting energy connectivity by addressing these challenges.

#### **IV. Existing initiatives**

19. By reviewing existing regional energy connectivity initiatives in the Asia-Pacific region, it is clear that the benefits of energy connectivity have been acknowledged to varying extents in the region, and important physical and institutional linkages are either in place or in development phases. There are also prominent axes around which this connectivity is developing. In South-East Asia, the Association of Southeast Asian Nations (ASEAN) Economic Community is an emerging and integrating energy demand block. Gradual progress is being made in South and South-West Asia through the South Asian Association for Regional Cooperation (SAARC), and the North and Central Asia subregion through the Central Asia South Asia Electricity Transmission and Trade Project (CASA-1000). South-west China is already linked to Central Asia via oil and gas pipelines: Kazakhstan supplies oil to Xinjiang province, China, via the 2,200-km Kazakhstan-China oil pipeline; and the Central Asia-China gas pipeline brings gas from Turkmenistan to Xinjiang province, transiting Uzbekistan and Kazakhstan. Lastly, East and North-East Asia is a highly import-dependent subregion; China is a dominant growing subregional and regional demand hub, but subregional energy cooperation has yet to be realized.



20. Ongoing connectivity projects within the region focus primarily on electricity transmission links and gas pipelines. Notable regional interconnection projects under development include the Turkmenistan-Afghanistan-Pakistan-India gas pipeline project, which will supply natural gas from Central Asia to Pakistan and India, and the Power of Siberia gas pipeline, which will bring gas from Siberia, Russian Federation, to the country's eastern seaboard for export as liquefied natural gas to Japan and eventually overland to China.

21. However, countries also need oil for transport and increasingly depend on internationally traded oil. The price is generally agreed bilaterally, although S&P Global Platts has recently introduced the Free-on-Board Straits process, which provides a market-determined price of refined oil products from commercial storages in Singapore and Malaysia. There are plans to implement larger commercial storage and another oil hub in the Republic of Korea.<sup>5</sup>

22. Most of the existing subregional programmes are in early stages of connectivity. Besides the limited cross-border power exchanges,<sup>6</sup> there are a few cross-border energy projects with private-sector participation. The region's energy sector remains largely national with limited connectivity beyond borders. A number of subgroup leaderships have agreed to move towards completely integrated power sector programmes, but overall energy connectivity with efficient power markets remains a distant prospect.

23. It is evident that regional integration is a long process and has to be built up over different stages of energy network connectivity. So far, the region is in early stages of energy connectivity, partly because the approach adopted is voluntary and informal. A number of cross-border exchanges occur, which are largely electricity interconnections along the borders of many countries, other than archipelagos. The addition of cross-border energy projects leads to the "national plus" stage. The approach of subregional programmes is also bottom up and focuses on building a portfolio of power projects in neighbouring countries. ASEAN is trying to progress to the next stage which will include sector-based subregional programmes like the ASEAN Power Grid and the Trans-ASEAN Gas Pipeline. Eventually, energy connectivity has to be developed across the entire region.

24. There are several energy connectivity initiatives in the region, but most of these have yet to move up the integration ladder. The Greater Mekong Subregion is perhaps the most advanced of all subregional programmes in terms of harmonization of power policies and technical standards. In terms of subregional market creation, the region is behind Africa and Central America, where power pools and market integration are at an advanced stage, though on a much smaller scale.

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<sup>5</sup> Platts, McGraw Hill Financial, "Special report: oil – FOB Singapore beyond Singapore – towards FOB Straits", August 2014. Available from [www.platts.com/IM.Platts.Content/InsightAnalysis/IndustrySolutionPapers/sr-oil-fob-singapore-straits.pdf](http://www.platts.com/IM.Platts.Content/InsightAnalysis/IndustrySolutionPapers/sr-oil-fob-singapore-straits.pdf).

<sup>6</sup> Cross-border power exchanges include those among the Central Asian countries; in South Asia, India with Nepal, Bangladesh and Bhutan; among countries of the ASEAN subregion, such as the Lao People's Democratic Republic with Thailand and Vietnam; and the Guangxi Zhuang and Yunnan provinces of southern China with the Greater Mekong Subregion countries.

