

**Economic and Social Commission for Asia and the Pacific**

Second Asian and Pacific Energy Forum

Bangkok, 3–5 April 2018

Items 2 and 5 of the provisional agenda**

Review of the draft ministerial declaration on regional cooperation for energy transition towards sustainable and resilient societies in Asia and the Pacific**Policy perspectives on the role of regional cooperation for energy transition towards sustainable and resilient societies in Asia and the Pacific****Review of the implementation of the Plan of Action on Regional Cooperation for Enhanced Energy Security and the Sustainable Use of Energy in Asia and the Pacific, 2014–2018**

Note by the secretariat***

Summary

In 2013, the member States of the Economic and Social Commission for Asia and the Pacific set forth a vision of a more sustainable energy future at the First Asian and Pacific Energy Forum. Fifteen focus areas were identified in the Plan of Action on Regional Cooperation for Enhanced Energy Security and the Sustainable Use of Energy in Asia and the Pacific, 2014–2018. The present document is submitted in response to the request of the Commission in its resolution 70/9 that the secretariat periodically review the progress made in the implementation of the Plan of Action. The present document contains information on the status of implementation, recent efforts and remaining challenges to implementation based on information provided by member States, as well as by collaborating international organizations.

I. Introduction

1. The Asian and Pacific Energy Forum was established in 2013 as a ministerial-level intergovernmental platform for promoting enhanced energy security and the sustainable use of energy in Asia and the Pacific. At the First Forum, the member States of the Economic and Social Commission for Asia and the Pacific (ESCAP) set forth a vision of a more secure, sustainable and

* Reissued for technical reasons on 20 March 2018.

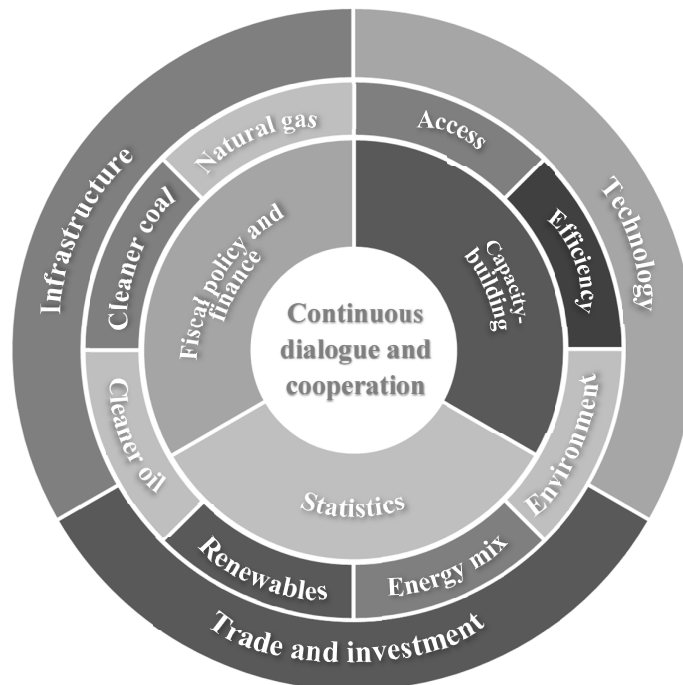
** ESCAP/APEF/2018/L.1.

*** The present document was submitted late owing to the need to incorporate additional inputs.

equitable energy future. The concept of enhanced energy security is recognized as going beyond supply and demand imbalances to fostering a more holistic regional approach that facilitates improved regional energy access and efficiency supported by energy diversification through renewables, cleaner fossil fuel use, technology, trade and investment (figure I). The First Forum issued two outcome documents, including the document entitled “Ministerial Declaration on Regional Cooperation for Enhanced Energy Security and the Sustainable Use of Energy in Asia and the Pacific: Shaping the Future of Sustainable Energy in Asia and the Pacific”, which offers an integrated approach to sustainable energy through actions in 15 focus areas, and the Plan of Action on Regional Cooperation for Enhanced Energy Security and the Sustainable Use of Energy in Asia and the Pacific, 2014–2018. The secretariat was given the mandate to support the implementation of the Declaration and the Plan of Action and to review and assess progress during the implementation period.

2. Since the First Forum and the adoption of the 2030 Agenda for Sustainable Development, sustainable energy has assumed greater significance. Sustainable Development Goal 7 focuses on ensuring access to affordable, reliable, sustainable and modern energy for all. Its scope has become an integral part of the Plan of Action and adds momentum to efforts to achieve global and regional sustainable energy objectives.

Figure I
Priority areas of the Plan of Action on Regional Cooperation for Enhanced Energy Security and the Sustainable Use of Energy in Asia and the Pacific, 2014–2018



II. Review of progress on the 15 areas of action

A. Establish a platform for facilitating continuous dialogue and cooperation among member States on enhanced energy security and the sustainable use of energy

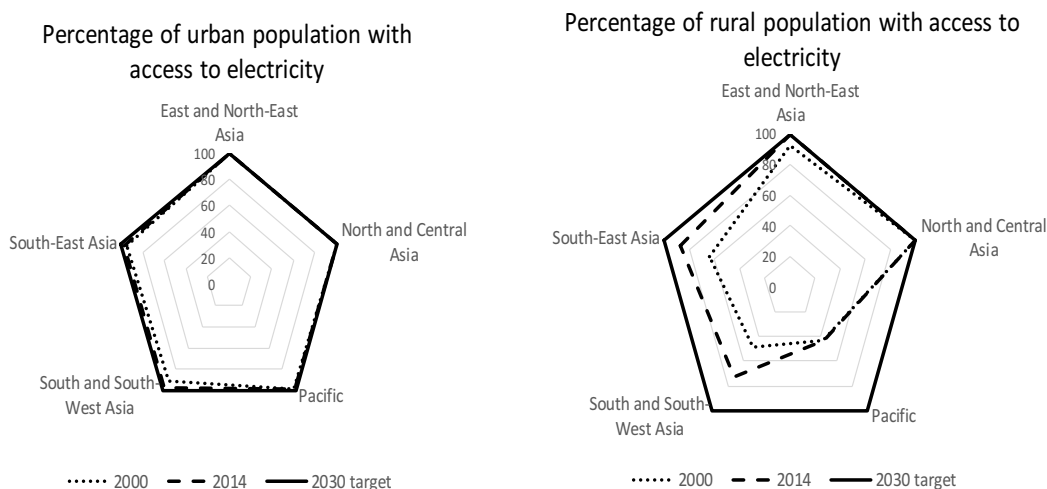
3. Since the First Forum in 2013, ESCAP has incrementally strengthened the regional platform for continuous dialogue and cooperation on energy in the Asia-Pacific region. For example, to support regional and global mandates, ESCAP hosts the annual Policy Dialogue on Energy for Sustainable Development in Asia and the Pacific. These Dialogues enable representatives of Governments as well as of research institutions, the private sector and civil society organizations to identify key and emerging energy challenges within the region. In 2016, an institutional milestone was reached when the Commission established the Committee on Energy; its first session was held in January 2017. In May 2017, the Commission created two expert working groups, one on energy connectivity and the other on universal access to modern energy services, renewable energy, energy efficiency and cleaner use of fossil fuels. The expert working groups support the secretariat in preparing reports for the intergovernmental discussions at the Committee on Energy and at the Forum.

4. To prepare for the second Asian and Pacific Energy Forum, guidance on and progress made in implementing the First Forum outcomes has been taken into account; the findings and recommendations of the theme study issued by the Commission at its seventy-third session and inputs from all stakeholders from across the region, including Governments, international bodies, the private sector and civil society have been considered. The second Forum provides member States with a high-level platform at which they can define the next phase of shared priorities, which can contribute to a more sustainable energy future in the Asia-Pacific region.

B. Work towards universal access to modern energy services

5. Sustainable development is impeded by energy poverty; a significant share of the population, particularly in rural areas, experiences a lack of access to modern energy services. According to the latest data, more than 421 million people, or 9.7 per cent of the Asia-Pacific population, did not have access to electricity in 2014, and 389 million of those are located in rural regions. In several subregions, rural electrification rates lag far behind urban areas, where universal access is nearly achieved (figure II).

Figure II
Access to electricity in rural areas lags behind urban areas



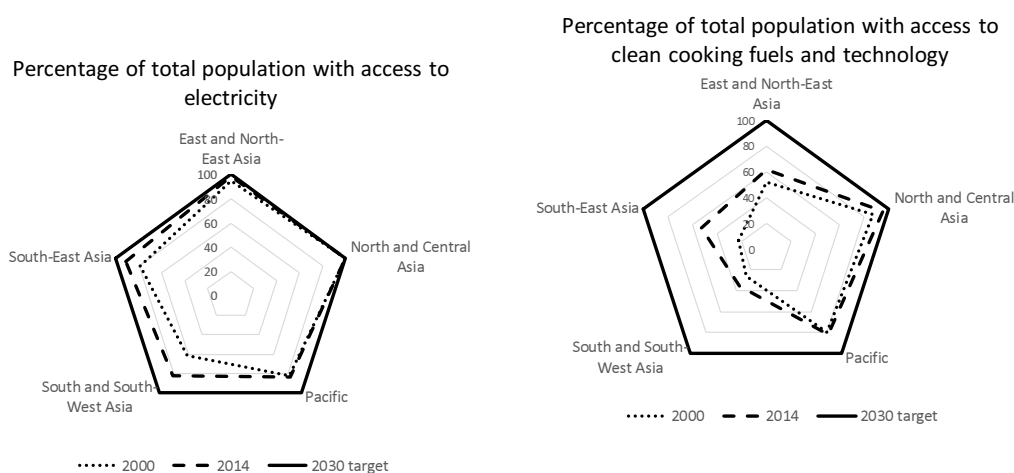
Source: ESCAP calculations based on data from the International Bank for Reconstruction and Development/World Bank, *Sustainable Energy for All 2017: Global Tracking Framework – Progress toward Sustainable Energy* (Washington, D.C., 2017). Available from http://gtf.esmap.org/data/files/download-documents/eegp17-01_gtf_full_report_for_web_0516.pdf.

