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Item 3 (d) of the provisional agenda^{*}**Review of issues pertinent to the subsidiary structure
of the Commission, including the work of the regional
institutions: environment and development****Promoting regional energy connectivity in Asia and the
Pacific: challenges and opportunities for aligning the
energy sector with sustainable development****Note by the secretariat***Summary*

At the sixty-eighth session of the Commission, in 2012, the Bangkok Declaration on Regional Economic Cooperation and Integration in Asia and the Pacific was endorsed, which promoted a comprehensive view of regional economic cooperation and integration. Energy connectivity, with a specific focus on transboundary interconnection and power trade, can play an important role in overall regional economic cooperation and integration. It can realise mutual benefits for member States and play a role in increasing the sustainability of the energy sector. Global leaders at the United Nations in September 2015 adopted the 2030 Agenda for Sustainable Development including the Sustainable Development Goals (SDGs). Goal 7 of the SDGs focuses on ensuring sustainable and modern energy for all by 2030.

With energy demand in Asia and the Pacific forecast to nearly double from 2010 to 2035, access to reliable and adequate energy services will remain a focus for the decades to come. The region is expected to account for over 40 per cent of the US\$68 trillion of cumulative energy investments until 2040. This document explores the potential of regional energy connectivity to meet broader energy goals within the framework of sustainable development.

The document addresses the challenges in meeting growing energy demand while ensuring that energy developments are consistent with the Sustainable Development Agenda. The document highlights opportunities and actions as well as a mechanism that can address the multiple challenges in the energy sector. The document focuses on the role that regional cooperation and energy connectivity will play in meeting this challenge.

Issues for consideration contained in this document have been submitted to the 2016 Policy Dialogue on Energy for Sustainable Development held in Bangkok from 25 to 27 April 2016. It was recommended by the participants of the Policy Dialogue to submit this document for the information of the Commission. The Commission may wish to take note of the analysis and recommendations contained in this document and provide guidance on the work of the secretariat in this area.

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I. Introduction

1. Deepening economic integration and cooperation in the Asia-Pacific region could be mutually beneficial to participating countries and instrumental in the achievement of the Sustainable Development Goals (SDGs). As energy demand rises, regional energy connectivity will take on an increasingly important role as a key dimension of regional economic cooperation and integration (RECI), which will enable countries to meet increasing demand, enhance energy access and improve the sustainability of the energy sector. Energy connectivity is strongly linked to Resolution 70/1 - Implementation of the Bangkok Declaration on Regional Economic Cooperation and Integration in Asia and the Pacific. This Resolution focuses on the four pillars of regional economic cooperation: (a) an integrated market; (b) seamless connectivity; (c) financial cooperation; and (d) addressing shared vulnerabilities and risks.

2. The agenda for RECI aims to deepen and broaden economic cooperation and integration in Asia and the Pacific and move towards the formation an economic community of Asia and the Pacific as a long-term goal. Energy connectivity, covering power grids as well as gas and oil pipelines is an important aspect of seamless regional connectivity in the region, and through the SDGs, the goals for the energy sector include reducing the number of people without access to energy services and moving to a low carbon energy system. Through the exchange of energy, mainly electricity and natural gas, the sustainability of power generation within the region could greatly increase by assisting a move away from traditional coal-fired generation, which accounted for 56 per cent of Asia-Pacific's electricity generation in 2013. Energy connectivity is also a means of meeting the growing energy demand and enhancing energy security within the region.

3. 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 on affordability, efficiency, and environmental soundness while the policies that promote these outcomes must maintain a focus on sustainable and equitable development. While long term goals focus on the integration of higher shares of renewables within the power sector, power generation from natural gas may act as a bridge to a low carbon future in the medium term.

4. While Asia-Pacific energy demand is forecast to nearly double from 2010 to 2035, (ADB, 2013), electricity demand is predicted to more than double, illustrating the increasing importance of electricity in an era where the sustainability of energy is a prime concern. 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 continues to fall and financing for renewables is expanding, the need for increased transboundary energy trade becomes 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.