25. The proposed ASEAN Electricity Exchange is a joint initiative by the ASEAN Energy Market Integration Initiative and Heads of ASEAN Power Utilities/Authorities, which is designed to utilize the ASEAN Power Grid infrastructure. The model for electricity trade will follow what has been done by the Nordic regional power market, based on its 20 years of successful operation. The ASEAN Electricity Exchange will adopt this stepwise approach, beginning by trading surplus power, as the basic method for market development. In other words, progress will be through evolution, not revolution. Stepwise implementation allows all stakeholders to learn as the market evolves and is relevant both for the market offerings as well as for geographical expansion. The model has proven robust through implementation in many other regions of the world, from India to Southern Africa.

26. The countries of North and Central Asia used to form a single, unified energy system and have been interconnected since 1960, under the former Soviet Union, by the creation of unified energy and resources management principles. The break-up of the Soviet Union in December 1991, along with the formation of the Commonwealth of Independent States and the division of energy property between the States, led to a drastic change in the energy sector's management mechanisms. At that time, the creation of an energy infrastructure that could maintain the energy independence of the individual countries became paramount. The North and Central Asia subregion has a clear view and particular objectives at the subregional level owing to the past influence of the Soviet Union and the continued existence of the unified energy system. At present, 8 of the 11 national power systems of the countries of the Commonwealth of Independent States have synchronized parallel operation, and it is economically feasible to restore full parallel operation of all power systems of the North and Central Asian countries. A number of the initiatives in the region are economically feasible, socially acceptable and environmentally sound. However, there are some political aspects that prevent the practical implementation of such projects and that also impede mutually beneficial cooperation in other areas.<sup>7</sup>

27. The Central Asia-South Asia Regional Electricity Market is a concept for developing electricity trade among the countries of the two subregions through a set of projects and concomitant investments, underpinned by the relevant institutional arrangements and legal agreements. The four countries that have agreed to pursue the idea of the Central Asia-South Asia Regional Electricity Market include Kyrgyzstan and Tajikistan in Central Asia (intended exporters), and Afghanistan and Pakistan in South Asia (intended importers). However, it is envisaged that other countries could join the initiative as the trade expands.

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<sup>7</sup> Initiatives on the interconnection of regional energy systems in the North and Central Asia subregion were tackled more broadly during a workshop on challenges and prospects for regional electricity cooperation and trade in Central Asia and the Caucasus, held in Baku on 18 and 19 October 2016. Fundamental principles of successful regional electricity market integration were considered more closely and gaps and missing links of subregional power grid connectivity were addressed. The experts underlined lack of mutual trust among the countries in region-wide energy planning issues and emphasized low awareness among both potential investors and countries about each other. Complemented by the lack of harmonized standards, this mostly leads to economic inefficiency of investments that often prove to be below the initially planned levels. In addition, the execution of multilateral energy connectivity projects reveals a lack of common understanding of sustainability among the countries, meaning that further work is required to address the issue of convergence of the perception of energy sustainability.

28. In order to promote cooperation among SAARC member States, the Islamabad Declaration of the twelfth SAARC Summit, held in January 2004, mandated South Asian energy cooperation, including the concept of an energy ring, a common regional highway of energy within and across the region for the movement of energy (including both commodity and services) in a market-based environment that would benefit all participants. By signing the framework agreement for cooperation in the power sector, which will ensure electricity trading through grid connectivity, the leaders directed the relevant SAARC bodies and mechanisms to identify regional and subregional projects in the areas of power generation, transmission and power trade, including hydropower, natural gas, solar, wind and biofuel.<sup>8</sup>

29. Another new initiative is the establishment of the Global Energy Interconnection Development and Cooperation Organization, led by China since March 2016. The Organization's main goal is to promote the establishment of a global energy interconnection system in order to meet the global demand for electricity in a clean and green way, to implement the United Nations Sustainable Energy for All and climate change initiatives and to promote sustainable development. The Organization facilitated the signing of a memorandum of understanding on the Asian Super Grid in East and North-East Asia in March 2016 by the State Grid Corporation of China; the main utility and power provider in the Republic of Korea, Korea Electric Power Corporation; Japanese renewable energy developer Softbank; and Russian grid operator PJSC ROSSETI. The proposed East and North-East Asia grid is a highly developed electrical grid that integrates various energy sources, including renewable energy, and relies upon the construction of vast electrical grid infrastructure for the exchange of power.