6. Although the electrification gap remains considerable, with the regional rural electrification rate reaching just 83.8 per cent, recent national efforts prioritizing energy access have shown clear results. Between 2012 and 2014, 93.1 million people in the region gained access to electricity, while the population grew by 83.8 million. Electrification targets and supportive measures have been strengthened across the region. National grids have been extended, while mini-grids and off-grid solutions have brought electricity to areas that have technical or economic challenges for power supply. Several countries with large deficits have put in place ambitious policies and programmes to facilitate rural electrification and can be expected to achieve universal access before 2030, though others have yet to adopt sufficient measures.

7. Countries with lower income levels and large or highly-dispersed rural populations that, in some cases, are growing face the greatest electrification challenges. On the positive side, assisted by the continued drop in renewable energy technology prices, particularly for solar photovoltaics, new and innovative models for modern energy service delivery are emerging with the participation of the private sector. Yet, challenges remain in mobilizing funds and technical capacity for the long-term management and maintenance costs of distributed systems. End-user affordability remains a barrier to the realization of positive socioeconomic development outcomes in some contexts.

8. In examining the current progress, it must be considered that a binary view of energy access, which measures whether an electrical connection is available or not, fails to capture aspects such as quantity, reliability and affordability. Future efforts to quantify these aspects are likely to reveal shortcomings among households considered to have access under current means of measurement.

Figure III
Access to electricity has increased in Asia and the Pacific, but access to clean cooking lags



Source: ESCAP calculations based on data from the International Bank for Reconstruction and Development/World Bank, *Sustainable Energy for All 2017: Global Tracking Framework – Progress toward Sustainable Energy* (Washington, D.C., 2017). Available from http://gtf.esmap.org/data/files/download-documents/eegp17-01_gtf_full_report_for_web_0516.pdf.

9. The second aspect of energy access, clean cooking, is an even larger challenge (figure III). Almost 2.1 billion people – nearly half of the Asia-Pacific population – continue to rely on traditional cooking fuels and technologies, which have harmful health effects,¹ particularly for women and children. In 2014, the regional rate of primary use of clean cooking fuels and technology was just 51.2 per cent, and only a few countries had demonstrated significant efforts or improvements. The emergence of new models of direct subsidies to consumers and the development of distribution chains and of schemes that engage women as household account holders or distributors of modern cooking appliances have helped to improve access.

10. The overall pace of improvement, with a regional average change in share of just 0.8 annual percentage points, falls well short of that required to achieve universal access within the next couple decades. More efforts are needed to expand markets for clean fuels and distributive technologies and to create financial models supporting the delivery of modern energy to less economical areas.

C. Advance the development and use of new and renewable sources of energy

11. Renewable energy has growing acceptance among Governments, resulting in increased political determination and support from regional policymakers. Most member States have adopted renewable energy targets, which have become more ambitious with the falling technology prices that make renewables an increasingly viable option. The Asia-Pacific region has emerged as the global leader in renewable energy with more investment, manufacturing, installed capacity and consumption than any other global region.

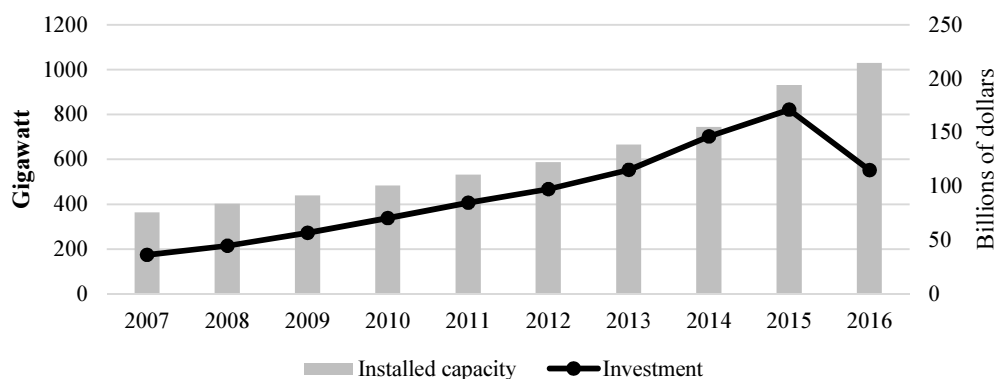
¹ The World Health Organization estimates 92 deaths occur per 100,000 people due to household air pollution in developing countries in Asia.

12. In 2014, modern renewables, which exclude traditional biomass, comprised 6.8 per cent of total final energy consumption, up from 6.2 per cent in 2012. Although the overall share of modern renewables is relatively low, recent years have demonstrated an accelerating upward trend, particularly within the power sector, where renewables accounted for 18.8 per cent of the regional electricity mix in 2014. Renewables, once dominated entirely by hydropower, are experiencing growth accompanied by increased diversification, as wind, solar, biomass, and, to a lesser extent, geothermal power gain shares. With broad resource availability and lower technical and cost barriers, wind and solar power are showing exponential growth and changing the face of the power supply in on-grid and off-grid areas.

13. Policy targets have set the direction for renewable energy development, while public investment and economic measures, such as capital subsidies, grants and tax measures, have boosted project implementation with growing participation from the private sector. Feed-in tariffs and, increasingly, auctions are encouraging investment while lowering the prices of renewables through competition and scaling-up. In some power markets, renewables are beginning to compete with fossil fuels, leading to the cancellation of some coal projects or the early retirement of existing coal-fired generators.²

14. Regional investments in renewable energy (excluding hydropower over 50 MW) rose from \$115.2 billion in 2013 and reached an all-time high of \$171.1 billion in 2015, but fell in 2016 to \$114.8 billion, largely because of the slowdown in new installations in the region’s two largest markets, China and Japan, though there has been an increase in renewable capacity additions in a few other markets. Declining investment levels in renewables are also reflective of the lowering of equipment prices (figure IV).

Figure IV
Installed renewable capacity and investment in Asia and the Pacific 2007–2016



Sources: ESCAP calculations based on International Renewable Energy Agency, Resource database, available from <http://resourceirena.irena.org/gateway/dashboard/> (accessed 9 September 2017); and Frankfurt School of Finance and Management-United Nations Environment Programme Collaborating Centre for Climate and Sustainable Energy Finance and Bloomberg New Energy Finance, *Global Trends in Renewable Energy Investment 2017* (Frankfurt, 2017), available from <http://fs-unep-centre.org/publications/global-trends-renewable-energy-investment-2017>.

² Bloomberg New Energy Finance, “Accelerating India’s clean energy transition: the future of rooftop PV and other distributed energy markets in India” (New York, 2017). Available from https://data.bloomberglp.com/bnef/sites/14/2017/11/BNEF_Accelerating-Indias-Clean-Energy-Transition_Nov-2017.pdf.

15. However, challenges remain. Inadequate electricity transmission and distribution infrastructure limit integration of new renewable energy projects and in some cases, constrain output through curtailment.³ Renewables have yet to make strong inroads in energy applications outside of the power sector. To reduce curtailment of variable renewable energy systems, improved technologies to manage the power system balance are needed, including energy forecasting, demand-side participation and energy storage. Enhanced cross-border interconnection can also play a role in supporting higher shares of variable renewable energy. Increasing the use of renewable energy in non-power sectors such as transport, heat and industry requires specific focus. Utility-scale storage can alleviate power-system balancing challenges, facilitate higher shares of variable renewable energy, and provide frequency control and ancillary services to the grid.⁴

16. Continued advancement in energy generation, transmission, distribution, control and storage is needed. A number of member States have committed funds for clean energy research and development,⁵ but larger investments across the energy sector are required to dramatically increase the share of renewables. The estimated yearly investment needed in Asia and the Pacific to double the share of renewable energy by 2030 is estimated at \$298 billion.⁶ From a policy and regulatory standpoint, many countries are not yet positioned to effectively mobilize investment in renewable energy and require stronger legal and regulatory frameworks to reduce investment risks.

D. Improve energy efficiency and conservation and observe sustainability in the supply, distribution and consumption of energy

17. The Asia-Pacific region has demonstrated a long-term, steady decline in energy intensity, resulting in a decoupling of energy use from gross domestic product (GDP) (figure V). In recent years, the region had the fastest rate of energy intensity reduction globally, in large part due to efficiency improvements within the industrial sector. In the buildings sector, energy codes are gaining traction, with some countries targeting net-zero energy building in the near future. Transport standards are lowering fuel consumption, while support is being given to increase availability of efficient public transport and increase the number of electric vehicles.

18. However, the region continues to rank the highest among global regions in terms of energy intensity. Furthermore, the residential and transport sectors are experiencing mounting energy consumption as income levels rise and people adopt more energy-intensive lifestyles. Meanwhile, the electrification of end uses – such as transport, cooking and heating – is changing the outlook for energy markets.

