

Background document for the consideration of the
2016 Policy Dialogue on Energy for Sustainable Development
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Session 2: Transboundary Power Trade and Interconnection

Promoting regional energy connectivity in Asia and the Pacific: Challenges and opportunities for aligning the energy sector with sustainable development

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, covering energy efficiency, renewable energy, and energy access. There is a large amount of knowledge and lessons learned on how this has been achieved in other regions. 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.

Policy Dialogue participants may wish to consider recommendations contained in this document to facilitate discussions during Session 2, regarding enhanced regional energy connectivity for sustainable development.

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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*¹, 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

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