30. One of the largest and most significant regional integration endeavours in the region will be the Belt and Road Initiative. This ambitious plan, supported by ESCAP, aims to establish six economic corridors of transport, energy and information and communications technology infrastructure linking more than 60 countries, with a third of global economic output. China and the countries linked to the Belt and Road Initiative have an opportunity to harness it for sustainable development by enhancing energy connectivity, with strategic initiatives for oil, gas and power transmission infrastructure incorporated within the economic corridors. In addition, the State Grid Corporation of China and the Global Energy Interconnection Development and Cooperation Organization are promoting the global energy interconnection initiative based on renewable energy. Through the Belt and Road Initiative planning process, more analytical work on energy connectivity could be undertaken and a more standardized approach towards transboundary energy trade and connectivity could be developed. The Belt and Road Initiative aligns well with other regional cooperation initiatives, including the recent dialogue by the Government of the Russian Federation on the development of its far east region at the Eastern Economic Forum in Vladivostok, Russian Federation, which called for the development of an Asian energy super ring to link the economies of North-East Asia.

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<sup>8</sup> Salis Usman, Research Fellow, "Medium term vision for energy connectivity in the SAARC region", presentation to the Eighth Japan-SAARC Energy Symposium, Islamabad, 9-10 March 2015. Available from: [www.saarcenergy.org/wp-content/uploads/2016/03/Medium%20Term%20Vision%20For%20Energy%20Connectivity%20in%20the%20SAARC%20Region%20by%20Mr.%20Salis%20Usman,%20SEC,%20Islamabad.pdf](http://www.saarcenergy.org/wp-content/uploads/2016/03/Medium%20Term%20Vision%20For%20Energy%20Connectivity%20in%20the%20SAARC%20Region%20by%20Mr.%20Salis%20Usman,%20SEC,%20Islamabad.pdf).

Also pursuing similar goals, the Economic Cooperation Organization,<sup>9</sup> the International Energy Charter and the World Bank Group are jointly addressing cross-border grid connectivity and the feasibility of an Economic Cooperation Organization regional electricity market through acknowledgment of market realities and identification of investment requirements.<sup>10</sup> Other initiatives in the region are listed in tables 1 and 2 below.

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<sup>9</sup> The member States of the Economic Cooperation Organization are Afghanistan, Azerbaijan, the Islamic Republic of Iran, Kazakhstan, Kyrgyzstan, Pakistan, Tajikistan, Turkey, Turkmenistan and Uzbekistan.

<sup>10</sup> On 12 October 2016, the International Energy Charter, the World Bank Group and the Economic Cooperation Organization organized a joint workshop during the World Energy Congress in Istanbul, Turkey, which featured a session entitled “Regional electricity market: realities and requirements”. Key discussion points included requirements for cross-border grid connectivity and investments for an Economic Cooperation Organization regional electricity market, practical experiences from Turkey and the Islamic Republic of Iran, and other initiatives in the Economic Cooperation Organization region, including the Caspian Energy Grid and the Central Asia South Asia Electricity Transmission and Trade Project (CASA-1000).

Table 1  
Energy connectivity initiatives

	<i>ASEAN</i>	<i>BCIM</i>	<i>BIMP-EAGA</i>	<i>BIMSTEC</i>	<i>CAREC</i>	<i>ECO</i>	<i>EEC</i>
Afghanistan					X	X	
Armenia							X
Azerbaijan					X	X	
Bangladesh		X		X			
Bhutan				X			
Brunei Darussalam	X		X				
Cambodia	X						
China		X			X		
Georgia							
India		X		X			
Indonesia	X		X				
Iran (Islamic Republic of)						X	
Japan							
Kazakhstan					X	X	X
Kyrgyzstan					X	X	X
Lao People's Democratic Republic	X						
Malaysia	X		X				
Maldives							
Mongolia					X		
Myanmar	X	X		X			
Nepal				X			
Pakistan					X	X	
Philippines	X		X				
Republic of Korea							
Russian Federation							X
Singapore	X						
Sri Lanka				X			
Tajikistan					X	X	
Thailand	X			X			
Turkey						X	
Turkmenistan					X	X	
Uzbekistan					X	X	
Viet Nam	X						