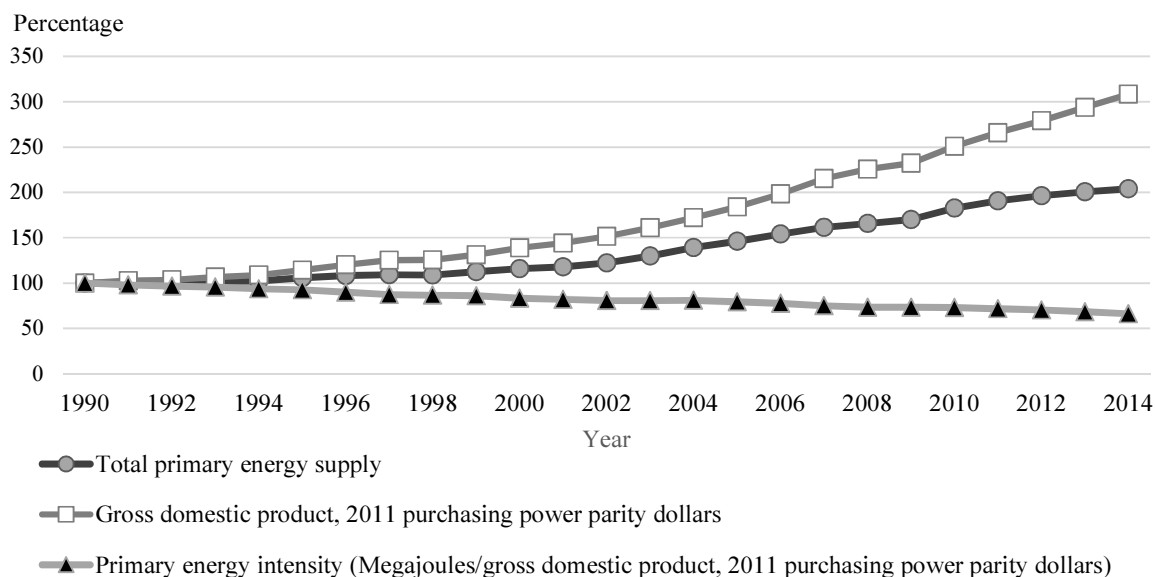
³ Curtailment is the deliberate reduction of the output of solar or wind generators owing to transmission capacity limits or owing to the need to maintain a system balance.

⁴ International Energy Agency, *World Energy Outlook 2017* (Paris, 2017).

⁵ Asia-Pacific countries have pledged \$4.87 billion for clean energy research under the Mission Innovation initiative, targeting areas such as energy efficiency, alternative and renewable energy, grids and storage.

⁶ Sustainable Energy for All, “Scaling up finance for sustainable energy investments: report of the SE4All Advisory Board’s Finance Committee - 2015” (New York, 2015). Available from www.se4all.org/sites/default/files/SE4All-Advisory-Board-Finance-Committee-Report.pdf.

Figure V
Growth in gross domestic product and energy consumption has markedly decoupled

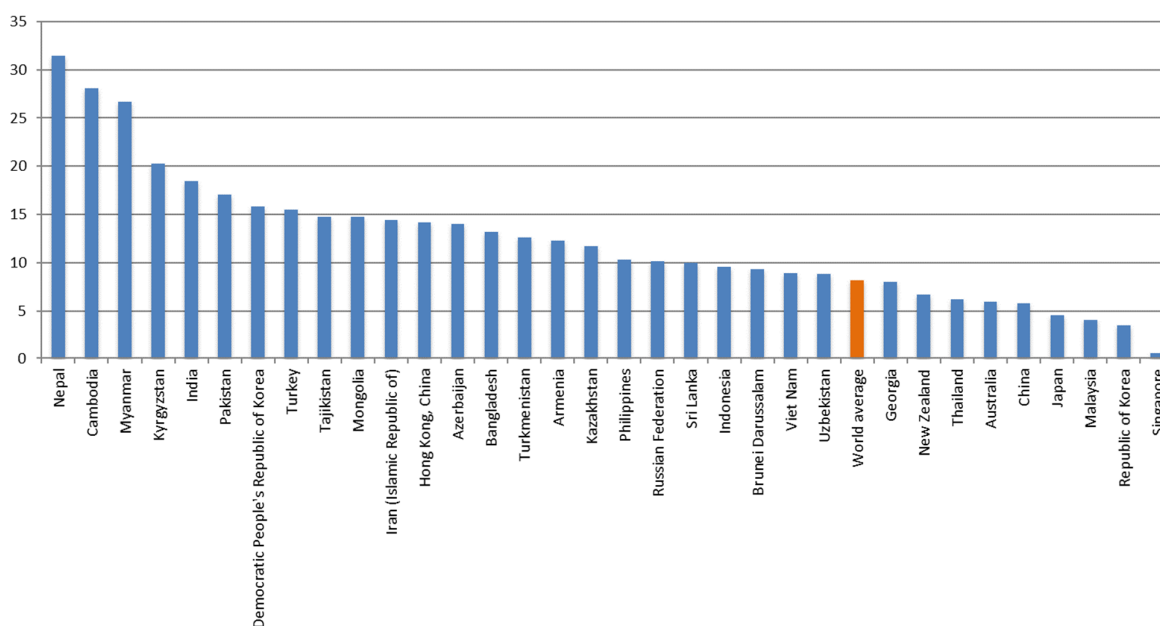


Source: International Bank for Reconstruction and Development/World Bank, *Sustainable Energy for All 2017: Global Tracking Framework – Progress toward Sustainable Energy* (Washington, D.C., 2017). Available from http://gtf.esmap.org/data/files/download-documents/eegp17-01_gtf_full_report_for_web_0516.pdf.

19. Energy efficiency has been increasingly prioritized within national strategies and energy development plans, as evidenced by the fact that most member States have established energy efficiency or conservation targets. Many countries, driven by climate objectives, have introduced new or increasingly ambitious targets for nationally determined contributions under the Paris Agreement.

20. Supply-side energy efficiency is showing improvement through the use of advanced power plant technology, as well as transmission and distribution upgrades. However, losses as a percentage of output remain high in many countries (figure VI).

Figure VI
Electricity losses as a percentage of output, 2014



Source: ESCAP calculations based on data from World Bank, World Development Indicators database. Available from <https://data.worldbank.org/indicator/EG.ELC.LOSS.ZS> (accessed 9 September 2017).

21. On the demand side, economic incentives and financing mechanisms have enabled the development of energy efficiency markets. Energy service companies have entered markets across the region. While exhibiting much progress, the energy service companies market remains immature and fractured, with a lack of standardization among practices and financing structures.⁷

22. Improved standards and regulations are being adopted. An increasing share of final energy consumption is covered by minimum energy performance standards, particularly for lighting, appliances, space heating and cooling, and water heating. Competitive top runner programmes have been an effective means of setting national efficiency benchmarks and reducing energy consumption within industrial, manufacturing and public facilities. To accelerate progress, efficiency standards must be expanded across sectors, though a lack of end-use data in some contexts hinders the identification of the most effective interventions.

23. In energy efficiency, a number of member States have led new technology developments, though continued efforts are needed to lower the cost of high-efficiency products and systems and the financial hurdles for Governments and consumers.

24. Greater investment levels are needed across sectors, together with improved financing mechanisms that target market barriers. Public financing has stimulated private sector investment, though expanding and sustaining energy efficiency markets require appropriate regulatory measures coupled

⁷ Navigant Research, “Executive Summary: ESCO market overview ” (Boulder, Colorado, 2017).

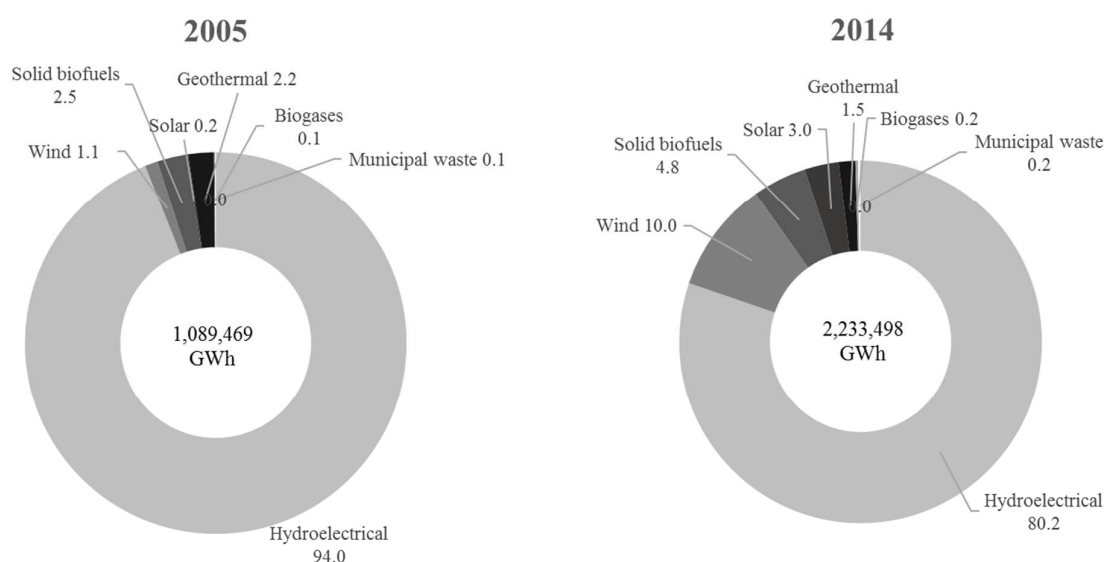
with effective monitoring and verification to support continued investment and market competitiveness.