5. Obstacles to promoting regional integration include, among others: political; technical; regulatory; and financial barriers. No single barrier is insurmountable; however the combination often proves difficult to overcome, as evidenced by the lack of regionally integrated power markets within Asia and the Pacific. While technical, regulatory, and financial barriers can be overcome through effective policy, they require political will, which can be challenging due to multiple factors. Energy security concerns have led some countries to discourage the expansion of transboundary power trade, i.e. through the introduction of local content requirements. Fundamentally, a shift in thinking is needed from a paradigm based on the idea that energy security requires self-sufficiency of domestic energy supply towards one based on the principle that energy security requires diversity and redundancy of domestic energy supply through both domestic supply maximization and trade with regional suppliers. Stable policy environments with long-term predictability and favorable investment conditions to minimize risk are needed to attract international investment.

6. This document focuses on exploring regional energy connectivity to meet broader energy goals within the framework of sustainable development. The document covers challenges in meeting the growing energy demand while still addressing the sustainable development agenda that encompasses the efficiency of energy used, the expansion of renewable energy, and universal energy access. There is a large volume of knowledge available that provides different narratives of how this was done in countries that are developed today. The document highlights opportunities and actions that are needed to meet the goal of universal access. In today's connected world, no country alone can address its energy challenges alone, hence it focuses on the role that stakeholders beyond borders will play in meeting this challenge.

II. Context for energy in the Asia-Pacific region

7. The region's energy imports have grown rapidly from 525 mega tonnes of oil equivalent (Mtoe) in 1980 to 2.3 billion Mtoe in 2013. Compared to 1980, the region's energy import share of the global total has nearly doubled from 23 per cent to nearly 44 per cent in 2013. Compared to imports, overall exports have remained more or less stagnant at around one third of global energy exports since 1990.

8. 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 of the region has translated into rising energy demands. As incomes rise, populations move up the energy ladder with significant impacts on the environment, such as pollution and climate change. Although the region has made impressive progress in eliminating poverty for millions, there still is a very large pool of energy poor in the region. The overall demand for energy

is expected to grow significantly due to three reasons: economic growth, the increase of the middle class, and the provision of universal access to energy.

9. There are several projections of future energy consumption and though actual numbers may vary, the directions of these are very similar. The latest projections by the International Energy Agency (IEA) under its new policies scenario predicts global energy demand to grow by 37 per cent by 2040, with the majority of this demand growth from the Asia-Pacific region. These projections foresee dramatic shifts in regional energy demand, with energy demand expected to remain flat in much of Europe, Japan, Republic of Korea and North America, and to rise in the rest of Asia (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 will be as large as that of the United States of America and is expected to contribute more than any other country, around one quarter of the total projected rise in global energy demand.

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

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

12. The region is expected to remain dependent on oil in the medium term, as the mobility and transport of goods and people is critical for economic development. Currently, transport is currently heavily dependent upon oil and is the fastest growing source of global carbon emissions. With growing middle class in the region and rapid urbanization, overall oil demand for personal mobility and transportation of goods is expected to rise significantly. For example, according to the International Energy Agency's forecasts, China's passenger transport fleet is expected to grow at a remarkable rate with penetration of passenger light duty vehicles from around 70 vehicles per 1,000 population to 360 vehicles by 2040, thus increasing oil use in transportation from 4.7 million barrels per day (mbd) to 9.2 mbd.

III. Aligning energy sector development to the Sustainable Development Agenda

13. Energy connectivity is an essential component of regional connectivity, and it provides an avenue to address many of the pervasive energy challenges within Asia and the Pacific including reducing energy sector emissions. The power generation sector continues to evolve,

specifically with regard to effectively integrating increased shares of variable renewable energy (VRE) within the electricity mix; however without large and diverse balancing areas, integrating higher shares of VRE becomes increasingly challenging from an economic and technical perspective. With higher shares of VRE a key part of the future energy scenario, the transboundary connectivity plays an increasingly important role in enabling continued expansion in the use of renewable energy.

14. The Asia-Pacific region is amongst the most diverse regions of the world in terms of geography, size of the economy, population and community, economic conditions, poverty and social situations, energy use and resources, environmental impacts, and the overall quality of human wellbeing. While the region has the world's seven most populous nations, it also has some of the smallest nations with populations of thousands. There are also different forms of governments and political systems. The region has some of the biggest energy producers and consumers. Although four of the largest economies of the world are located in the region, 15 per cent of the region's total population still lives in extreme poverty.