*Abbreviations:* ASEAN, Association of Southeast Asian Nations; BCIM, Bangladesh-China-India-Myanmar Corridor; BIMP-EAGA, Brunei Darussalam-Indonesia-Malaysia-Philippines East ASEAN Growth Area; BIMSTEC, Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation; CAREC, Central Asia Regional Economic Cooperation Programme; ECO, Economic Cooperation Organization; EEC, Eurasian Economic Community.

Table 2  
Energy connectivity initiatives

	<i>Asian Energy Super Ring</i>	<i>GMS</i>	<i>GTI</i>	<i>IGC-TRACECA</i>	<i>IMT-GT</i>	<i>SAARC</i>	<i>SASEC</i>	<i>SCO</i>
Afghanistan						X		
Armenia				X				
Azerbaijan				X				
Bangladesh						X	X	
Bhutan						X	X	
Brunei Darussalam								
Cambodia		X						
China	X	X	X					X
Georgia				X				
India						X	X	
Indonesia					X			
Iran (Islamic Republic of)				X				
Japan	X							
Kazakhstan				X				X
Kyrgyzstan				X				X
Lao People's Democratic Republic		X						
Malaysia					X			
Maldives						X	X	
Mongolia			X					X
Myanmar		X						
Nepal						X	X	
Pakistan						X		
Philippines								
Republic of Korea	X		X					
Russian Federation	X		X					X
Singapore								
Sri Lanka						X	X	
Tajikistan				X				X
Thailand		X			X			
Turkey				X				
Turkmenistan								
Uzbekistan				X				X
Viet Nam		X						

*Abbreviations:* GMS, Greater Mekong Subregion; GTI, Greater Tumen Initiative; IGC-TRACECA, Intergovernmental Commission – Transport Corridor Europe Caucasus Asia; IMT-GT, Indonesia-Malaysia-Thailand Growth Triangle; SAARC, South Asian Association for Regional Cooperation; SASEC, South Asia Subregional Economic Cooperation; SCO, Shanghai Cooperation Organization.

## V. Context and strategies for the promotion of energy connectivity

31. Energy connectivity and trade in the region need to be considered in the context of overall trade conditions. Over the last two decades, there has been a tendency in the Asia-Pacific region to liberalize trade conditions and many countries have entered into free trade arrangements, including the Asia-Pacific Trade Agreement, the ASEAN Free Trade Area, the Commonwealth of Independent States Free Trade Area and the Eurasian Economic Union, in addition to numerous bilateral free trade agreements between Asia-Pacific member States.<sup>11</sup> Nevertheless, there are vast differences between subregions and countries, and the majority of the signed and implemented free trade agreements are bilateral, with large regional agreements, such as the Regional Comprehensive Economic Partnership involving the ASEAN Plus Six economies, and the Trans-Pacific Partnership, so far proving elusive. The differences in trade liberalization are also demonstrated in the share of intra-subregional trade. While approximately 25 per cent of the total trade of ASEAN members was within the subregion, for SAARC countries the figure was only approximately 5 per cent. In East and North East Asia, 35 per cent of the total trade value was within the subregion. There are also striking differences within the subregions: while the Lao People's Democratic Republic and Nepal exchanged more than 55 per cent of their trade value within their respective subregions, for India, Pakistan and Viet Nam the figure was only 5 per cent, 7 per cent and 15 per cent, respectively.