E. Diversify the energy mix and enhance energy security

25. Primary energy demand is expected to rise in the Asia-Pacific region from 5.69 billion tonnes oil equivalent in 2016 to 8.06 billion tonnes oil equivalent in 2040.⁸ Meanwhile, policymakers need to consider how to transition from conventional energy supply systems to new structures that are responsive to evolving resource availability and to the shifting supply and consumption dynamics of energy markets. Growing demand, the rapidly falling costs of technologies, environmental considerations and the shifting geopolitical landscape create new challenges and opportunities for diversifying the energy mix and enhancing energy security.

26. Rising energy demand and import dependence has resulted in lowered energy self-sufficiency among many member States. Subsequently, increased focus has been placed on expanding and diversifying indigenous energy production. Progress, supported by the increasing cost-competitiveness of renewable technologies, can be seen in the power sector (figure VII).

Figure VII
Renewable electricity output mix in Asia and the Pacific
(Percentage)



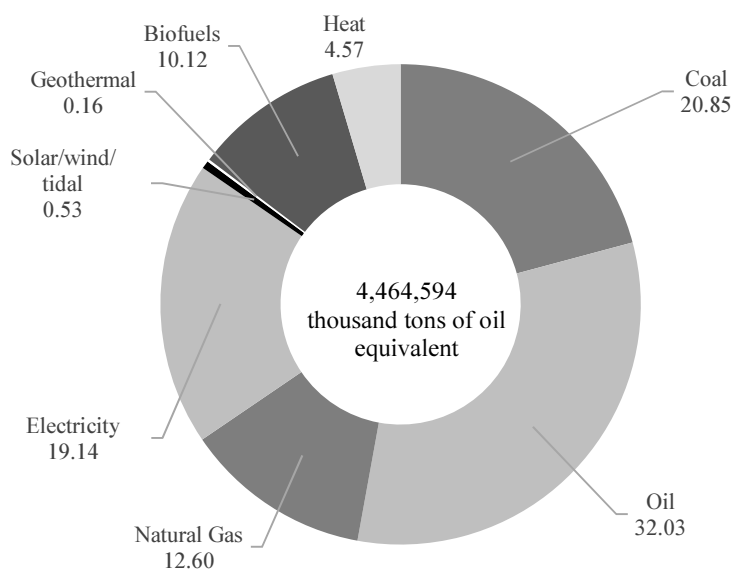
Source: ESCAP calculations based on data from the Organization for Economic Cooperation and Development (OECD) and International Energy Agency, World Energy Statistics and Balances database. Available from <http://wds.iea.org/> (accessed 9 September 2017).

27. Electricity is growing as a share of energy consumption due to the electrification of end uses; however, in 2015, electricity (produced from both conventional and renewable resources) represented just 19.1 per cent of the region’s final consumption. Coal, oil and gas account for more than two thirds

⁸ International Energy Agency, *World Energy Outlook 2017* (Paris, 2017). The group of countries included in the International Energy Agency’s definition of the Asia-Pacific region differs from that of ESCAP.

of regional consumption (figure VIII), supplying sectors such as transportation, agriculture and industry.

Figure VIII
Final consumption by resource in Asia and the Pacific, 2015
 (Percentage)



Source: ESCAP calculations based on data from OECD and International Energy Agency, World Energy Statistics and Balances database. Available from <http://wds.iea.org/> (accessed 9 September 2017).

28. Outside the power sector, diversification has proven challenging. Natural gas is slowly gaining shares, though limited infrastructure prevents rapid market expansion. Low oil prices have tempered the development of the biofuels industry, though some member States are pushing forward with new initiatives and targets for biofuel for transport. Heat, from biomass sources such as agricultural residues, is also being utilized in a few cases.

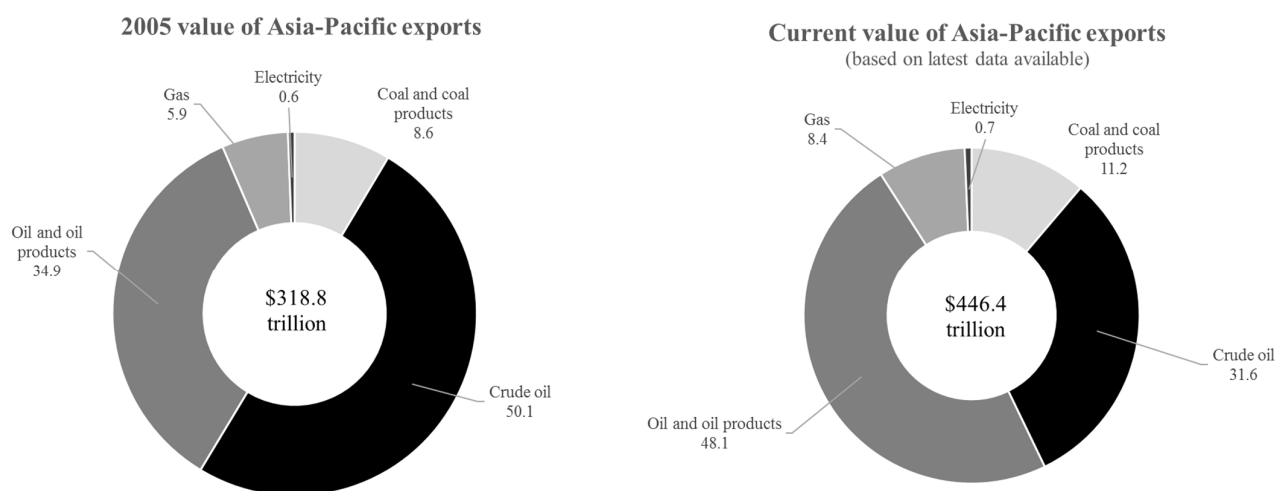
29. Energy security is defined at the national, rather than the regional level. Therefore, the approach to diversifying the energy mix is dependent on a number of factors which evolve over time, such as indigenous resource availability, trade opportunities and technology costs. Consequently, greater efforts are needed to better assess national supply and demand dynamics to build responsive policy systems that can integrate the many relevant factors.

F. Improve energy trade and investment opportunities to optimize the development and utilization of current and emerging energy resources

30. Based on an analysis of the data in the United Nations Comtrade, International Trade Statistics Database, energy exports in Asia and the Pacific grew from approximately \$318.6 trillion in 2005 to \$446.4 trillion in 2016. Exports remain dominated by oil, with a shift toward refined products (figure IX), though natural gas, electricity and renewable energy trade prospects are increasing, and there are plans for new pipelines, terminals and transmission lines. Major energy exporters have turned towards Asia-Pacific energy markets, exporting a larger share to the region; however, demand has outpaced this trend, and major importers have had to increasingly meet demand from outside the region. The energy trade is dominated by bilateral trade

agreements, though across the region, new and existing multilateral initiatives supporting diversified energy trade and integrated energy markets are gaining momentum.

Figure IX
Trade of energy products in Asia and the Pacific has increased and shows a shift toward refined oil products
 (Percentage)



Sources: ESCAP calculations based on data from United Nations Comtrade, International Trade Statistics Database, available from <https://comtrade.un.org>; and OECD and International Energy Agency, World Energy Statistics and Balances database, available from <http://wds.iea.org/> (both accessed 9 September 2017).

Table
Top five exporters in the Asia-Pacific region by volume, 2015

<i>Coal and coal products</i>	<i>Crude-oil</i>	<i>Oil and oil products</i>	<i>Gas</i>	<i>Electricity</i>
Australia	Russian Federation	Russian Federation	Russian Federation	China
Indonesia	Iran (Islamic Republic of)	Singapore	Turkmenistan	Russian Federation
Russian Federation	Kazakhstan	India	Australia	Uzbekistan
Kazakhstan	Azerbaijan	Republic of Korea	Malaysia	Iran (Islamic Republic of)
Democratic People's Republic of Korea	Malaysia	China	Indonesia	India

Note: The current trade value chart represents the latest data available.

31. By supporting the Central Asia Regional Economic Cooperation Programme 2030 strategy in October 2017, policymakers from its members demonstrated unity and commitment to advancing energy and infrastructure development in the region. The Asian Development Bank (ADB) has committed \$5 billion in financing over the next five years, including \$150 million for the first phase of the Turkmenistan-Afghanistan-Pakistan

transmission line project.⁹ Efforts are also being made to implement the long-proposed Turkmenistan-Afghanistan-Pakistan-India gas pipeline, with a \$200 million investment agreement signed by stakeholder countries in 2016. In the Association for Southeast Asian Nations (ASEAN) subregion, the Trans-ASEAN Gas Pipeline is being implemented through bilateral projects that will eventually create a regional system for gas trade. Section N of the present document contains additional information about current multilateral initiatives.

32. There is increasing motivation among regional policymakers to build upon the growing number of bilateral energy trade arrangements in order to take advantage of newly developed energy resources and to expand into regional markets. However, regional energy market developments face a number of challenges.

33. Project development terms can be difficult to negotiate in a manner that all parties consider beneficial. The time needed to resolve technical and institutional issues in energy infrastructure development has proven to be extensive and requires transparency in system operations, fair trade practices and cost-reflective pricing. Laws and regulations containing the necessary provisions to govern and facilitate cross-border trade remain underdeveloped.

