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Renewable Energy Sector in Emerging Asia: Development and Policies

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Trade, Investment and Innovation

Working Paper Series

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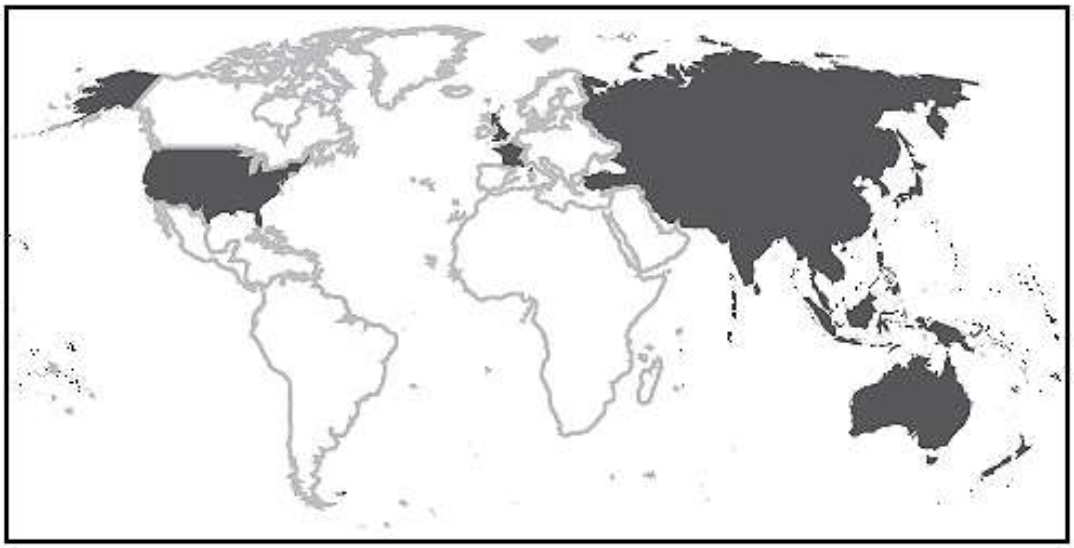

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Abstract

In the past few decades rapid economic growth in emerging Asia has led to a critical increase of greenhouse gas (GHG) emissions, especially in China, which has now become one of the biggest GHG emitting countries in the world. To decouple economic growth from negative environmental impact, renewable energy sources and associated new technologies have emerged. Transition to renewable energy sources, however, requires a massive investment from various financial sources. In this sense, this paper particularly focuses on greenfield foreign direct investment (FDI) as one of the most efficient and practical ways to enhance environmental sustainability through the development of the renewable energy sector beyond its obvious contribution to finance capital for sustainable development. FDI does not only enable the transfer of capital but also facilitates the transfer of technology and expertise to boost the use of renewable energy from multinational corporations (MNCs) to host countries of FDI and local companies. FDI also contributes to the host country's economy through the creation of direct, indirect and inclusive jobs in the low-carbon and resource-efficient sectors, also known as "green jobs". In the world, as well as in emerging Asia such as ASEAN member States, China and India, the creation of new jobs related to conventional energy sources, such as oil, natural gas and coal, has massively decreased since 2010 while green jobs have gradually increased over the same period, especially in the biomass, solar and wind sectors. Targeted policy interventions would promote and facilitate trade and investment in the renewable energy sector and the deployment of renewable energy and therefore foster job creation. The effectiveness of such policies is sensitive to good public governance, strong trade and investment facilitation and well-designed economic incentives. For example, the feed-in-tariff (FIT) scheme has been one of the most widely adopted subsidy-like policies to spur the uptake of indigenous renewable energy for the last two decades, and the relatively recent adoption of the scheme in five out of the 10 ASEAN member States, as well as in China and India, has contributed to the rapid development of solar and wind energy markets.

Key words: Climate change mitigation, Emerging Asia, FDI, feed-in-tariffs, green jobs and renewable energy.

JEL: F13; F18; Q4; Q5

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1. Introduction

Emerging Asia, which comprises the ten member States of the Association of Southeast Asian Nations (ASEAN)[2], China and India, has experienced rapid economic development over the last decades aggressively shifting labour and capital toward the manufacturing and services sectors, which has significantly affected the environment. Trade and investment in particular, through the globally expanding networks of business, have played a crucial role in triggering economic growth and accompanied unprecedented increase of greenhouse gas (GHG) emissions in the world (ESCAP, 2011; WTO-UNEP, 2009). In the 10 ASEAN countries, China and India GHG emissions increased by more than 350% from 1970 to 2012 whereas the rest of the world experienced a 50% rise (World Bank, 2016a).

The rapid development of regional and global value chains in the past two decades, spurred by trade and investment liberalization and advancements in information and communication technologies (ICTs) and logistical services, has led to increased use of carbon-based fuels, such as coal, oil and natural gas, and, hence, a surge in carbon dioxide (CO2) emissions, the largest single source of GHG. For example, transportation services, such as shipping, aviation, road, rail, and other transport activity, were responsible for 23% of global CO2 emissions in 2013 (IEA, 2015). Compared to 1990, CO2 emissions from the road sector, which account for more than three quarters of total transport-related CO2 emissions, increased by 68% in 2013, while emissions from marine and aviation bunkers also showed rapid growth by 64% and 90%, respectively (IEA, 2015).

Against the globally shared concerns on environmental degradation, renewable energy sources and associated new technologies have emerged as reasonable solutions to decouple economic growth from its negative environmental impact and to achieve environmental sustainability (Čekanavičius, *et al.*, 2014; ESCAP, 2011). Renewable energy is defined as energy that derives from natural processes and is renewed at a higher rate than it is consumed (IEA, 2016a). Hydropower, solar, wind, geothermal, bioenergy and ocean power are the main sources of renewable energy (IEA, 2016a; OECD, 2016). Switching to renewable sources of energy would lead to a significant reduction of GHG emissions but also requires a major investment.

While foreign direct investment (FDI) may lead to increased GHG emissions, it has also been viewed as an efficient way to accomplish environmental sustainability and transfer capital, technology and expertise from multinational corporations (MNCs) to local companies and recipient countries which are involved in the market of renewable energy and technologies (ESCAP, 2015). In emerging Asia, solar, wind, biomass, marine and hydroelectric subsectors are the main renewable energy sectors receiving FDI (fDi Intelligence, 2016).

FDI also makes an indirect contribution to the host country's economy via the creation of green jobs, which are jobs that contribute to preserving or restoring environmental quality (ILO, 2013; UNEP, ILO, IOE & ITUC, 2008). Renewable energy is the most promising sector to create such

[2] The ten member States of ASEAN are: Cambodia, Brunei Darussalam, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Viet Nam.

employment. While jobs related to conventional high GHG emitting energy sources, such as oil, coal and natural gas, have sharply decreased since 2010, the share of green jobs in renewables has increased over the same period both in the world and in emerging Asia. Although biomass was the most job generating subsector earlier, solar and wind have recently taken the lead.

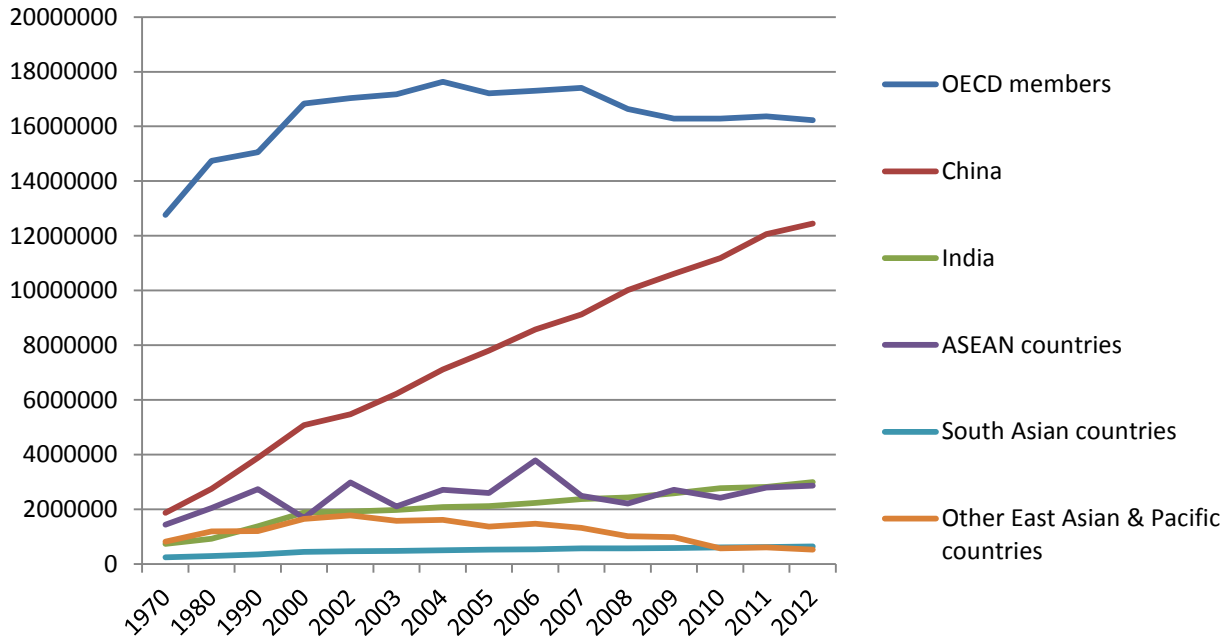
Targeted policy interventions would contribute to the deployment of renewable energy and the creation of jobs in any country. The effectiveness of such policies depends on good public governance, far-reaching trade and investment facilitation and well-designed economic incentives. For example, feed-in-tariffs (FITs) have been helpful to the development of solar and wind energy markets and to the creation of green jobs in five out of the 10 ASEAN countries, as well as in China and India.