32. On a regional level, intraregional trade in Asia and the Pacific accounted for 54 per cent of the total share (by comparison, this figure for the European Union was 64 per cent).<sup>12</sup> The increase in the share of intraregional trade in Asia and the Pacific has flattened in the past few years, partially as a result of targeted increase of foreign direct investment flows from Japan, China or the Republic of Korea to other countries in the region, most notably ASEAN countries. The subregional differences are also reflected in the intra-subregional energy trading share, which is higher in subregions with higher intra-subregional trade shares (South-East Asia and North-East Asia) than in subregions with low intra-subregional trade shares (South and South-West Asia, North and Central Asia and the Pacific). These developments further highlight the need for greater harmonization and liberalization of regional financial markets, in order to strengthen the domestic investor base and facilitate intraregional investment flows.<sup>13</sup>

33. Connection of energy markets does not happen automatically, in particular not without strong political will or state involvement. It typically requires the cooperation of multiple Governments. In the next few decades, actions will be needed to build physical energy networks and institutional connectivity, and, most importantly, trust between nations. General strategies to increase interconnection and promote power trade on a bilateral level include building upon previously concluded trade agreements to promote the

<sup>11</sup> Asia Regional Integration Centre, Free Trade Agreements database. Available from <https://aric.adb.org/fta> (accessed 5 November 2016).

<sup>12</sup> Nigel Lucas, *Energy Security in Asia: Prospects for Regional Cooperation*, ADB Economics Working Paper Series, No. 407 (Manila, Asian Development Bank, 2014). Available from [www.adb.org/sites/default/files/publication/59617/ewp-407.pdf](http://www.adb.org/sites/default/files/publication/59617/ewp-407.pdf).

<sup>13</sup> Asian Development Bank, *Asian Economic Integration Report 2015: How Can Special Economic Zones Catalyze Economic Development?* (Manila, 2015).

establishment of trust that is essential for power trading and further developing deeply integrated trade relationships, with a range of competitive markets and regional regulatory bodies. Establishing power trade and interconnection on a subregional and eventually regional level is much more complex and may require the following strategies to accelerate implementation:

(a) Dealing with barriers to energy trade through the removal of legal, regulatory and technical hurdles and seeking up-front political authorization. Despite many benefits of energy resource trade and exchange, a number of countries have explicit and implicit restrictions on exports and imports of energy goods and services, the removal of which is critical;

(b) Promoting sufficient levels of harmonization of technical standards, grid codes and regulations to provide a basis for deepening interconnectivity and the eventual development of an integrated power grid;

(c) Promoting competitive energy market structures through the rationalization of States' roles, together with measures to improve the investment climate to attract new investments, and the adoption of new generation technologies, energy-efficient end uses and smart grid technologies;

(d) Building on the existing political support to promote regional energy connectivity. There is a need to formalize and consolidate declarations and intentions from the subregional level to the regional level in the shape of an Asia-Pacific energy charter. This could be modelled on the International Energy Charter, in which it was recognized that all countries stood to benefit from a balanced framework for cooperation in the energy sector. Countries with natural resources receive the means to attract investment, protect their interests downstream and ensure reliable transportation for their energy exports to consumers, while energy-importing countries receive protection for their outward energy investments and mechanisms to promote security of supply. An Asia-Pacific energy charter would help to nurture the long-term commitment of member Governments and provide increased comfort and confidence to the private sector and institutional investors;

(e) Developing a regional mechanism to facilitate transboundary power trade through the streamlining of contracts, increasing the availability of financing, reducing risk and accelerating project development through the building of mutual trust among parties and norm setting. A broad regional agreement and strong institutional arrangements are critical in order to ensure that importing and exporting member States benefit from power trade. Neutral institutions to regulate project implementation will be essential;

(f) Conducting feasibility studies and mapping exercises to determine the viability of transboundary power trade and interconnection and to identify potential routes for interconnection in order to progress towards the creation of a regional agreement. This can improve the ability of member State policymakers to contribute to regional strategies on establishing integrated power markets in the region and to develop national strategies on establishing integrated power markets;

(g) Achieving a broader range of consensus on regional energy interconnection to promote sustainable transboundary power trade and interconnection through the facilitation of bilateral and multilateral consultation and studies undertaken by ESCAP to address common concerns and challenges;

(h) Developing a master plan for energy connectivity in Asia and the Pacific with a focus on power grid connectivity to address the missing links of ongoing subregional initiatives and projects.