34. Regional investment in energy infrastructure falls below needed levels. Spending on infrastructure as a share of GDP is low in many member States, and low-income and Pacific island nations face particular challenges to investing higher shares of GDP into infrastructure development.¹⁰ The power sector alone requires \$14.7 trillion in climate-adjusted investment between 2016 and 2030. However, most infrastructure bonds in the region's markets are below investment grade, limiting investor interest. To increase investor confidence, Governments could offer credit guarantees or provide a better view of risk by improving local credit ratings agencies.¹¹

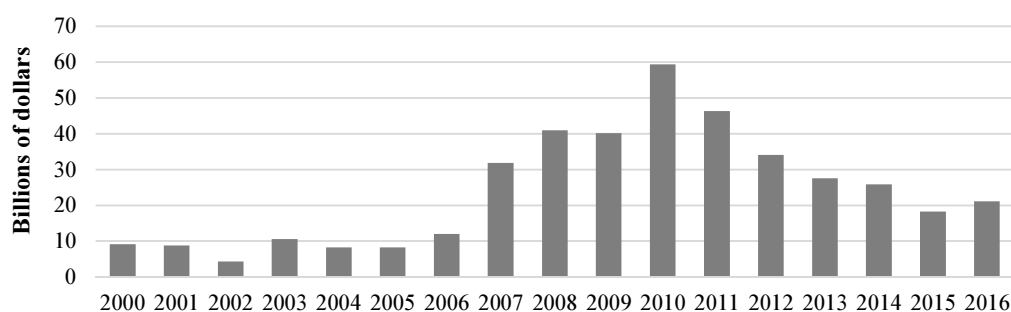
35. Unpredictable regulatory regimes, constraining market ownership structures and low levels of transparency present disincentives to investment. Regulatory and institutional reforms are needed to attract increased private investment, which peaked regionally in 2010, but has since fallen (figure X). Issues such as double taxation, limited cross-border capital flows, misaligned licensing regimes, anti-competition provisions and limited third-party access to infrastructure hinder regional cooperation and investment potential.

⁹ Takehiko Nakao, "A new era of cooperation for Central Asia", *China Daily*, 27 October 2017. Available from www.chinadaily.com.cn/bizchina/2017-10/27/content_33787205.htm.

¹⁰ ADB, "How can Asia finance the infrastructure it needs?", 27 June 2017. Available from www.adb.org/news/features/how-can-asia-finance-infrastructure-it-needs.

¹¹ ADB, *Meeting Asia's Infrastructure Needs* (Manila, 2017). Available from www.adb.org/sites/default/files/publication/227496/special-report-infrastructure.pdf.

Figure X
Investment in energy projects with private participation in select Asia-Pacific economies, 2000–2016



Source: ESCAP calculations based on data from the World Bank, World Development Indicators database. Available from <https://data.worldbank.org/indicator/IE.PPI.ENERGY.CD?view=chart> (accessed 17 November 2017).

Note: Data is compiled from the following economies: Afghanistan; Armenia; Azerbaijan; Bangladesh; Bhutan; Cambodia; China; Georgia; India; Indonesia; Iran (Islamic Republic of); Kazakhstan; Kyrgyzstan; Lao People’s Democratic Republic; Malaysia; Mongolia; Myanmar; Nepal; Pakistan; Papua New Guinea; Philippines; Russian Federation; Sri Lanka; Tajikistan; Thailand; Tonga; Turkey; Vanuatu; and Viet Nam.

G. Improve fiscal policy and financing mechanisms to incentivize and strengthen markets for sustainable energy

36. To facilitate renewable energy and energy efficiency expansion, member States have adopted economic measures to create lower-risk investment environments and increase the availability of financing. Incentives for clean energy project developers and consumers include capital grants, tax reductions, rebates, risk guarantees and low-interest loans. Fuel and carbon pricing is also being used to increase the market competitiveness of renewable energies. Carbon pricing has been or is scheduled to be introduced at national or subnational levels in Australia, China, Japan, Kazakhstan, New Zealand, the Republic of Korea, Singapore, Thailand and Turkey.¹² These measures have particularly benefited commercial and industrial sectors, though the cost of debt remains high in some member States, and the region’s residential sector shows a shortage of financing options for household-scale projects, which carry relatively high capital expenditures.¹³

37. Market liberalization and the growing maturity and acceptance of renewable energy and energy efficiency technologies have led to the expansion of investment sources. Green bonds have emerged as a new asset class in China and India and in some ASEAN countries. The Asia-Pacific region has surged ahead in issuing these debt securities, which fund a broad range of clean energy and climate change adaptation projects. Foreign direct investment (FDI) flows to the energy sector are on the rise for both conventional and alternative and renewable energy, with interest trending towards advanced industries, though

¹² World Bank and Ecofys, “Carbon pricing watch 2017” (Washington, D.C., World Bank, 2017). Available from <https://openknowledge.worldbank.org/handle/10986/26565>.

¹³ International Energy Agency, *World Energy Outlook 2017* (Paris, 2017).

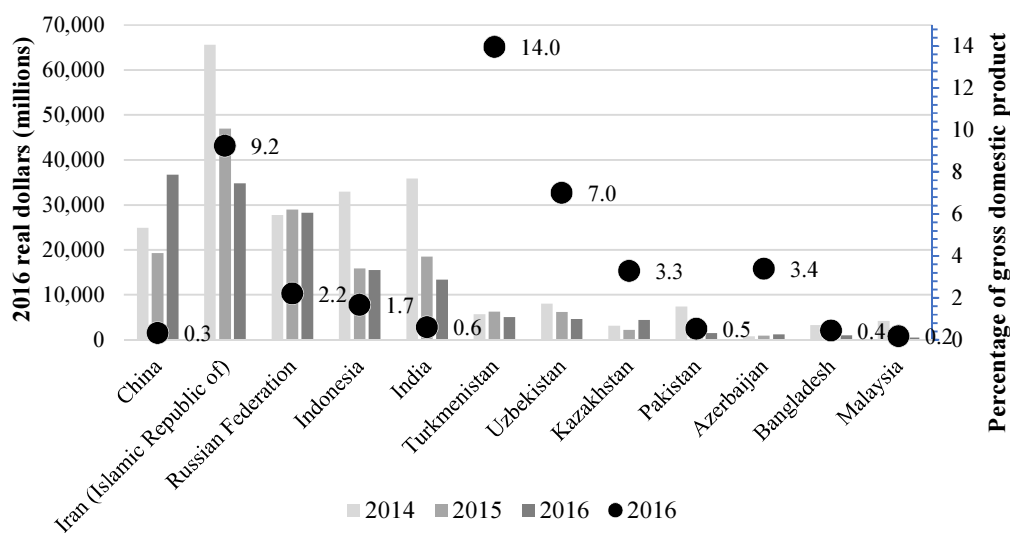
the region could further benefit from the expanded development of carefully formulated FDI policies targeting sustainable energy.¹⁴

38. Trade also has an important role to play in strengthening markets, and economies that have moved to cut tariffs on energy efficiency and renewable energy goods have demonstrated increased exports and imports. However, the region’s least developed countries continue to apply tariffs on these goods at rates above the regional average, impeding market development.¹⁴

39. Fossil fuel subsidies, often used to stabilize consumer prices and producer revenues, discourage investment in clean energy and encourage wasteful consumption. Efforts to rationalize and phase out inefficient subsidies, supported by lower international fuel prices, have led to a reduction in a number of economies. In comparison, for some, total subsidies remain high in absolute terms, are growing or represent a significant share of national GDP (figure XI). Oil and gas producers tend to have higher subsidization levels on a per capita basis while, in 2016, average subsidization levels exceeded 20 per cent in a number of economies (figure XII). While a number of member States have made strong efforts to incentivize clean energy and have committed to phasing out fossil fuel subsidies, more determined moves in this direction are needed. Lowering subsidies, as part of a comprehensive package of policies that includes social safety mechanisms, could allow funds to be reallocated to other development priority areas such as education, health and infrastructure.

40. However, no one-size-fits-all policy path exists, and member States are challenged to determine which mechanisms can best support development objectives while avoiding market distortions.

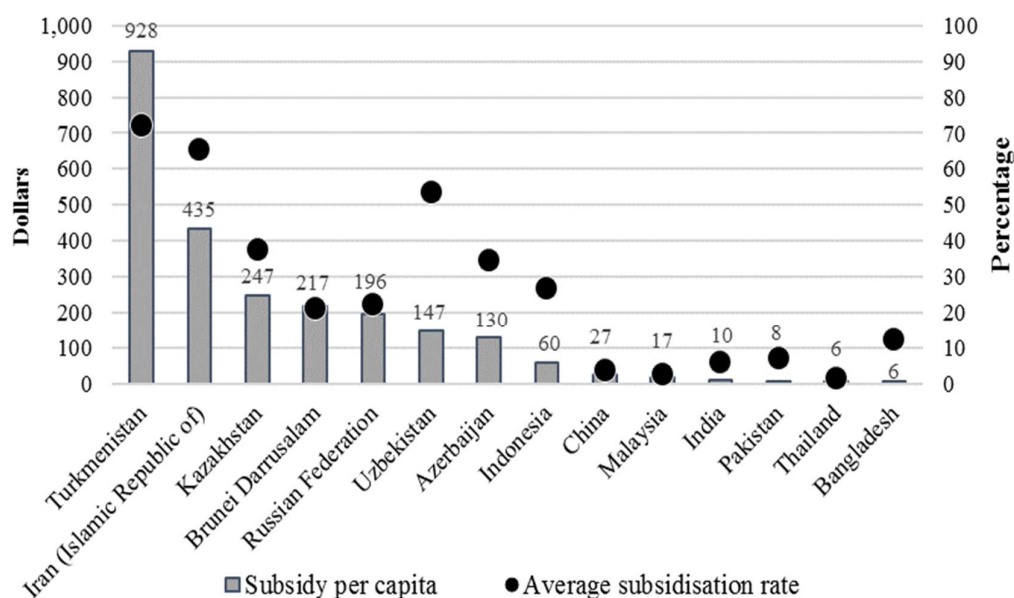
Figure XI
Total fossil fuel subsidies in selected Asia-Pacific countries



Source: ESCAP calculations based on data from the International Energy Agency, *World Energy Outlook 2017* (Paris, 2017).