This paper first sets the scene of GHG emissions in emerging Asia and identifies the main GHG emitting countries. Subsequently, the paper makes an analysis of energy mix and FDI flows in the renewable energy sector in emerging Asia. The status of green job generation is discussed in depth based on international databases. Existing policy options for the promotion of renewable energy sources are finally discussed as the main driver for the reduction of GHG emissions with a detailed discussion on the status of and challenges related to feed-in-tariff measures.

2. Who are the major GHG emission contributors?

An overview of the evolution of GHG emissions in different regions of the world is provided in figure 1. It appears that, since the 1970s, OECD member states have been the country group that makes the most contributions to the GHG emissions in the world while the amount of their GHG emissions has been gradually declined since 2004. Over the years, China experienced the most rapid increase in GHG emissions in the world, leading it to represent over 75% of OECD member states' GHG emissions by 2012. The level of GHG emissions in India has tripled since 1970 and is presently equivalent to that of the entire ASEAN region.

Figure 1: GHG emissions by major countries and subgroups of countries, 1970-2012



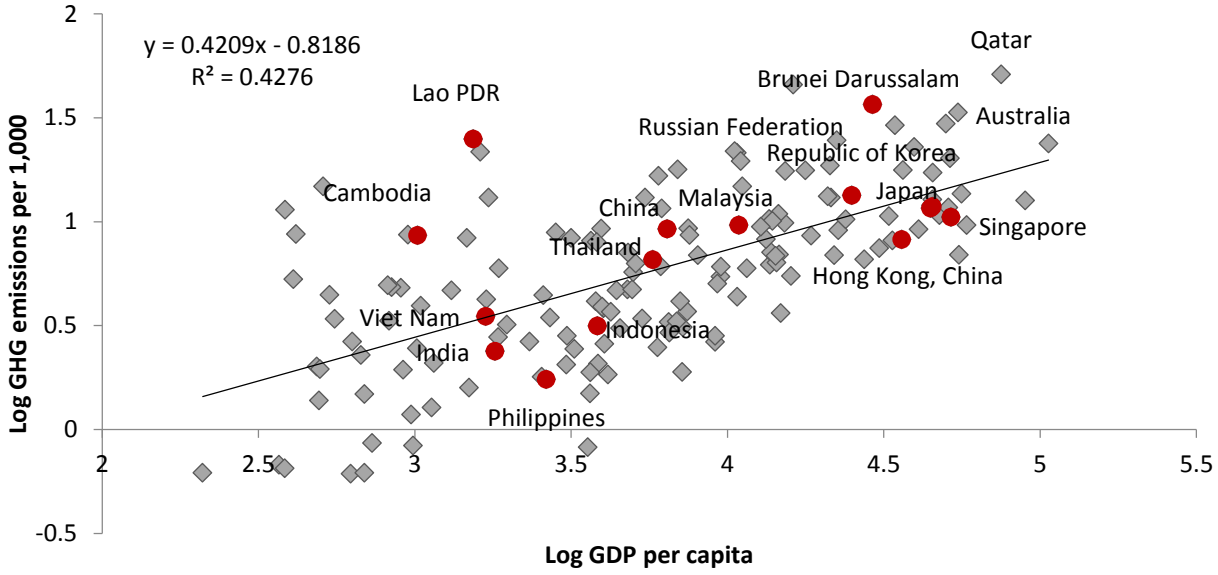
Source: The authors based on data of the World Bank (2016a).

Notes: Data are expressed in kiloton of CO_2 equivalent. Other East Asian and Pacific countries include: American Samoa; Democratic People's Republic of Korea; Federal States of Micronesia; Fiji; French Polynesia; Guam; Hong Kong, China; Kiribati; Macao, China; Marshall Islands; Mongolia; New Caledonia; Northern Mariana Islands; Palau; Papua New Guinea; Samoa; Solomon Islands; Timor-Leste; Tonga; Tuvalu; and Vanuatu. South Asian countries include Afghanistan, Bangladesh, Bhutan, Maldives, Nepal, Pakistan and Sri Lanka.

Figure 2 presents a moderate linear relationship between GDP per capita and GHG emissions per 1,000 people. The result suggests that the more a country is economically developed the more per-capita GHG emission the country generates. It also supports the negative impact of industrialization on global warming in general. Except for Brunei Darussalam and Lao PDR, perhaps, which produce relatively high GHG emissions compared to their GDP per capita[3], all ASEAN member States, China and India, are located closely to the exponential trend line. This also suggests that a country which presently produces relatively low GHG emissions may increase those emissions gradually as its economy grows, and policy interventions to control GHG emissions are required even at the early stage of development.

[3] The relatively high GHG emissions for Brunei Darussalam are related to oil production. A possible explanation for Lao PDR's relatively high GHG emissions is the high incidence of intensive onsite burning of forests for slash-and-burn agriculture and extensive commercial exploitation (Thongmanivong, *et al*., 2013; UNEP, 2012a).

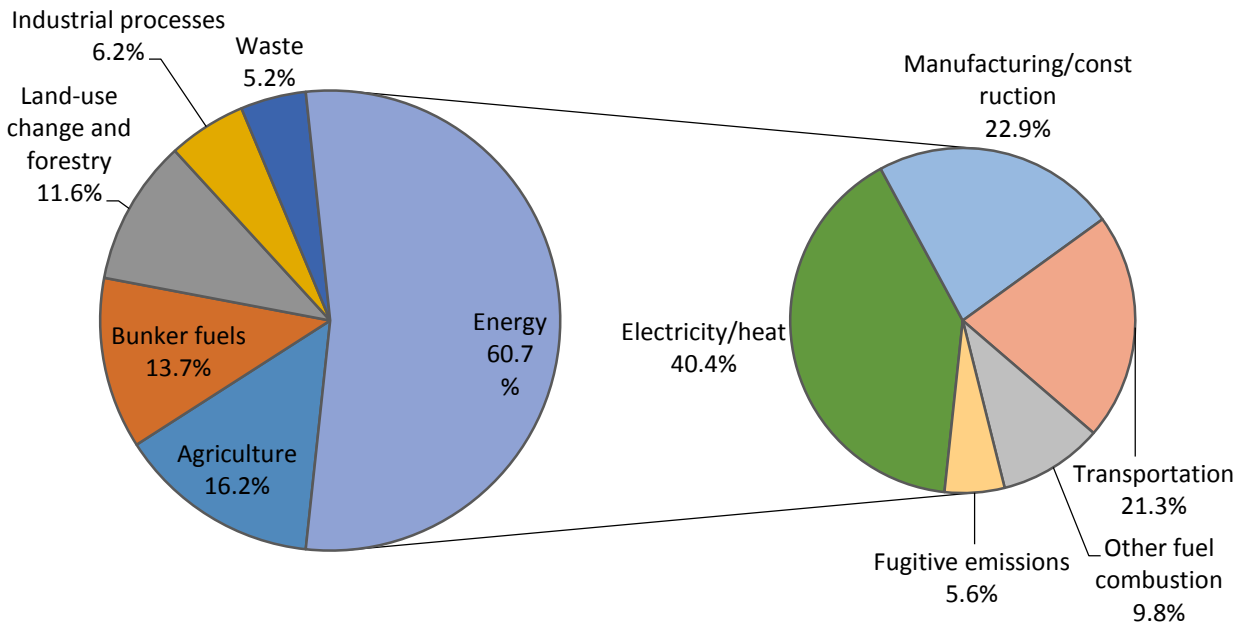
Figure 2: Relationship between GHG emissions and GDP per capita



Source: The authors based on data of the World Bank (2016a; 2016b).

As illustrated in figures 3, 4 and 5, energy is the most GHG emitting sector among six ASEAN member states (i.e., Cambodia, Malaysia, the Philippines, Singapore, Thailand and Viet Nam), China and India, followed by agriculture in those six ASEAN countries and India and industrial processes in China. When solely focusing on the energy sector, it appears that electricity and heat generation represent the main sources of GHG emissions while manufacturing/ construction accounts for more than 20% of the emissions in all countries. Transportation-related emissions have a more significant impact in the six ASEAN countries (21.3%) than in India and China (10.2% and 8.1%, respectively). In Indonesia, land-use change and forestry are by far the largest GHG emitting sectors, followed by agriculture and energy (figure 6). This is a result from active deforestation and forest fires to cultivate oil palm and increase in biodiesel production, posing a unique challenge for the country (World Bank, 2006).