34. These actions are required to meet the region's two most important challenges: overcoming energy poverty and mitigating climate change. Governments, policymakers and experts must work together in partnership with the private sector towards the sustainable energy goal by connecting Asia-Pacific energy networks and building institutions of integration. The secretariat is in a unique position to lead such a transformative partnership to ensure that regional energy connectivity creates incentive structures and institutions to deliver cost-effective energy for the entire region. Building energy connectivity can deliver on the vision of an interdependent Asia-Pacific region that is prosperous and connected, thus ending regional economies' dependency on a single source or a single fuel.

35. Energy, and in particular electricity, is an inherently strategic commodity, as its trade entails additional obstacles compared to other commodities, owing to energy security concerns. Efforts to engage in deep integrated trading in energy or electricity thus entail not only technical, financial and regulatory issues but also strong political concerns based on the energy security dilemma. Establishment of an integrated regional power market should therefore be pursued gradually and requires broader commitment to trade and economic cooperation in order to create the necessary enabling environment. The establishment of bilateral or trilateral trade, by building transmission interconnectors and negotiating long-term power purchase agreements, has proven to be a successful basis for existing integrated power pools.

36. In order to effectively advance energy connectivity within Asia and the Pacific, there is a need for a common understanding by member States of the benefits. This could lead to a shared vision for energy connectivity that could encompass a connected and fully energized Asia-Pacific region. The region has many promising proposed subregional energy connectivity initiatives that offer significant regional benefits if political and institutional barriers can be overcome. Notable among these are the Asian energy super ring, which can meet the growing energy deficit and reduce reliance on imports in North-East Asia by connecting hydropower and gas resources from the far east region of the Russian Federation as well as solar and wind power from the Gobi desert in China to demand centres. Given the growth in demand of its members and the diversity of energy resources available across the ASEAN subregion, the deepening of its energy market integration through the ASEAN Power Grid can play a strong role in enhancing the overall integration and competitiveness of the ASEAN bloc. The South and South-West Asia subregion, with its large population without access to electricity and its strong energy demand growth, perhaps has most to gain among all subregions from greater energy connectivity, through gas and electricity from North and Central Asia as well as hydropower resources in the Himalayan belt.

## **VI. Issues for consideration by the Committee**

37. Regional energy connectivity has an important role to play in meeting the objectives of Sustainable Development Goal 7 and the Paris Agreement, which call for access to be improved, energy efficiency and renewable energy to be scaled up, and greenhouse gas emissions to be limited. The establishment of the Committee on Energy offers an opportunity to institutionalize an intergovernmental platform that can consider measures to foster an enabling environment to promote regional energy connectivity.

38. While energy connectivity includes trade and exchange of energy in multiple forms, the power sector presents the greatest opportunities for harnessing its benefits. Many of the challenges outlined in section V can be addressed through regional cooperation. The recommendations that follow are based on, and designed to address, the challenges identified through research and workshops and expert group meetings organized by the secretariat to delineate the principal barriers to energy connectivity from a national, subregional and regional perspective.

39. The Committee may wish to:

(a) Take note of the analysis and issues for consideration contained in the present document and provide guidance and advice to the secretariat to move forward with the priorities for regional cooperation to promote energy connectivity;

(b) Establish consensus among member States on the need for increased regional energy connectivity by guiding the secretariat in promoting energy connectivity as a vehicle to ensure universal access to affordable, reliable and modern energy services and increase substantially the share of renewable energy in the global energy mix by 2030;

(c) Guide the secretariat in continuing to expand partnerships and collaboration with various international and regional organizations and member States in order to establish a shared vision for energy connectivity within the region;

(d) Direct the secretariat in undertaking analysis to support regional connectivity, including through a policy study on energy connectivity and implementation of the Sustainable Development Goals through regional cooperation, feasibility studies and mapping exercises to determine the viability of transboundary power trade and interconnection;

(e) Guide the secretariat in developing a master plan for energy connectivity in Asia and the Pacific with a focus on power grid connectivity to address the missing links of ongoing subregional initiatives and projects supported by the secretariat;

(f) Guide the secretariat in developing a regional mechanism to facilitate increased transboundary power trade through the normalization of national policy and legal frameworks;

(g) Guide the secretariat in developing an expert advisory group on energy connectivity that would direct the work of the secretariat and which would report to the Committee.

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