¹⁴ *Asia-Pacific Trade and Investment Report 2017: Channelling Trade and Investment into Sustainable Development* (United Nations publication, Sales No. E.17.II.F.22). Available from www.unescap.org/sites/default/files/publications/APTIR%202017%20full%2016Nov17.pdf.

Figure XII
Per capita fossil fuel subsidization in selected Asia-Pacific countries, 2016



Source: ESCAP calculations based on data from the International Energy Agency, *World Energy Outlook 2017* (Paris, 2017).

H. Improve energy statistics and facilitate information sharing

41. Reliable and up-to-date statistics support informed decision-making. Yet, a large number of national statistical agencies in the Asia-Pacific region struggle to produce basic ranges of energy statistics. Several countries lack the capacity to produce energy balances in line with international standards.

42. Recognizing underlying methodological and capacity gaps, member States have committed to addressing systemic issues, as reflected in Sustainable Development Goal targets 17.18 and 17.19, raising expectations that statistics will improve. However, the statistical requirements for supporting energy sector assessments and integrated planning extend beyond energy balances and Goal indicators. In particular, end-use data remain scarce within the region, and the overall lack of uniformity, transparency and timeliness of information hinders policy development, project research and planning. Fostering an enabling cooperation and investment environment requires greater availability and sharing of more reliable information.

43. A number of regional efforts have been made to centralize and disseminate energy-related data and policy information, including the creation of the ASEAN Centre for Energy, the South Asian Association for Regional Cooperation (SAARC) Energy Centre, the Pacific Regional Data Repository, the Asia-Pacific Economic Cooperation (APEC) Energy Database, the APEC Energy Standards Information System and the ESCAP Asia Pacific Energy Portal.

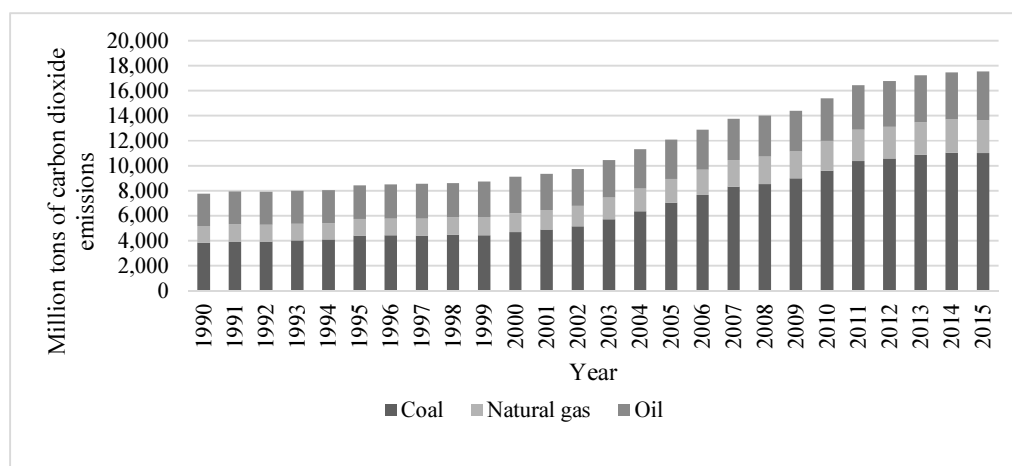
44. Discrepancies between sources, particularly between national statistics and those produced by international organizations, point to the need for greater harmonization of methodologies and definitions. Furthermore, the assessment and quantification of the socioeconomic benefits of energy-related developments remains a largely untouched area. To support stronger energy policies, efforts are needed to increase regional capacities to develop, analyse and apply data

and information with consideration for broader national and regional development contexts, policy frameworks and sectoral development trends.

I. Minimize the environmental impact of the energy sector

45. The energy that has powered the region’s economic growth has been accompanied by significant environmental impacts. As income levels rise, so have absolute and per capita carbon emissions. In the past few years, the Asia-Pacific region has accounted for more than 50 per cent of global emissions (nearly two thirds of which were from coal). In 2015, emissions reached 17.6 billion tons of carbon dioxide (CO₂) from fuel combustion (figure XIII). The East and North-East Asia subregion was the largest emitter in the region, with 55 per cent of total emissions, followed by South and South-West Asia, with 18 per cent. With the adoption of the 2030 Agenda and the Paris Agreement, economies of the Asia-Pacific region have set in motion strategies for climate change adaptation and mitigation efforts and reducing the regional carbon footprint, as seen in their nationally determined contributions. By October 2017, 43 countries in Asia and the Pacific had signed and ratified the Paris Agreement, which sets greenhouse gas emissions mitigation targets, while 8 countries were still in the process of ratifying it through their national legislatures. Fifty-one countries in the region submitted nationally determined contributions with a mitigation target, and energy has emerged as the priority sector of countries, including in most of the nationally determined contributions. Countries in the region adopted different types of targets, including absolute emission reduction targets, relative emission reduction targets, carbon intensity reduction (China, India, Malaysia and Singapore), peak carbon emissions, as well as policies and actions.

Figure XIII
Carbon dioxide emissions from fuel combustion for energy use in Asia and the Pacific, 1990–2015



Source: ESCAP calculations based on data from OECD and the International Energy Agency, World Energy Statistics and Balances database. Available from <http://wds.iea.org/> (accessed 9 September 2017).

46. Measures such as carbon taxation and emissions trading schemes are taking hold in some economies, and, with the introduction of more renewables, have the potential to curb emissions, particularly in power and major industrial sectors.

47. Although member States have committed to pursuing low-carbon solutions, fossil fuels in all major scenarios are expected to continue to hold a majority share of the regional energy mix for the foreseeable future. Carbon capture and storage, as part of a suite of decarbonization solutions, has potential for managing carbon emissions from fossil fuels. The majority of climate change models incorporate carbon capture and storage, without which reaching the goal of limiting global temperature rise to 2°C can be expected to be significantly more expensive.¹⁵ Efforts to develop carbon capture and storage in the power sector are continuing but the technology will need to overcome hurdles to become competitive.

48. Advanced non-CO₂ emissions technologies are also being developed and deployed in some member States, with the goal of significantly lowering particulate matter, sulphur dioxide and nitrogen oxide emissions in new power plants and retrofits.¹⁶ However, few countries have demonstrated improved air quality in recent years, and the trend shows worsening air pollution with negative health implications. Current policies suggest that large portions of the Asia-Pacific population will continue to be exposed to air pollution that exceeds not only World Health Organization (WHO) air quality guidelines, but also interim target levels.

49. In addition, according to WHO data, 83 of the world's top 100 polluted cities, as measured by particulate matter 2.5 microns or less in diameter (PM 2.5), are located in the Asia-Pacific region, while approximately 98 per cent of the region's population is exposed to PM 2.5 levels exceeding the WHO guideline.

50. Reducing emissions while also improving the health and well-being of populations through improved air quality requires more aggressive policies targeting increased energy efficiency, the expanded use of renewables, and advanced development and use of end-of-pipe abatement technologies. Also critical is the mobilization of adequate and sustained financing for research, development and deployment of these technologies.

J. Promote more efficient and cleaner use of oil

51. Regional oil demand is expected to rise; the International Energy Agency in its new policies scenario suggested it will reach 41.4 million barrels per day in 2030, up from 33.5 in 2016. The transport sector will continue to drive oil demand as passenger vehicle uptake increases and air, marine and heavy transport continue to expand. Improved fuel quality and consumption standards are being introduced; these factors together with the electrification of the transport sector are expected to moderate, but not entirely subdue, demand growth in the near term.

52. As demand for oil is increasing, production is falling in several countries. New regional developments are relatively scarce as discovery of new oilfields is increasingly difficult and expensive. Tapping into some of the region's large but maturing reserves to boost production and maximize

¹⁵ Intergovernmental Panel on Climate Change, *Climate Change 2014: Mitigation of Climate Change - Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (New York, Cambridge University Press, 2014).

¹⁶ World Coal Association, "Near-zero non-CO₂ emissions: Shenhua Group" (London, 2017). Available from www.worldcoal.org/sites/default/files/Shenhua%20case%20study_2017.pdf.

resource potential requires expensive enhanced oil recovery technologies, which have the potential to multiply oilfield recovery rates.

53. Enhanced oil recovery is being applied in oilfields in East and North-East Asia and in North and Central Asia, while South-East Asia has had its first large-scale offshore enhanced oil recovery effort, in Malaysia.¹⁷ In India, a policy is expected to allow bidding on enhanced oil recovery contracts to boost output.¹⁸ Low oil prices are currently tempering upstream investments, including within the enhanced oil recovery market, yet the enhanced oil recovery market is projected to grow at a compound annual growth rate of more than 12 per cent during 2017–2022.¹⁹

54. The potential to capture carbon as part of enhanced oil recovery operations is also being explored. Maximizing oil production can help meet the region's growing demand but is also associated with increasing carbon emissions. However, oil reservoirs are recognized as ideal locations for storing carbon.