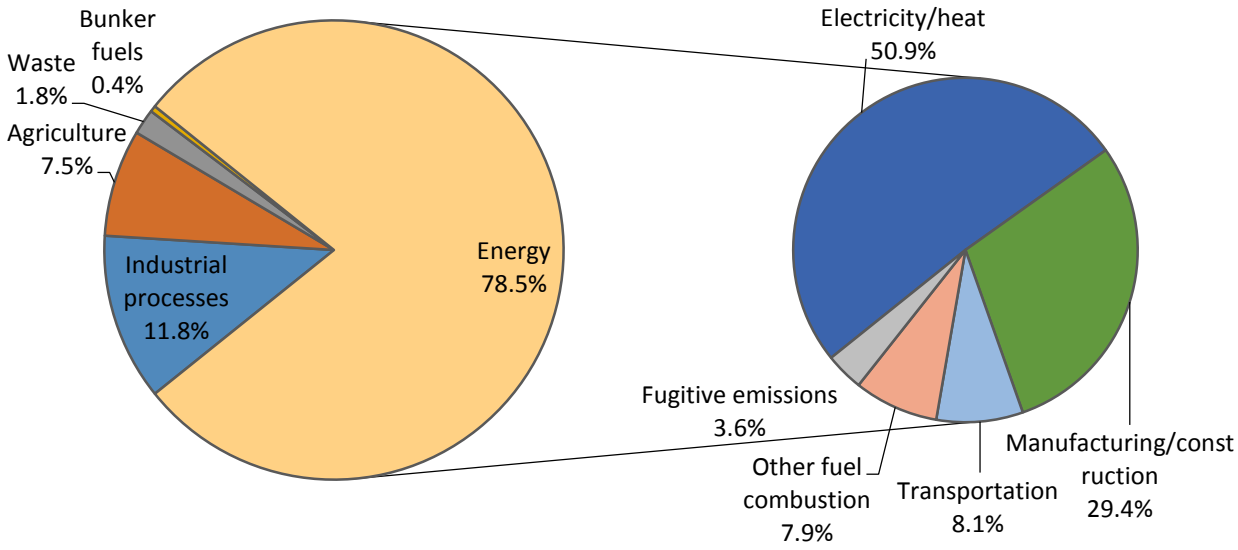
Figure 3: GHG emissions by sector and energy subsector in six ASEAN countries, 2012



Source: The authors based on data from the World Resources Institute (2015).

Notes: Brunei Darussalam, Lao PDR and Myanmar were excluded due to lack of data. The data for Indonesia are analyzed separately in figure 6.

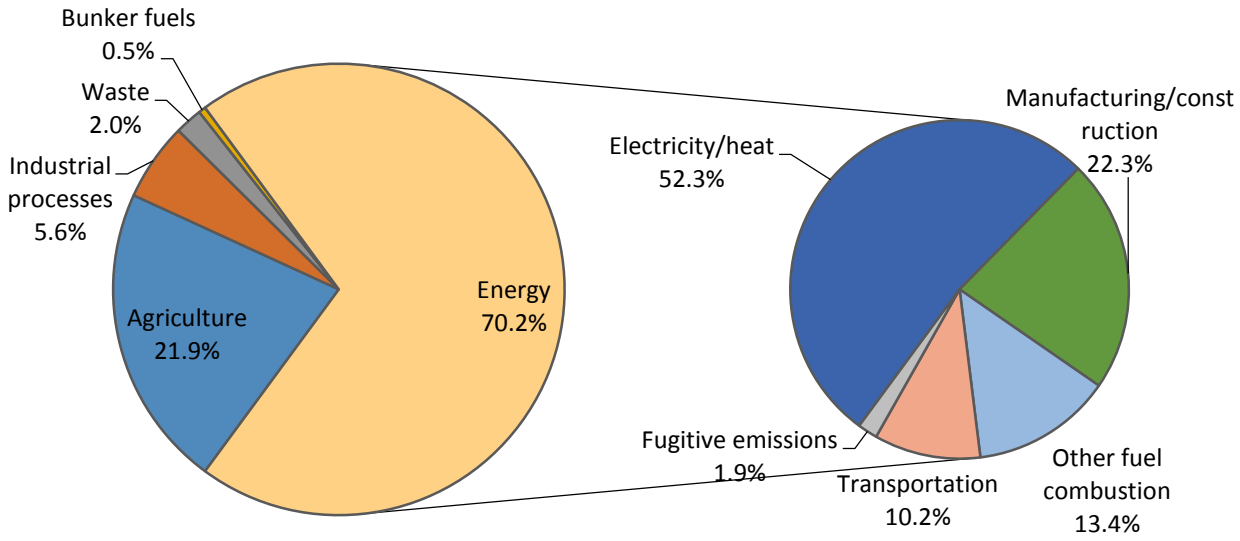
Figure 4: GHG emissions by sector and energy subsector in China, 2012



Source: The authors based on data from the World Resources Institute (2015).

Notes: Land-use change and forestry have been excluded as they have a negative contribution, which means that the sectors absorb a higher level of GHG emissions than what is emitted for exploitation. Bunker fuels emissions refer to CO_2 emissions from aviation and marine bunkers activities. Fugitive emissions comprise: CO_2 emissions natural gas flaring/venting; CH_4 from natural gas and oil systems; CH_4 from coal mining; and CH_4 and N_2O from other energy sources.

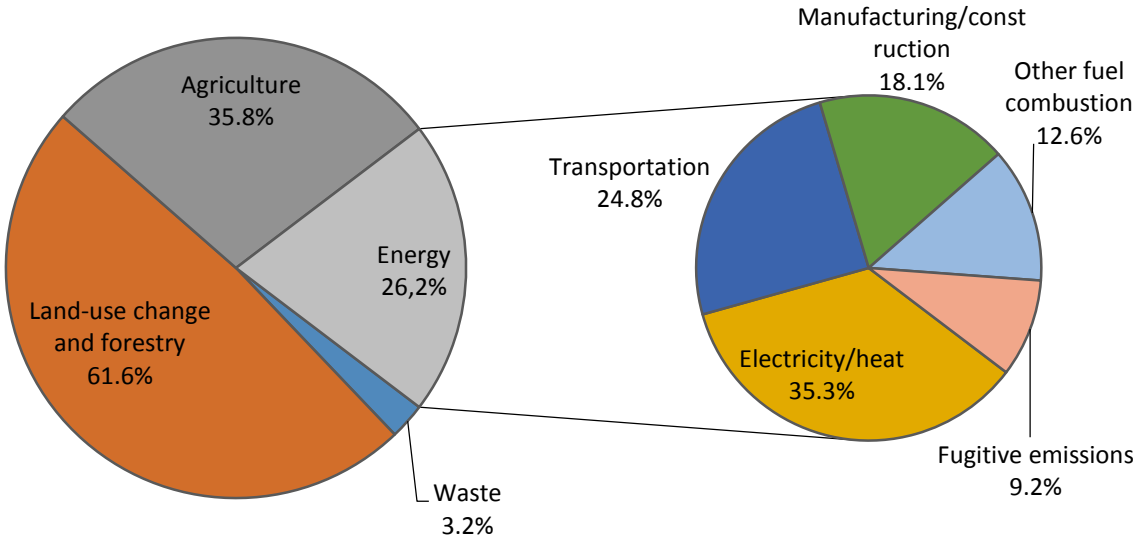
Figure 5: GHG emissions by sector and energy subsector in India, 2012



Source: The authors based on data from the World Resources Institute (2015).

Note: Land-use change and forestry have been excluded as they have a negative contribution.

Figure 6: GHG emissions by sector and energy subsector in Indonesia, 2012



Source: The authors based on data from the World Resources Institute (2015).

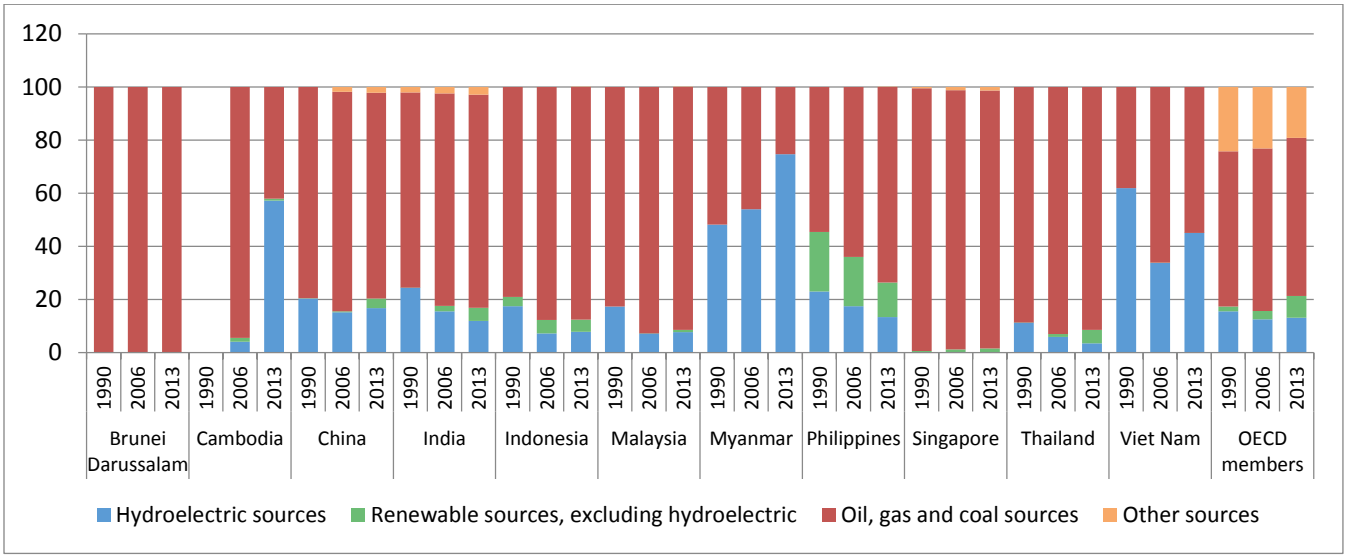
3. Energy sources and investments in renewable energy are diversified