15. The global leadership at the United Nations in September 2015 adopted the 2030 Agenda for Sustainable Development. Goal 7 on affordable and clean energy aims to ensure access to affordable, reliable, sustainable and modern energy for all by 2030. The task at hand is extremely challenging: despite enormous economic success, the Asia-Pacific region is home to the majority of the world's energy poor, without access to electricity or who use traditional fuels for cooking and heating, which raise significant environmental concerns, health problems, and gender inequality issues. Some of the linkages between access to modern energy and economic growth and poverty reduction are direct as energy is a key input into industrial development, quality of life, transportation, and communication networks. Others are indirect: for example effective health care service delivery requires access to modern energy sources.

16. Three future trends are likely to dominate the Sustainable Development Agenda for the region. First, the next few decades will see a tremendous rise in the urban population globally, but particularly in the region; and new cities and new buildings will have to be built to cope with rapid urbanization. Second, the world will witness a major rise in global middle class: from 1.8 billion in 2009 to 4.9 billion by 2030. Asia will represent 66 per cent of the global middle class population and 59 per cent of global middle-class consumption, compared to 28 per cent and 23 per cent today. The emergence of a large middle class will have a significant impact on energy demand and on the goods and services that have embedded energy. Finally, many countries will create new infrastructure including energy networks to serve the large and growing demand for energy services in the next few decades. This document explores the role of regional energy connectivity to meet broader energy goals within the framework of sustainable development.

17. Favourable market conditions are being created in terms of economies of scale and scope, especially for large scale distributed and renewable energy systems to be integrated with the traditional power networks. The fact that large economies have been able to reduce costs of many of the renewable energy options, coupled with Asia's good production and supply chains, has created a more competitive market position for solar and wind energy. Advances in high voltage direct current (HVDC) transmission technology have reduced costs and led to greater efficiencies in transporting power over increasingly longer distances. Similarly, the development of natural gas

networks helps to expand access to gas for power generation and other end uses, thereby displacing more carbon intensive fuels such as coal. It is possible for private investments to flow if the regulatory barriers for energy trade are addressed. What is needed is to replicate the success of global supply chains for energy sector and allow the market to jump-start the process of connectivity and integration as so many important drivers of energy connectivity are already present in the region.

IV. Benefits of transboundary power trade

18. Transboundary power trade is an important aspect of energy connectivity and of sustainable development, as emissions from the combustion of fossil fuels for power generation are the leading source of global CO₂ emissions. From a near-term perspective however, the benefits of transboundary power trade lay within the scope of increased energy security, including reliability, adequacy, and flexibility, as well as the economic gains associated with reduced need for generation reserve margins, and increased generation economies of scale achievable with access to larger markets. The following are examples of benefits attainable through increased interconnection.

a. *Economies of scale and scope.* The European Union and large countries such as the US, China, and India have integrated their power networks and this leads to augmenting national supplies and realizing significant energy system cost savings due to economies of scale and scope. Major savings occur due to capacity cost savings from avoided generation capacity through complementary demand profiling across countries, lower reserves margin, improved load factor of generators, increasing load mix, and coordinating maintenance schedules. Overall resource pooling affords complementarities and comparative advantages, for fuel sources used for power generation, thus lowering overall costs.

b. *Sustainable energy for all.* Regional energy connectivity can also contribute to the SDGs under Goal 7, Sustainable Energy for All. New renewable energy power generation capacity has begun to outpace the fossil fuel capacity additions, while the costs of renewable energy options continue to decline. Increasing connectivity can reinforce this transition by enhancing the viability of renewable energy projects by connecting to markets, even in other countries. Especially for countries that have low energy access rates, regional energy connectivity can increase energy supply and present multiple 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 sustainable development goals.