55. To work towards reducing the environmental impacts of oil production, a number of countries and oil companies have joined the World Bank's Zero Routine Flaring by 2030 initiative to end gas flaring at oil production sites. Ten of the world's top thirty flaring countries by volume are located in the region, and the most recent data from the World Bank²⁰ shows mixed progress (figure XIV).

56. Meanwhile, rising regional demand for refined oil products exceeds regional refining capacity, pointing to the need for new investment, particularly in the growing demand centres of India and South-East Asia. Expanded capacity is necessary, while aging refineries require upgrades to increase efficiency and competitiveness.

57. Reducing the environmental impact of oil requires Governments to set stricter regulations for the production, processing and consumption of oil. Supporting the use of advanced technologies while creating more attractive, predictable, reliable terms for investors are key components in the development of policies in this sector.

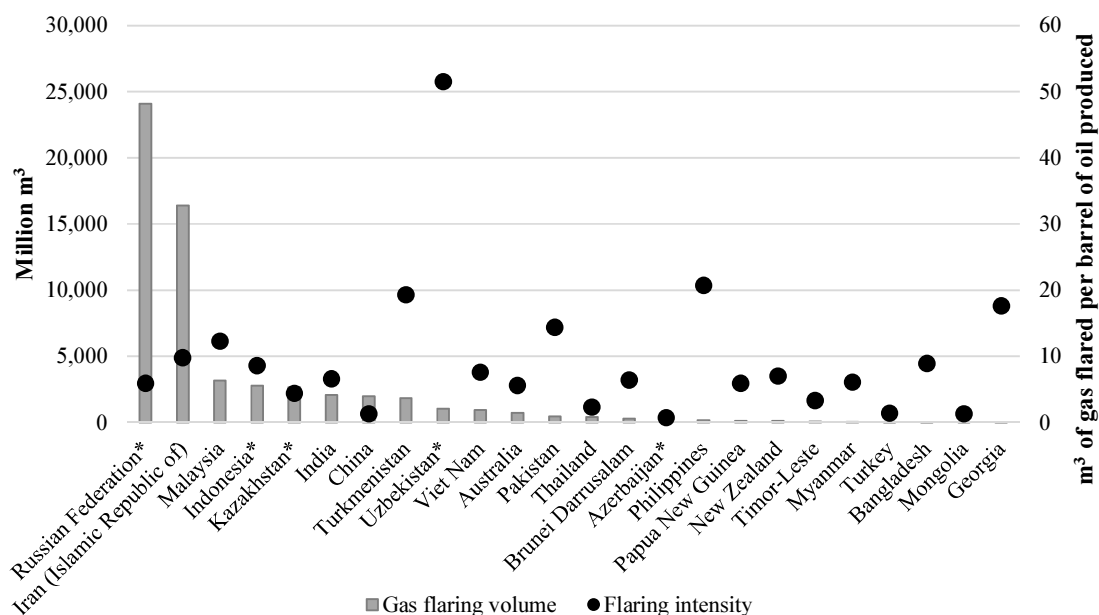
¹⁷ Petronas, "Enhanced oil recovery offshore" (n.d.). Available from www.petronas.com.my/our-business/Upstream/projects/Pages/EORO.aspx.

¹⁸ Himangshu Watts and Sanjeev Choudhary, "Govt plans to auction nominated fields of ONGC, OIL to private players to boost output", *Economic Times*, 31 May 2017. Available from <https://economictimes.indiatimes.com/industry/energy/oil-gas/governments-new-policy-on-enhanced-oil-recovery-contracts-can-help-double-indias-oil-output/articleshow/58918296.cms>.

¹⁹ TechSci Research, *Asia-Pacific Enhanced Oil Recovery Market by Onshore vs. Offshore, by Type (Thermal, Miscible Gas, Chemical and Others), Competition Forecast and Opportunities, 2012 – 2022* (2017). Available from www.techsciresearch.com/report/asia-pacific-enhanced-oil-recovery-market-by-onshore-vs-offshore-by-type-thermal-miscible-gas-chemical-others-competition-forecast-opportunities/1000.html.

²⁰ World Bank, "New data reveals uptick in global gas flaring", 12 December 2016. Available from www.worldbank.org/en/news/press-release/2016/12/12/new-data-reveals-uptick-in-global-gas-flaring.

Figure XIV
Gas flaring in Asia and the Pacific, 2016



* Global Gas Flaring Reduction Partnership member.

Source: ESCAP calculations based on data from the World Bank, Global Gas Flaring Reduction Partnership database. Available from www.worldbank.org/en/programs/gasflaringreduction#7 (accessed 22 November 2017).

K. Promote the efficient and clean use of coal

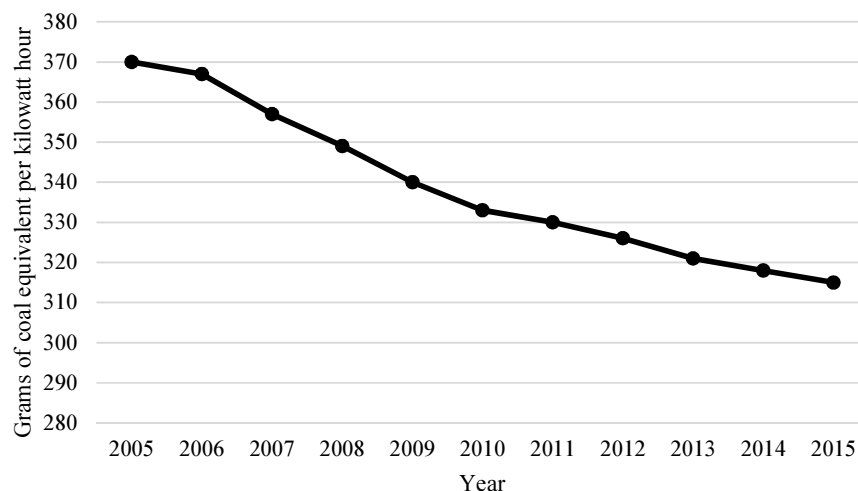
58. Coal dominates the Asia-Pacific energy mix. It is consumed mainly within the power and industrial sectors, and, in 2015, represented 43.5 per cent of the region’s primary energy supply and 62.4 per cent of CO₂ emissions from fuel combustion. Whereas coal’s share within the primary energy mix shows signs of levelling off, and solar is challenging coal in new capacity additions in a few countries, coal does not appear to yet be giving up its central role in meeting the region’s energy demand. The International Energy Agency in its new policies scenario predicted that coal production will rise by 10 per cent between 2016 and 2030. India and several other countries are expected to increase their rate of coal use, while South-East Asia is expected to double its coal consumption.²¹

59. In consideration of growing environmental concerns and commitments made under the 2030 Agenda and the Paris Agreement, limiting the use of coal when viable cleaner alternatives are available and maximizing the efficiency of coal use is imperative. High-efficiency low-emissions power plants can lower the coal consumption rate per unit of power generated, supporting energy savings and emissions reduction. The region’s largest consumer, China, responsible for more than two thirds of regional consumption, has phased out many older power plants and introduced supercritical and ultra-supercritical technologies in its new capacity additions. The fleet has seen a resulting drop in consumption rates in line with the government target of 310 g of coal equivalent per kWh by 2020 (figure XV). The country’s ultra-supercritical

²¹ International Energy Agency, *World Energy Outlook 2017* (Paris, 2017).

units reportedly have an efficiency of more than 47 per cent²² in comparison to a fleet average of 35.8 per cent. The country’s target, for 2030, is that ultra-low polluting coal power plants shall comprise more than 80 per cent of coal power plants.²³

Figure XV
Coal consumption rate of coal power plants in China, 2005-2015



Source: Shiyan Chang and others , “Clean coal technologies in China: current status and future perspectives”, *Engineering*, vol. 2, No. 4 (December 2016). Available from www.sciencedirect.com/science/article/pii/S2095809917300814#bib11.

60. Current coal-fired power plant efficiency in many countries in the region falls below the global average, suggesting that more efforts are needed to upgrade the existing power generation infrastructure and to also limit new coal capacity to high-efficiency low-emission technology. Overall, requirements for efficient coal technology uptake and for limiting carbon emissions need to be better integrated within national policies and regulations. Though some examples have emerged, incentives to promote wide-spread adoption of efficient coal technology remain insufficient.

L. Promote expanded production, trade and use of natural gas as a low-emission fuel

61. According to International Energy Agency figures, Asia and the Pacific held a 41.7 per cent share of the global natural gas supply in 2015, which represents a small decline over the previous year due to lower production, though the overall trend is a rising one. The share of natural gas within the regional primary energy mix stood at 18.2 per cent.

²² Shiyan Chang and others , “Clean coal technologies in China: current status and future perspectives”, *Engineering*, vol. 2, No. 4 (December 2016). Available from www.sciencedirect.com/science/article/pii/S2095809917300814#bib11.

²³ China, National Development and Reform Commission and National Energy Administration, *Energy Supply and Consumption Revolution Strategy (2016–2030)* (Beijing, 2017).

62. The region represents the world's largest gas market, and demand is growing. The price for liquefied natural gas has traditionally been significantly higher in Asian markets compared to markets in the United States of America, but in recent years that gap has narrowed. The global liquefied natural gas supply is expected to increase, with new supplies from Australia, the Russian Federation and the United States, while China, India and, to a lesser extent, new importer Pakistan are predicted to drive rising demand and are expected to make up for declining exports to Japan and the Republic of Korea.