The shares of different sources of electricity production in emerging Asia are illustrated in figure 7. Except for Cambodia, Myanmar, the Philippines and Viet Nam, 80% or more of the produced electricity comes from oil, gas or coal in all ASEAN countries, China and India, while those sources account for approximately 60% of electricity generation among OECD countries. Most countries in emerging Asia also produce electricity from hydroelectric sources, which account for nearly half of electricity generation in Cambodia, Myanmar and Viet Nam. The Philippines is the leader in the renewable energy sector as 13% of its electricity comes from renewable sources excluding hydroelectric, although this share has gradually declined. Renewable energy sources have also been exploited by Cambodia, China, India, Indonesia, Malaysia, Singapore and Thailand but to a lesser extent compared to OECD members.[4] Brunei Darussalam and Singapore are two countries whose electricity production relies only, or almost exclusively, on gas, oil or coal sources.[5] In addition to efficiency improvements in conventional energy

[4] It is also noteworthy that the share of renewable energy sources in East Asia and Pacific in electricity generation increased significantly in 2013.
[5] This is understandable as Brunei Darussalam is a fossil-resource rich country while the small land size of Singapore and its lack of natural resources limit the country's alternative energy options.

production, the reduction in GHG emissions in emerging Asia significantly is best achieved through a focus on alternative renewable energy sources, such as solar, wind and biomass, in particular as such sources have been mostly untapped so far in emerging Asia (ESCAP, 2011). However, a large amount of investment is needed to accomplish such a shift (ADB-ADBI, 2013).

Figure 7: Production of electricity by sources in select countries and regions, percentage of total



Source: The authors based on the World Bank (2016b).

Notes: Lao PDR is excluded from the analysis due to the lack of data.

Despite the recent fall of fossil fuel prices, investment in renewables has increased, establishing a new record in 2015 with $329 billion invested globally (Mills and Byrne, 2016). The continuation of global negotiations, including the conclusion of the Paris Agreement on climate change mitigation[6], and improving cost-competitiveness of renewable energy sources have enabled investments in renewables to keep growing at the expense of carbon-emitting sources (McCrone, *et al.*, 2016). In 2015, annual investment in the renewable energy sector in the Asia-Pacific region was nearly ten times higher than it was in 2004, increasing from $19 billion to $179 billion (Mills and Byrne, 2016). In particular, China raised its investment in the renewable energy sector from $3 billion in 2004 to $102.9 billion in 2015 (McCrone, *et al.*, 2016). India has also extended its investment in this sector by 22% from 2014 reaching $10.2 billion in 2015 (McCrone, *et al.*, 2016). Among the ASEAN countries, the hike has almost exclusively benefited the solar and wind subsectors which are, with biomass, the less exploited renewable resources,

[6] The Paris Agreement is an agreement within the United Nations Framework Convention on Climate Change (UNFCCC) dealing with GHG emissions mitigation, adaptation and finance starting in the year 2020. The Agreement was negotiated by representatives of 195 countries at the 21st Conference of the Parties of the UNFCCC in Paris and adopted by consensus on 12 December 2015. It was opened for signature on 22 April 2016 (Earth Day) at a ceremony in New York. As of December 2016, 194 UNFCCC members have signed the treaty, 117 of which have ratified it.

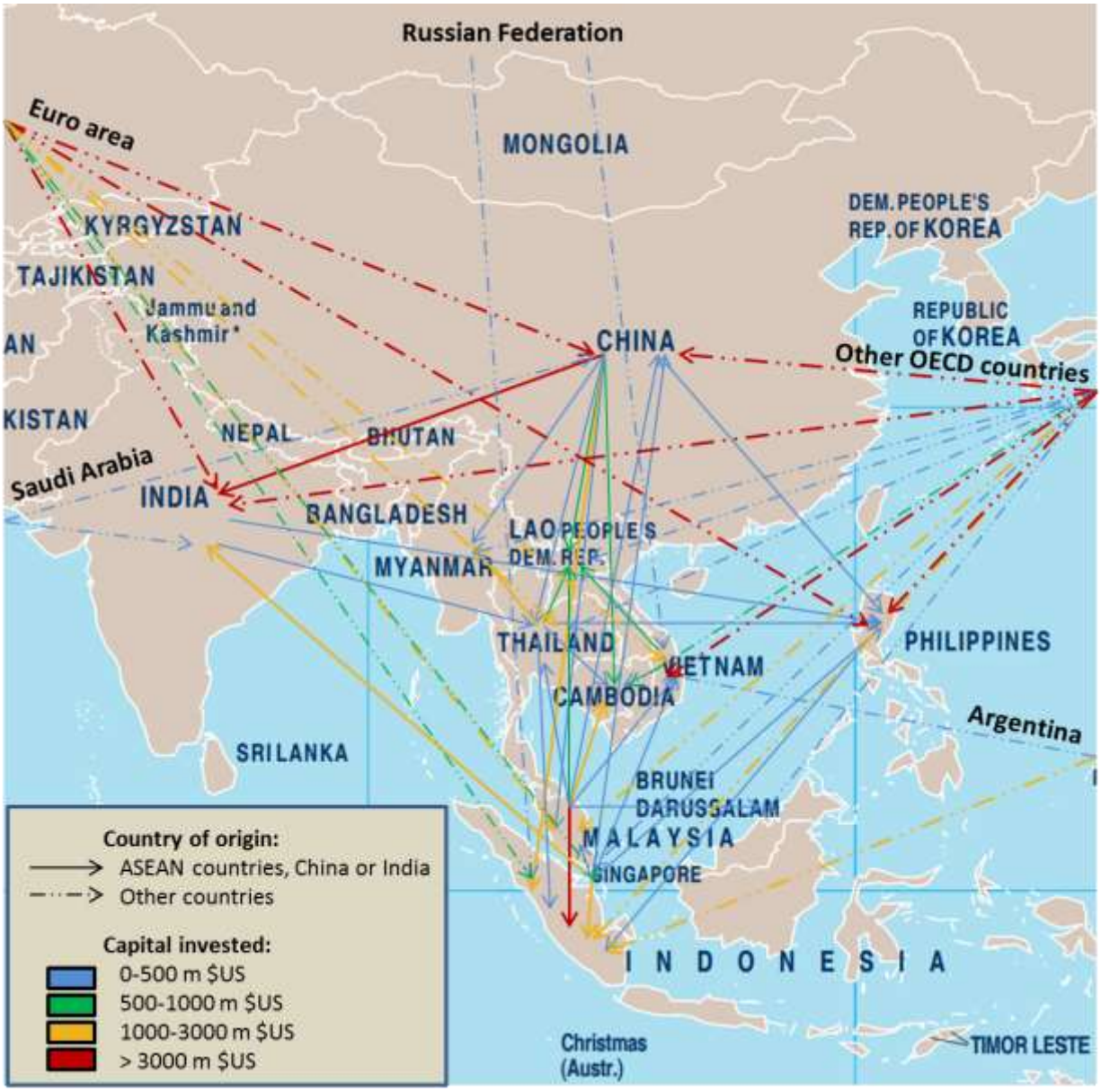
while hydropower generation has more or less matured in the region (Mills and Byrne, 2016; OECD, 2016).

FDI promotion is an important policy option to develop the energy sector as FDI is associated with the transfer of capital, technology and expertise from home countries to host countries. In other words, it allows both MNCs and local companies to get involved in such transfers through trade and investment in climate smart goods and technologies (ESCAP, 2011; Kalirajan, 2012). Figure 8 shows greenfield FDI[7] flows in ASEAN countries, China and India between January 2003 and August 2016 by country of origin in the renewable energy sector. India ($24,688 million), China ($13,555 million) and Indonesia ($11,930 million) have attracted most FDI in the sector among those countries during that period; they account for more than 60% of total greenfield FDI received in those countries in the renewable energy sector. Brunei Darussalam and Singapore are two of the least attractive markets for the renewable energy sector ($409 million and $946 million, respectively during the period). ASEAN countries ($24,347 million) together received about the same amount as India but Indonesia alone attracted almost half of it. Regarding countries of origin of the investment, the Euro area seems to be the main investor with 28.7% of the total capital invested during the period. It is however important to note that the United Kingdom by itself represents one third of total Euro area investment and more than 17% of India's FDI in this sector. China and the United States, followed by Japan, Malaysia and the Republic of Korea, are the next main investors in the region, particularly in India, which welcomed more than half of the FDI from these countries. Among the ASEAN countries, Brunei Darussalam, Cambodia, Lao PDR and Myanmar do not make any outward investment to other countries in emerging Asia, while they received 12.6% of the capital invested in the region. India is the largest recipient for FDI in renewable energy; however, it is not a major source country. An inverse trend is observed for Singapore which is the eighth largest investor in the world in the renewable energy sector whereas it receives, along with Brunei Darussalam, the lowest amounts of FDI inflows in the sector. ASEAN countries invest more among themselves than in India and China.