c. *Expansion of renewable energy use.* There is frequently a greater array of choices for renewable energy options beyond domestic borders. For example, interconnection of the entire Island of Ireland has resulted in wind energy now accounting for up to 25 per cent of annual energy generation in Northern Ireland and 40 per cent in the Republic of Ireland. Similarly, a large number of countries in the region have hydropower potential but lack the financial resources and domestic demand to justify such investments. Data on power sector dependency on fossil fuels show that it is possible to expand possibilities for improving fuel mix. The *Herschman-Herfindahl Index*, used to assess fuel source dependency, indicated that for 60 per cent of countries for which such data exist, the dependency is high on a few fuels, with values of more than 50 per cent. The world average is 25 per cent compared to the regional average of 56 per cent. Energy integration will thus afford possibilities for many countries to diversify sources of power generation

including more sustainable solutions and allow the region's vast solar and wind resources to be tapped.

d. *Address social and environmental concerns.* The region has yet to create a large part of the future energy infrastructure that it will need. Hence it is possible to address social and environmental concerns and include these in the overall planning process. Most of energy infrastructure is path dependent and difficult to change because of technology lock-in effects. Developing countries can then leapfrog to clean technologies using regional integration.

e. *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 very constrained and hence large potential exists for enhancing regional trade and investments. The region has large savings and hence financial resources are not seen as major constraints. The greatest challenge is streamlining processes and removing barriers to energy trade and this would be a major source of economic growth.

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

g. *Dynamic competitiveness.* As the experience 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.

h. *Learning and knowledge sharing.* The Asian global production network has shown that it is possible for economies to learn and through shared knowledge, create prosperity in the entire region. Asia 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.

i. *Energy security.* Finally, 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, thereby lessening their potential impacts on any single country.

19. In order to effectively progress energy connectivity within Asia and the Pacific there is a need for a common understanding of the benefits by member States. This could lead to a shared vision for energy connectivity that could encompass a connected and fully energized Asia-Pacific region through realising the following benefits by 2050:

a. Energy interdependence fosters harmonious relations between members and thereby yields peace dividend that improves quality of life and

overall well-being, supports wealth creation, and protects environment for the future generations;

b. Expanded supply and robust networks enable universal energy access and delivery of crucial social services including education, health, communication, and leisure;

c. Reliable energy supply supports the member economies in creating employment opportunities and robust economic growth;

d. Large regional renewable energy resources – hydropower, wind, solar, geothermal and tidal power – are unlocked;

e. Technologies that minimize ecological footprints are mainstreamed – e.g., efficient fossil fuel production and conversion;

f. Innovations in transportation and other energy applications help de-carbonize economies;

g. Additional resources are sourced from the private sector for implementing cross-border infrastructure under PPPs help create robust and competitive energy markets;

h. Improved regional energy governance strengthens transparency, and streamlines approvals of regional projects including transnational natural gas pipelines, power grids, and secured energy transportation routes;

i. Harmonized energy policies, regulations, and standards lower overall risks;

j. A conducive environment is created where innovations and local adaptations allow countries to leapfrog to cleaner and more sustainable energy sources; and

k. Thought leadership and knowledge pooling underpin sustainable development of the energy sector and thus the entire region.

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

V. Challenges in the promotion of transboundary power trade

21. Asia's dynamism stems from an intricate web of regional supply chains and global production networks. For the last four decades, The Asia-Pacific has transformed itself into the global manufacturing hub and this has been possible due to success in connecting to global production networks and supply chains 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 investments. These Asian production networks essentially became self-reinforcing, bolstering investments and fostering transfer of technology. Asia's diversity emerged as the main strength and the resulting production integration provided it with a vital new comparative advantage in the global economy. Where markets led, governments usually followed and in reality, these production networks have become a major force to integrate Asian markets in many different ways. Intra-regional trade in the region is still low,

it accounts for 55.6 per cent compared to European Union where it is estimated at 64 per cent.

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

a. Energy networks, unlike commodities have special attributes make it difficult to trade easily. 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 large sunk costs, energy networks present major challenges in financing and maintenance, especially when these 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 these are within single national boundary, when these are under different national legal and governance systems, it creates political risks and aversion.