63. Market structures are shifting, and regional policymakers are making a push towards greater trade flexibility. Mounting emphasis on shorter contracts and the removal of destination clauses, allowing the resale of liquefied natural gas, promise to introduce more competition to regional markets.

64. Natural gas is highly versatile for power, heat and transportation, though its regional competitiveness is challenged due to the high cost of infrastructure and transport, making it an expensive option outside gas-rich countries. It must also compete directly with the cost of existing fuels within various sectors.

65. Despite higher economic and technical challenges, demand is rising and national and regional plans are targeting increased production and accessibility through upstream, midstream and downstream liquefied natural gas projects. Recently, a number of Asia-Pacific countries have seen new infrastructure commissions, including pipelines and regasification terminals. Recent project approvals by regional development banks include funding for the expansion of gas fields and processing capacity, as well as expanded distribution.

66. Expanding the trade and use of natural gas requires investments, new infrastructure, and comprehensive and predictable policies, as well as the strengthening of the region's fiscal and regulatory regimes, which remain immature. Market reforms that allow for third-party access to pipelines and increased private sector participation in the production, transport and marketing of natural gas can encourage investment while stabilizing supply and demand.²⁴ The introduction of carbon pricing and stricter regulations on air pollution can also facilitate the expansion of the gas market.

M. Promote the development of advanced energy technologies

67. The Asia-Pacific region is a leader in the development of advanced energy technologies and is at the global forefront in areas such as renewable energy, efficient power generation, smart distribution, electrified transport, mechanical energy efficiency, biofuels and more.

68. Regional growth of clean energy technology development and manufacturing industries has come in response to domestic policy pivots towards greener energy systems, combined with emerging global market opportunities. Technology road maps have appeared in a number of national policy frameworks, while numerous member States participate in regional and global clean energy research and development initiatives. For example, under the international Mission Innovation initiative, six Asia-Pacific countries will

²⁴ International Energy Agency, *Gas 2017: Analysis and Forecasts to 2022* (Paris, 2017). Available from www.iea.org/publications/freepublications/publication/MarketReportSeriesGas2017ExecutiveSummaryEnglish.pdf.

invest a combined \$4.87 billion annually in clean energy research and development.²⁵

69. Joint initiatives, which support the dual objectives of technology dissemination and uptake, are on the rise. Regional country-to-country exchange has become more dynamic, with current joint feasibility studies and demonstration projects focused on areas such as renewables, smart grids, commercial and industrial energy efficiency, high-efficiency thermal power generation, and carbon capture and storage.

70. However, adoption of advanced technologies varies across ESCAP member States, and many lack the necessary legal, institutional and financial mechanisms to adequately encourage technology development and dissemination. Policymakers continue to emphasize the need for increased technology transfer to enable the achievement of sustainable energy targets and objectives.

71. Regional technology centres and intergovernmental organizations have a key role to play in technology development and transfer and have the potential to build collaboration and partnerships among the broad range of stakeholders involved in technology value chains, from development to commercialization.

N. Develop common infrastructure and harmonized energy policies with a view to increasing regional economic integration

72. Inter-subregional energy connectivity has been progressing in the Asia-Pacific region through various initiatives, including the Turkmenistan-Afghanistan-Pakistan-India gas pipeline, the Central Asia South Asia Regional Electricity Market project, and natural gas pipelines connecting the Russian Federation and Turkmenistan with China. Proposals have been made to enhance gas trading in the region, especially among South Asia, Central Asia and the Islamic Republic of Iran. With the rising prominence of liquefied natural gas in the global gas trade, several liquefied natural gas import terminal hubs have been proposed to serve as regional re-export facilities.

73. In terms of subregional energy connectivity, the ASEAN and Greater Mekong Subregion programmes are among the most advanced in the region. The heads of ASEAN power utilities and authorities have committed to implementing the first phase of the Lao People's Democratic Republic-Thailand-Malaysia-Singapore Power Integration Project, building on the nine interconnection projects already completed. In 2017, the Lao People's Democratic Republic, Malaysia and Thailand signed a cross-border power and transmission agreement, with trade expected to commence in January 2018. ASEAN aims to double the exchange and purchase of power in South-East Asia by 2020.²⁶ In the gas sector, progress has been made building the Trans-ASEAN Gas Pipeline, which will link existing and planned gas pipeline infrastructure in conjunction with the development of new gasification

²⁵ Based on figures reported by Mission Innovation for Australia, China, India, Indonesia, Japan and the Republic of Korea. See Mission Innovation, *Strategies, Progress, Plans, and Funding Information Submitted by Mission Innovation Members* (2017). Available from <http://mission-innovation.net/wp-content/uploads/2016/06/MI-Country-Plans-and-Priorities.pdf>.

²⁶ Heads of ASEAN Power Utilities/Authorities, "The HAPUA Council Members Joint Statement 2017", 14 September 2017. Available from <http://hapua.org/main/2017/09/14/the-hapua-council-members-joint-statement-2017/>.

terminals for areas where pipelines are not economically feasible. As of 2015, 13 bilateral pipelines had been completed under the initiative, as well as four terminals. Multilateral pipelines are planned.²⁷

74. Most initiatives to promote cooperation in the subregion of East and North-East Asia are bilateral and limited to small-scale projects. However, various ideas for additional energy connectivity have been proposed, including the Gobitec initiative, the Asia Super Grid, and the Asian energy super ring projects, which aim to harness the potential for renewable energy in Mongolia and the Russian Federation to supply electricity to the entire subregion. With the potential to maximize energy resources and integrate higher levels of renewable energy, these structural approaches are beginning to gain support from regional policymakers for their technical feasibility to maximize the subregion's energy resources, though political and financial obstacles are present.

75. Bids are being made for the construction of transmission lines for the Central Asia South Asia Electricity Transmission and Trade Project (CASA-1000), which will enable the export of surplus summer hydropower from Kyrgyzstan and Tajikistan to Afghanistan and Pakistan. It is the first stage of developing a wider Central Asia-South Asia regional electricity market. Interconnections exist among some SAARC member States, such as Bhutan, Bangladesh, India and Nepal, which support hydropower trade arrangements. Proposals have been made for electricity interconnections between India and Sri Lanka, while the Islamic Republic of Iran currently trades electricity with Pakistan.

76. The Belt and Road Initiative proposes to connect infrastructure and trade across Asia, Europe and Africa. It has the potential to link existing regional power and gas initiatives and has resulted in a number of related infrastructure projects that are in their initial stages. The Initiative provides an opportunity to strengthen energy connectivity along its six proposed economic corridors, spanning from China to Europe, and from the Russian Federation to Indonesia. The Belt and Road Initiative is backed by the \$40 billion Silk Road Fund of China and has gathered initial support from dozens of countries as well as the private sector, though project implementation has proven more challenging.

O. Promote capacity-building, education and knowledge-sharing in the field of energy

77. The Asian and Pacific Energy Forum review and assessment mechanism, developed by the secretariat to support the implementation of the outcomes of the First Asian and Pacific Energy Forum, focuses on three pillars: (a) energy data and policy information, (b) analysis and reporting, and (c) dialogue (figure XVI).

78. Under the first pillar, the Asia Pacific Energy Portal (www.asiapacificenergy.org) was launched to support analysis and information sharing. The open-access portal offers an interactive data visualization interface for statistics and power plant infrastructure, as well as a searchable library of national energy-related policies for all member States.

²⁷ ASEAN Council on Petroleum, "Trans ASEAN Gas Pipeline Project (TAGP)", May 2015. Available from www.ascope.org/Projects/Detail/1060.

79. Under the second pillar, ESCAP produces analyses of developments in the energy sector and of the steps needed to accelerate the region's efforts towards a more sustainable energy future. The *Regional Trends Report on Energy for Sustainable Development in Asia and the Pacific* was launched to provide a comprehensive look at energy sector progress and challenges in the region. *Towards a Sustainable Future: Energy Connectivity in Asia and the Pacific* was released in 2016 with a focus on the integration of regional energy systems, while the 2017 *Regional Cooperation for Sustainable Energy in Asia and the Pacific* provides information on the role of cooperation among member States in achieving Sustainable Development Goal 7.

80. ESCAP continues to coordinate closely with development partners. Earlier collaboration with the United Nations Development Programme and ADB, under the Sustainable Energy for All Asia-Pacific Hub, resulted in the 2015 summary report, *Sustainable Energy for All: Tracking Progress in Asia and the Pacific*. ESCAP, together with ADB and other regional commissions, contributed to the report *Global Tracking Framework 2017: Progress toward Sustainable Energy* produced by the World Bank. ESCAP followed with the regional edition, *Asia-Pacific Progress in Sustainable Energy: A Global Tracking Framework 2017 Regional Assessment Report*.

81. The third pillar has been addressed through annual, high-level policy dialogues that engage Governments and stakeholders from research institutions, the private sector and civil society. Regular meetings support networking among member States and facilitate the identification of policies and strategies to address common challenges to achieving sustainable energy objectives. The establishment and first session of the Committee on Energy, in 2017, provided greater institutional strength for strategic collaborations to attain regional and internationally agreed development goals concerning energy. The secretariat also continues to organize capacity-building activities under various project initiatives.

82. The institutional frameworks enabling capacity-building, education and knowledge exchange activities are in place. Progress therefore hinges on member States' continued commitment to the maximization of this platform for regional cooperation.

Figure XVI
Information, analysis and dialogue have underpinned efforts under the Asian and Pacific Energy Forum agenda