[7] As defined by UNCTAD (2007), greenfield FDI is one of the three components of FDI. The other two components are mergers and acquisitions (M&A) and intercompany loans. Of the three types, greenfield investment, i.e., investment for new facilities and operations, is arguably of most importance to development.

Figure 8: Greenfield FDI inflows in emerging Asia the renewable energy sector

January 2003 to August 2016

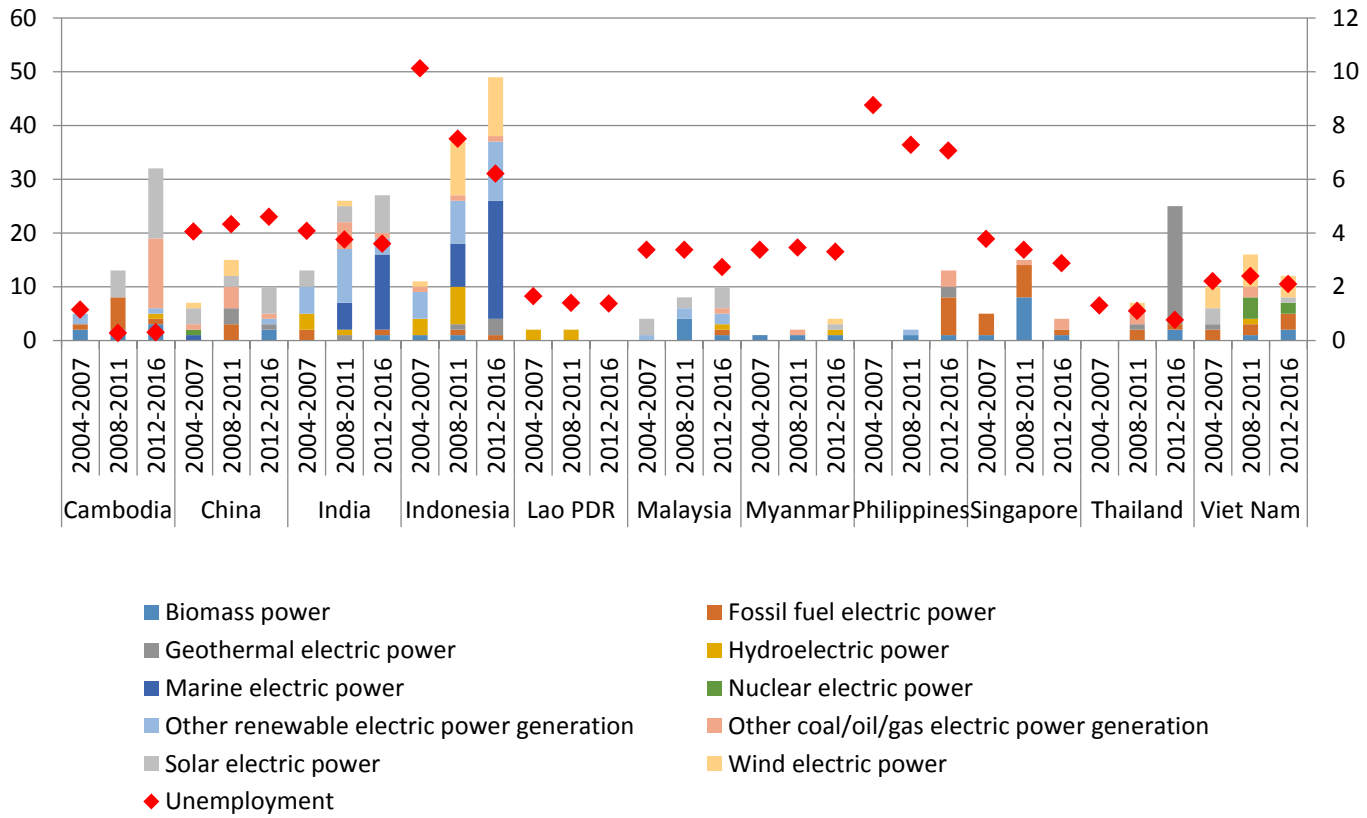


Source: The authors based on data from fDi Intelligence Ltd. (2016).

Notes: Euro area comprises Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Spain, Sweden, Switzerland and the United Kingdom. Other OECD countries comprise Australia, Canada, Israel, Japan, Mexico, New Zealand, the Republic of Korea, Turkey and the United States.

Figure 9 displays the number of greenfield FDI projects in various energy subsectors, including fossil fuel, in emerging Asia during three distinct periods (i.e., 2004-2007, 2008-2011 and 2012-2016). The figure suggests five general trends: (a) there is a growing number of energy projects in the region; (b) investment is made in a diversified mix of energy sectors in the countries concerned; (c) there has been a decline in projects in the fossil fuel energy subsector; (d) there is an increased number of solar electric power projects; and (e) there is a declining number of projects in the biomass energy subsector. These trends are also supported by the recent drastic cost reduction in some renewable energy sectors (e.g., solar and wind) due to larger economies of scale and rapid technological advancement (Mills and Byrne, 2016).

Figure 9: Number of greenfield FDI projects by energy subsector and unemployment rate 2004-2016



Source: The authors based on data from the fDi Intelligence Ltd. (2016); the World Bank (2016c).

Note: The data for 2016 cover up to August 2016.

Indonesia, followed by Cambodia, India and Thailand attracted the largest numbers of FDI projects in energy during the period 2012-2016. When looking at the total distribution of investment by energy subsector in the region, it appears that solar electric power (56 projects), marine (50 projects) and wind electric power (43 projects) are three of the most attractive subsectors in the region. They account for almost 40% of all the renewable energy projects in the region. While a number of countries (e.g., Cambodia, China, India, Malaysia, Myanmar and Viet Nam) have greenfield FDI projects in solar, the high score of the marine subsector is almost exclusively due to India and Indonesia which together represent 98% of all projects. Indonesia, along with Viet Nam, is also a leader in wind power generation. The two countries accounted for 84% of the projects in this area. In all countries, the number of FDI projects has increased between the first two periods, and it has kept rising during the last period except for China, Lao PDR, Singapore and Viet Nam. Cambodia, the Philippines and Singapore are the only three countries which have experienced an increase in the fossil fuel and other coal/gas/oil electric power subsectors. Cambodia has also attracted a growing number of FDI projects in the solar electric power subsector. In Thailand, geothermal electric power has led the rise in renewable electric power generation, whereas wind and nuclear power were the most important subsectors in Viet Nam. To meet the growing power demand in the country, the Government of Viet Nam has planned to develop up to 10 nuclear power plants by 2030 (Nuclear Energy Institute, 2014).[8] China has also attracted FDI in almost all energy subsectors from 2003 to 2016 with a particular focus on solar power. In Lao PDR, only FDI in the hydroelectric power sector is significant. However, though the country has abundant water resources, the number of FDI projects has not increased over the years. Malaysia has mainly focused on the development of its solar electric power and biomass power subsectors. In Myanmar, projects in the biomass sector have been replaced by projects in solar, wind and hydroelectric power.

It is also important to notice the inverse trend between the increase in the total number of FDI projects in energy and the decrease in the unemployment rate in most countries (figure 9). Indonesia and the Philippines show the greatest improvement in employment during the period. A series of country case studies on the causality of FDI and employment have suggested that FDI leads to the decline in the unemployment rate (Akram, 2016; Fabus, 2015; Shaari, *et al.*, 2012). In terms of the renewable energy industry, increased FDI can contribute to multiplier effects that trigger indirect and induced employment, and add to direct job creation. According to Greenpeace (2013), for example, the solar energy industry has the potential of creating a large number of indirect jobs in supporting industries such as the production of raw materials. It is estimated that, for every job created by the PV industry, approximately 1.8-2.8 jobs are created in other segments of the economy in a country. Although this observation cannot be easily generalized, it supports the trend towards growing green jobs, particularly in the wind and solar subsectors.

[8] However, Viet Nam may change this plan as its National Assembly cancelled the development of two nuclear power plants in November 2016. The country projects to fill the power gap by importing electricity from Lao PDR and investing in the renewable energy sector (World Nuclear Association, 2016).