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 these can translate to 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 in a relatively short period of time. However, the payback period for energy connectivity is long and uncertain.

g. Lack of physical capacity and credit worthiness of state enterprises also inhibit 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. There are large positive and negative externalities inherent in energy connectivity so rules and regulations need to be in place for not only ensuring a fair distribution of costs and benefits amongst stakeholders, but also for those who gain to suitably compensate the losers in the global economic space.¹ Invariably, there are problems of measurements and designing policy regimes that can fully address these externalities, determining compensations for those affected negatively, and identifying benefits from large investments in energy networks. Moreover, the energy integration process is not limited to just the creation of physical links across the region. It requires a series of policies, regulations and governance for facilitating different types of flows inherent in this 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 programs supporting the energy integration process in the region show a lack of consensus in defining a comprehensive model of integration and satisfying 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.

k. Human resource capacity is one of the key factors influencing what regional institutions can achieve. The European Commission — the heart of the European Union (EU) administration — employs over 23,000 people in total; the two Directorates for Environment and Climate have staffs of 454 and 137, respectively; the European Environment Agency, which deals mainly with monitoring and information brokerage, employs around 200, and a number of environmental research centers are part of the EU administration, adding further expertise and capacity. Whilst a comparison of EU and Association of Southeast Asian Nations (ASEAN) secretariat capacity is perhaps unfair given that they have different mandates, it is notable in that ASEAN's secretariat employs just over 300 and the department dealing with environmental issues has less than 10 staff. As a further comparison, the secretariat of the Council for Environmental Cooperation (the organization set up as part of the NAFTA agreement to facilitate coordination of environmental protection in the three countries) employs less than 50 people.

23. Energy security issues are of prime importance to political leadership and it was believed that national energy security would be compromised with regional energy trade that creates import dependency on neighboring countries. The political and policy mind set was thus opposed to regional energy connectivity until very recently. With the changing global socio-economic conditions, there is enough momentum for political leaders in the regions to move forward in promoting energy connectivity by addressing these challenges.

VI. Existing initiatives and plans

24. As late as 1800, Asia was one of the most open regions of the world and occupied an important position in the global economy through not only population and production, but also in productivity, trade, competitiveness, and capital formation (Sakakibara and Yamakawa 2003) and connectivity was a major contributing factor in Asia's prosperity. Today, as the global centre of gravity again shifts to Asia, it is appropriate to rebuild regional connectivity and pursue actions for eliminating poverty, inequality, and environmental risks.

25. In reviewing existing regional energy connectivity initiatives in the Asia-Pacific, 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 developing phases. There are also prominent axes around which this connectivity is developing: the ASEAN economic community is an emerging and integrating energy demand block; gradual progress is being made in both the South Asian (SAARC) and the Central Asian – South Asian (CASAREM) energy markets, with particularly large demand growth projected for India; and finally, North-East Asia as a highly import dependent subregion, with China a dominant growing subregional and regional demand hub, but also with somewhat limited subregional energy cooperation at this stage.

26. Linkages are also already developing and further opportunities are being identified between these interconnecting hubs. ASEAN (through the Greater Mekong Subregion - GMS - electricity market program) is developing infrastructure ties with Southern China, and China is conversely developing gas and oil trading links into ASEAN through Myanmar, which has also been considered by Bangladesh and India for gas trading.

27. There are emerging opportunities to consider energy connectivity as a viable option in promoting sustainable development. In North and Central Asia, there is an emerging political consolidation towards re-connecting energy systems, in particular the power grids among countries of Central Asia and the Russian Federation. The rest of the region could benefit from the lessons learned towards with respect to policy coordination and technical standardization through this initiative. The Global Energy Transition proposed by China provides a grand vision towards an integrated energy system at the global scale, which could certainly provide a number of socio-economic and environmental benefits to the region. As a result of the removal of sanctions against the Islamic Republic of Iran, new opportunities emerge in developing new plans and projects for expanding connectivity, particularly through gas pipelines and power grids.

28. Central Asia is also already trading gas with China through Turkmenistan, with the Russia Federation also progressing trade in natural gas and electricity with China and LNG with Japan.

29. Most of the existing subregional programmes in the region are at early stages of connectivity. Besides the limited cross-border power exchanges, there are a few cross-border energy projects with private sector participation. Asian energy sectors remain largely national with limited connectivity beyond borders. A number of sub-group leaderships have agreed to move towards completely integrated power sector programs; however, overall energy connectivity with efficient power markets remains a distant prospect.

30. Experts distinguish between regional cooperation and regional integration, as the underlying processes for both are quite distinct. Regional cooperation remains contingent on usually voluntary, unanimous, and continuous decisions of members. Entry and exits are relatively costless since there are no rigid organizations. As a result, collective efforts at the regional level are likely to be erratic, conditional and confined to pre-specified issues. Regional integration, on the other hand is a formal process, based on treaty and legal instruments. In this document, these two terms are used interchangeably; however, this distinction needs to be kept in view when considering establishing the institutions of integration.

31. It is evident that regional integration is a long process and has to be built up over three stages of energy network connectivity. So far, the region is in early stages of energy connectivity and this is partly because of the approach adopted is voluntary and informal. A number of cross-border exchanges occur, which are largely electricity interconnections along borders of many countries, other than archipelagoes. The addition of cross-border energy projects leads to the “national plus” stage. The approach of subregional programs is also bottom-up, building a portfolio of power projects in neighboring countries. ASEAN is trying to progress to the next stage that will see sector-based subregional programs like the ASEAN Power Grid and TransASEAN Gas Pipeline. Eventually, energy connectivity has to develop across the entire region.

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

b. Regional cooperation in energy has been evolving mainly through five subregional clusters – South-East Asia, North and Central Asia, South and South-West Asia, North-East Asia, and the Pacific. The small island nations in the Pacific have a very different perspective of energy connectivity; while physical infrastructure is unviable, software for managing energy security risks and approaches to integrate renewables into diesel power systems can be better organized through close cooperation.

VII. Looking Forward: Strategies for promotion of energy connectivity

32. Connection of energy markets does not happen automatically. In the next few decades, actions will be needed to build physical energy networks and institutional connectivity, and most importantly, trust between nations. These actions are required to meet the region’s two most important challenges — overcoming energy poverty and mitigating climate change. Governments, policy makers and experts must work together in partnership with the private sector towards the sustainable energy goal by connecting Asian energy networks and building institutions of integration. The ESCAP secretariat is in 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 and the Pacific, prosperous and connected, thus ending regional economies’ dependency on a single source or a single fuel.

33. Energy and in particular, electricity is an inherently strategic commodity, as its trade faces additional obstacles compared to other commodities due to energy security concerns. Efforts to engage in deep integrated energy or electricity trading thus face 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 it requires broader commitment to trade and economic cooperation in order to create the necessary enabling environment. The establishment of bilateral or trilateral trade (through building transmission interconnectors and negotiating long-term PPAs) has proven to be a successful basis for existing integrated power pools.

VIII. Issues for consideration

34. Regional energy connectivity will help implementation of the SDG7 that calls for improved access and move to cleaner source of energy to meet the region's future energy demand. The establishment of the new ESCAP Energy Committee offers an opportunity to institutionalize an intergovernmental platform, which can consider measures to foster an enabling environment to promote regional energy connectivity. Issues for consideration include the following:

a. Deal with barriers to energy trade through removal of legal, regulatory and technical hurdles and seek for upfront 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 whose removal is critical upfront.

b. Promote sufficient levels of technical and regulatory standardization for deepening interconnectivity through development of an integrated power grid eventually.

c. Promoting competitive energy market structures through rationalization of the state's role along with measures to improve investment climate to attract new investments, improve efficiency, and adopt new technologies.

d. Develop 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 is critical to monitor and ensure the achievement of benefits while creating neutral institutions to regulate project implementation and benefits will also be essential.

e. Build on the existing political support to promote regional energy connectivity, there is a need to formalize and consolidate declarations and intentions from the subregional levels in the shape of Asia-Pacific Energy Charter. This will help to nurture long-term commitment of member governments and provide increased comfort and confidence to the private sector and institutional investors.

35. While energy connectivity includes trade and exchange of energy in multiple forms of energy, the power sector presents the greatest opportunities for harnessing the benefits of connectivity. Many of the challenges can be addressed through regional cooperation. The previous recommendations are based on, and designed to address, the challenges identified in the draft 2016 Regional Trends Report. These have been identified through workshops and expert group meetings organised by the secretariat to delineate the principal barriers to energy connectivity from a national, subregional, and regional perspective.

36. The Commission may wish to take note of the analysis and issues for consideration contained in this document.