4. The renewable energy sector has created green jobs

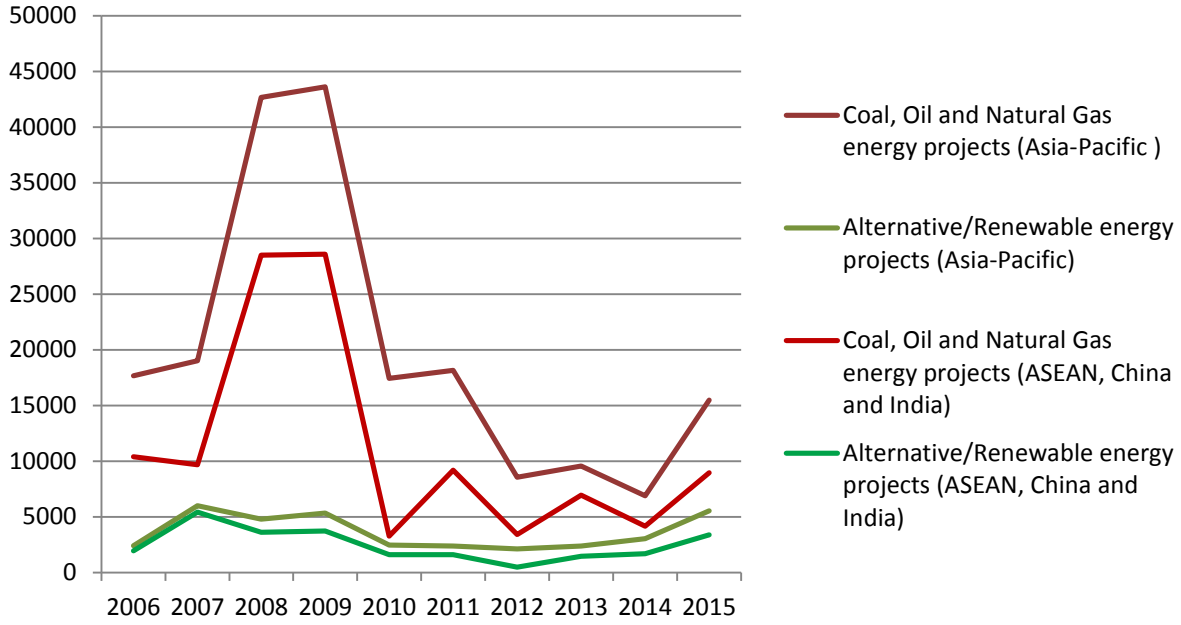
The renewable energy sector not only helps to slow growing GHG emissions but also to provide direct opportunities to generate more decent jobs. Jobs created through the low-carbon and resource-efficient sectors, also known as “green jobs”, generally refer to jobs in agriculture, manufacturing, research and development (R&D), administration and services that contribute substantially to preserving or restoring environmental quality, including jobs that help to protect ecosystems and biodiversity; reduce energy, materials and water consumption through higher efficiency; decarbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution (UNEP, ILO, IOE & ITUC, 2008).

Renewable energy is one of the most promising sectors that can fulfill sustainable economic and social development by creating green jobs while protecting the environment and ecosystem at the same time. In a broader sense, renewable energy makes an important contribution to achieving the United Nations’ Sustainable Development Goals (SDGs). Investment in renewable energy is expected to contribute to SDG 7 to ensure access to affordable, reliable, sustainable and modern energy while contributing to SDG 8 by creating full and productive employment and decent work. The renewable energy sector employed 8.1 million people worldwide in 2015, directly or indirectly, with a 5% year-over-year rise. In the Asia-Pacific region, green jobs in the sector have also grown rapidly: in China, India and Japan 4.3 million people in total were employed in the sector in the same year (IRENA, 2016). The trend of employment in the renewable energy sector indicates that solar and wind are among the most dominant and fast-growing renewable energy subsectors in both the world and in the Asia-Pacific region (IRENA, 2016; 2015).

FDI in renewable energy also has direct and indirect impacts on job creation. As mentioned before, in emerging Asia greenfield FDI in the sector has expanded (figure 9) and FDI projects in this sector created nearly as many jobs as conventional energy projects in 2011 (IRENA, 2013). It is worth noting that, in the case of FDI, jobs are created principally in the recipient, or host country where a new power facility is being established or an investment project in renewables is being developed (IRENA, 2013). The indirect impact of FDI on employment in the renewable energy sector may also include new jobs created as a result of knowledge acquisition and general economic activity of foreign firms or increased local spending by employees in FDI projects on renewable energy.

Figure 10 shows that jobs in the renewable energy sector created through greenfield FDI in the Asia-Pacific region at large have been gradually growing in recent years while the number of jobs created through FDI in the conventional coal, oil and natural gas energy sectors has fluctuated since it plummeted from a peak in the late 2000s, apparently due to the economic slowdown after the global economic crisis of 2008/2009. A similar trend is also noted in ASEAN, China and India.

Figure 10: Total jobs created through FDI in conventional and renewable energy projects 2006-2015

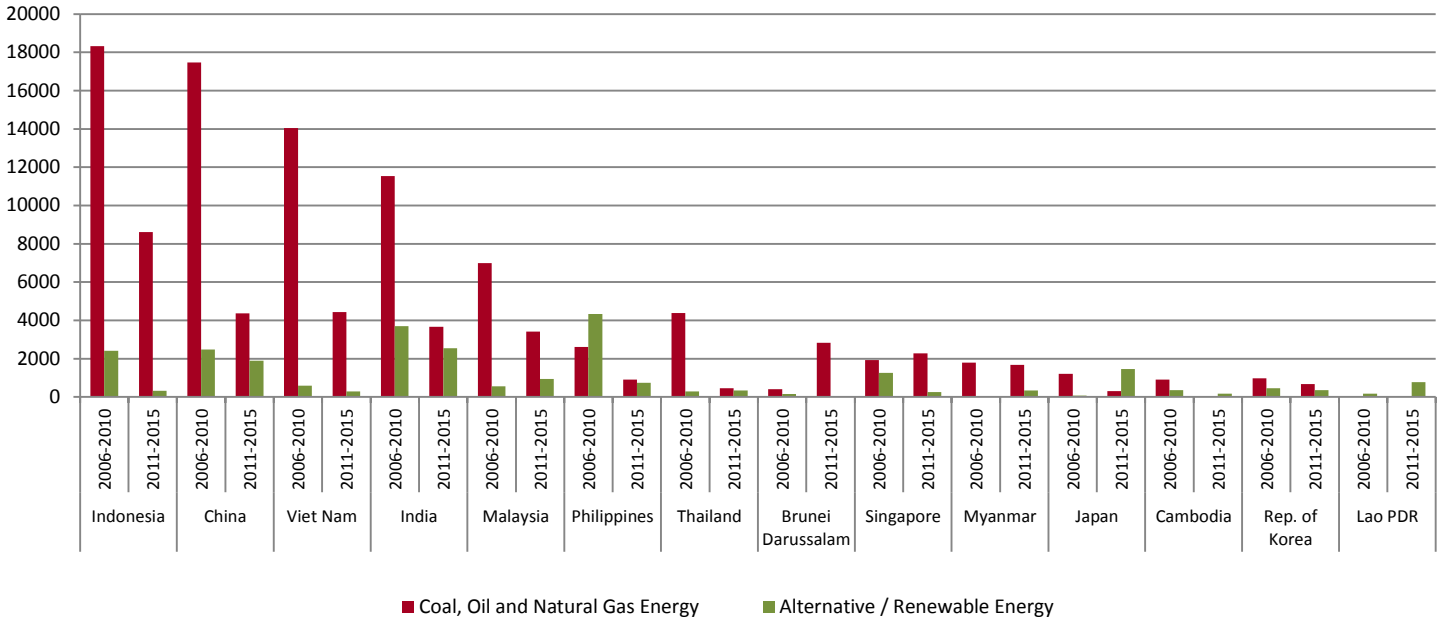


Source: The authors based on data from fDi Intelligence Ltd. (2016).

Notes: The data on job creation refer to the number of new jobs directly associated with FDI projects, calculated based on the information released by companies at the time of project announcement or opening and a proprietary econometric model estimating jobs and investment where the actual value is not reported.

A break-down by country and by period shows that jobs created through FDI in coal, oil and natural gas energy projects decreased dramatically in almost all countries while jobs created through FDI in alternative or renewable energy projects were relatively stable or increased. In China, India and Viet Nam, the number of jobs created through coal, oil and natural gas energy projects from 2011 to 2015 plunged to less than one-third of the jobs created from 2006 to 2010 while Thailand also marked drastic decrease to less than one-tenth during 2011-15 compared to 2006-10. As a result, the gap between the number of jobs created in the conventional energy sectors and number of jobs created in the renewable energy sector has been significantly reduced although it still exists (figure 11).

Figure 11: Changes in jobs created through greenfield FDI energy projects by country

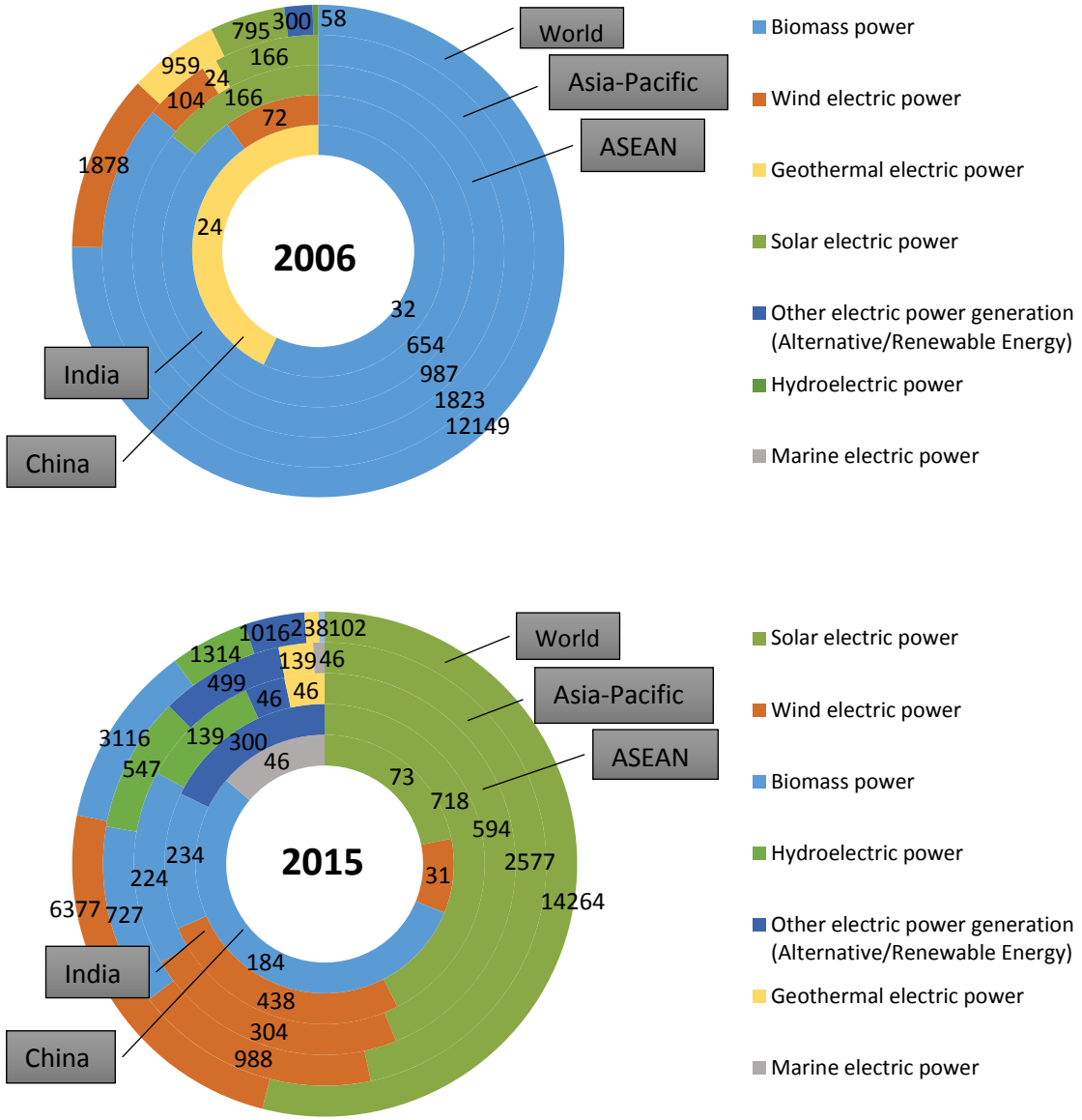


Source: The authors based on data from fDi Intelligence Ltd. (2016).

In terms of the number of jobs created through greenfield FDI in the renewable energy sector in 2006 and 2015, the Asia-Pacific region and ASEAN share similar trends with the world as a whole (figure 12). In all geographical regions represented in figure 12, solar power created the largest number of jobs in 2015, followed by the wind and biomass power sectors. However, employment created in these three sectors as a share of total employment created in all renewable energy sectors in 2015 is relatively small in the Asia-Pacific (77%) and in ASEAN (84%) in comparison with the world at large (90%). Compared with 2006, when jobs in the biomass power sector were dominant, jobs resulting from FDI in 2015 were created across more balanced and diversified renewable energy subsectors both in the Asia-Pacific region and in ASEAN. In 2015 China and India also presented a similar composition although biomass power-related FDI created the largest number of jobs in China. However, the total number of jobs created in China in the period 2011 to 2015 through solar electric power-related FDI increased four-fold compared to the number of jobs created in the period 2006 to 2010. This general trend is shared by the majority of selected countries. Also noteworthy is India's six-fold increase in the number of jobs in the solar power subsector (figure 13).

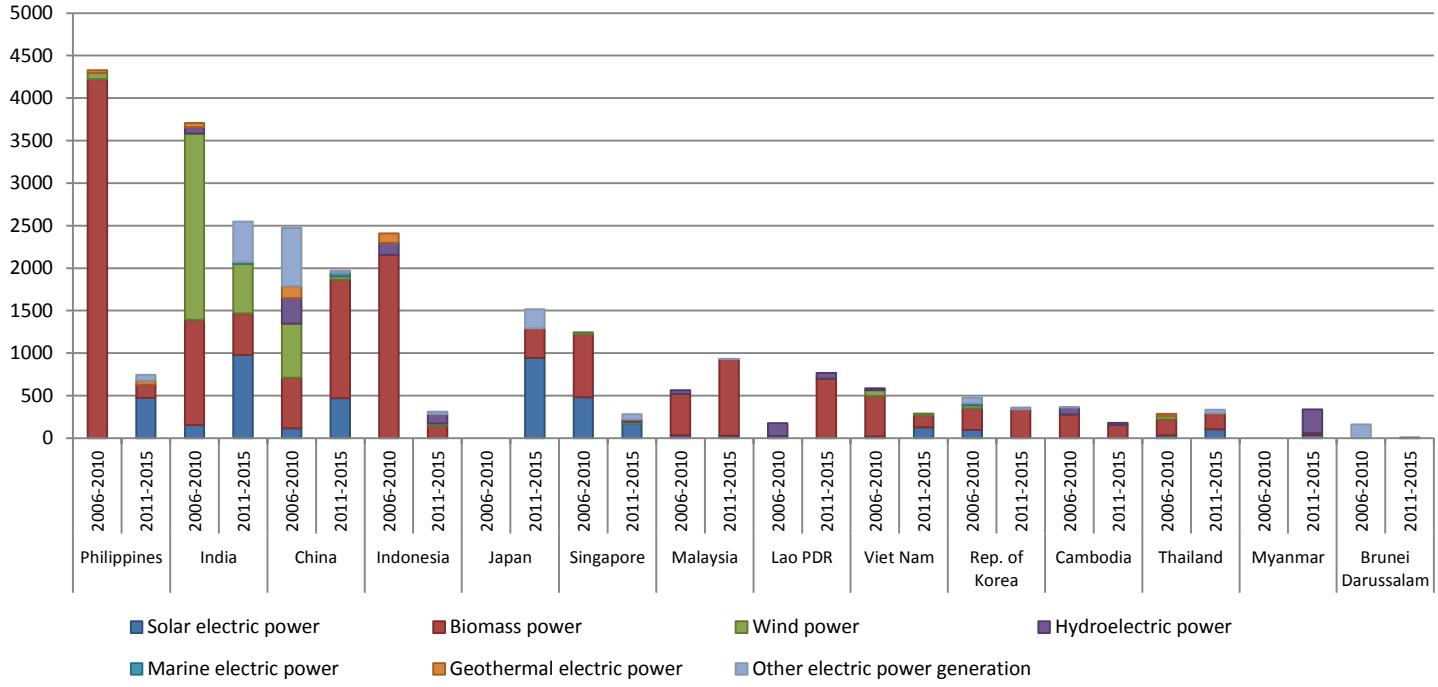
Figure 12: Jobs created through renewable energy FDI projects by region and sector

2006 and 2015



Source: The authors based on data from fDi Intelligence Ltd. (2016).

Figure 13: Jobs created through renewable energy FDI projects by country, 2006-2015



Source: The authors based on data from the fDi Intelligence Ltd. (2016).

Targeted and systematic policy frameworks, along with adequate institutional capacity, are likely to accelerate investment in the development of renewable energy sources. The contribution of this investment to the creation of green jobs has significant implications not only for energy, infrastructure or transport policy but also for labour and social welfare policy in emerging Asia. In addition to direct job creation, increased FDI in the renewable energy industry can generate a multiplier effect that triggers indirect and induced employment. Moreover, it is plausible to assume that those green jobs through FDI tend to create "good-quality jobs", or decent jobs, with higher wage, better working conditions and employment stability (Javorcik, 2014), which may exert a positive influence on the domestic labour market and policy. The policy framework for renewable energy is discussed in the next section.

5. Targeted policies can foster renewable energy development

A boost in the development of renewable energy backed by conducive and targeted policies is likely to reduce GHG emissions while generating a substantial increase in the level of employment as well. Therefore, governments have a significant role to play in establishing an

enabling environment for the renewable energy sector by implementing an adequate regulatory framework, strengthening institutions' capacity and addressing non-tariff barriers to facilitate and liberalize trade in renewable energy and related products and services (ESCAP, 2015, 2011; Sugiyama and Ohshita, 2006). In particular, the objectives of such policies are to: (a) widen the usage of renewable energy sources; (b) reduce the costs of renewable energy; (c) promote innovation and invention of renewable energy technologies; and (d) facilitate trade and investment in renewable energy and related products and services.

Table 1 summarizes possible policy options for the promotion of renewable energy sources and technologies. Detailed polices are categorized into four groups: (a) public governance; (b) trade and investment promotion and facilitation; (c) tax-based economic incentives; and (d) subsidy-based economic incentives. Each policy contains a description, opportunities and challenges.

Good governance directly and indirectly influences the broad level of innovation and productivity of a country. This will further spur the expansion of renewable energy uptake and foster further development of environment-related technologies. The absence of corruption, political stability, presence of a strong regulatory and administrative framework and government's ability to formulate and implement adequate policies are particularly important aspects of good governance. Government expenditure should focus on building quality transport, water, telecommunications and energy infrastructure which are needed to provide essential services to the renewable energy sector at a reasonable cost while removing administrative and market-related obstacles (ESCAP, 2015). In addition, to build a country's institutional capacity, governments are also encouraged to invest broadly in national and subnational innovation systems, multi-stakeholder collaboration and the strengthening of research institutes.

Governments should also promote trade and investment among the countries of emerging Asia in renewable energy products, services and technologies (ADB-ADBI, 2013; OECD, 2016). In particular, they should reduce import tariffs and non-tariff barriers (NTBs), promote the use of tradable renewable energy certificates and strengthen an enabling environment for FDI in renewables. The reduction of import tariffs and NTBs, including bureaucratic red tape, would reduce transaction costs of trade and investment in renewable energy. Tradable renewable energy certificates (TREC), which represent certified electricity generated from eligible renewable energy resources, could be sold and traded or bartered by individuals, corporations and government agencies worldwide in order to reach the least expensive renewable technologies while providing greater transparency and simplified transactions with lower contract costs. An enabling environment for FDI should include active promotion and targeting of FDI in renewable energy through appropriate marketing techniques and incentives while reducing bureaucratic barriers.

Table 1: Policy options for the promotion of renewable energy

Field / subfield	Policy	Description	Opportunities	Challenges
Public governance	Removal of administrative and market-related obstacles.	Remove barriers for business, trade and investment, energy products and services, and science, technology and innovation.	– Increases trade in energy products and services. – Facilitates development and transfer of technology, and FDI inflows.	– Difficulty in finding right balance between openness and competitiveness. – Bureaucratic red tape and corruption.
	Development of quality transport, water, telecommunications and energy infrastructure.	Provide necessary and adequate public services at reasonable economic, social and environmental costs and benefits by developing quality public infrastructures.	– Reduces the costs of renewable energy. – Facilitates trade and investment in the sector, encourages innovation and creates new jobs.	– Large amount of investment inflows. – Low commercial returns. – Bureaucratic red tape and corruption.
Trade and investment facilitation	Reduction of non-tariff barriers.	Reduce or eliminate import tariffs and non-tariff barriers for renewable energy goods, services and technologies.	– Avoids redundancy and reduce the costs of renewable energy products, services and technologies to be deployed in the country.	– Lower tax income from import duties. – Difficulty in finding right balance between openness and competitiveness. – Sectoral disagreements. – Bureaucratic red tape and corruption.
	Tradable renewable energy certificates.	Implement certificates of origin, or non-tangible, tradable commodities, created at the point of electricity generation, which represents proof that the generation of 1 megawatt-hour (MWh) of electricity is from an eligible renewable energy resource. This certificate could be sold and traded or bartered by individuals, corporations and government agencies worldwide.	– Taps the least expensive sources and technologies to realize renewable energy procurement. – Provides greater transparency and simplified transactions with lower contract costs. – Provides a new revenue stream to small renewable energy generators.	– Little direct correlation to a reduction of higher GHG emissions. – Bureaucratic red tape and corruption.
	FDI promotion.	Encourage new investments in the renewable energy sector	– Targets new foreign investors. – Increases the amount of FDI inflows.	– Difficulty in monitoring outcomes and effects.

		through various economic/fiscal and administrative/regulatory incentives.	– Gains new knowledge and technologies.	– Intensified competition among investors and domestic enterprises. – High public spending. – Lack of expertise in effective FDI promotion.
Economic incentives / tax	Carbon taxes.	Collect a tax, or a form of explicit carbon pricing, on businesses and industries that emit GHGs throughout their operations or supply chains.	– Reduces the demand and curb consumption of hydrocarbon fuels and concomitantly reduce GHG emissions. – Encourages companies to invest in energy-saving technologies and to create environment-friendly substitutes. – Generates national revenues that can be used to subsidize renewable energy sources.	– Uncertain level of carbon produced. – Difficulty in calculating external cost of carbon emissions. – Possible downswing in economic activity due to increased energy costs.
	Cap-and-trade.	Set a cap, maximum allowable amount of certain pollutant emissions; issuing of allowances, which are tradeable in markets, to companies. A penalty is imposed on businesses exceeding the limit.	– Limits and controls the quantity of pollutants released by companies. – Create a source of revenue for the government to promote renewable energy. – Provides a clear incentive for businesses to reduce their emissions and foster the development of innovative technologies.	– Difficulty in setting sufficiently tight emissions caps and covering all emissions with a long-term horizon. – Cash-rich businesses, still depending on traditional energy sources such as coal, gas and oil and emitting GHGs simply purchase permits from other businesses. – Increased price of electrical power for both consumers and industrial manufacturers.
	Renewable portfolio standards	Mandate electricity providers to procure a specified share of the total power generation from designated renewable sources.	– Ensures certain quantities of renewable energy. – Creates jobs directly to construct and manage facilities and indirectly in other stages of the supply chains of renewable energy. – Potential to lead to technology growth of the least-cost renewable energy source.	– High transaction costs. – Deteriorated market function in the energy sector. – Potential to increase near term electricity generation costs and rates.

	R&D tax credit	Provide tax incentive, or a tax offset, for companies that incur costs in conducting eligible R&D activities for the innovation of efficient renewable energy. For example, companies developing new renewable energy products or electricity generation processes receive a cash payment or tax deduction for qualified R&D expenses.	– Accelerates investment in R&D for innovative renewable energy technologies. – Directly contingent on new investment equally available to companies, including SMEs, which attempt innovative improvements to existing products or processes.	– High cost burden for the government and higher uncertainty of budget consequences. – Inadequate R&D capacity at firms.
Economic incentives / subsidy	Feed-in-tariff (FIT)	Develop an incentive scheme that ensures that investors receive payment for electricity that is generated from renewable energy sources over the entire length of the contract with the relevant public authority.	– Secures revenue of electricity generation at predetermined rate per unit of electricity in a long-term agreement, normally a set period of time of 15-20 years. – Creates a financial benefit such as savings on electricity bills and an additional payment for each unit of surplus electricity exported to the grid, which directly goes to households, small businesses and community organizations. – Fast uptake of renewable energy in producing electricity and foster renewable energy market while reducing costs for facility development and operations through economies of scale.	– Financial burden for the governments to cover the cost of the FITs and retail prices. – Increased residential electricity prices caused by excessive FITs. – Opportunity cost or benefit according to the price fluctuations of the oil/gas markets. – Difficulty in setting reasonable tariff rates among various renewables.
	Auctions and tendering	Develop a market-based scheme where the government puts out a tender to install a certain capacity of electricity generation from renewable energy sources. The successful bidder with the most competitive price signs a power	– Enables policymakers to track and control renewable energy capacity and generation. – Delivers the largest volumes of renewable energy with the lowest cost based on the market mechanism. – Controls public spending easily.	– Inadequate number of bidders to conduct competitive bidding. – Unrealistic projects proposed by the government. – Inadequate capacity of successful bidders. – Cartel.

	purchasing agreement with the government.		
Green bonds	Create a bond market where qualified businesses, organizations or municipalities can raise capitals to implement renewable energy or other projects which reduce GHG emission.	– Enhances reputation of issuers and marketing opportunity. – Provides issuers with access to a broader range of global investors who seek socially responsible investment. – Eases the redirection of capital and enable projects at a reduced cost of capital. – Promotes the implementation of long-term climate strategies with low-risk capital.	– Small green bond markets with perceived low liquidity. – Lack of a clear definition or standardized criteria for a green bond. – Difficulty in monitoring whether the project under green bonds is actually environment-friendly.
Green public procurement	Provide a special window for the government to obtain products and services with a reduced GHG emission throughout their life cycle.	– Fosters innovation in the energy sector, following the increase in the demand for more sustainable goods and services which are low-carbon and environment-friendly. – Provides a business opportunity for the suppliers of environment-friendly goods and services.	– Difficulty in political leadership at the national or subnational level. – Difficulty in the procurement of personnel to measure and monitor environmental impacts. – Poor functionalities and high prices of the eco-friendly products and services. – Reduce bureaucratic red tape and corruption.
Soft loans with credit guarantees	Provide subsided commercial loans through development / commercial banks along with credit guarantee schemes	– Encourages private investment in the development and deployment of renewable energy sources and technologies. – Shares and reduces risks among multiple players.	– High public spending. – Poor capacity of the banking sector. – Difficulty in developing a capable credit guarantee schemes. – Moral hazard and non-performing loans.

Source: The authors based on Abe, *et al.* (2012); ESCAP (2016, 2015, 2011); ICAP (2016); KPMG (2015).

Economic incentives in the form of tax holidays or subsidies can also contribute to the development of innovative and cost-efficient technologies and deployment of renewable energy goods and services for various actors. They can be designed and implemented with specific reference to environmental considerations in each country. The first category, a tax-like policy, intends to internalize environmental costs, and comprises carbon taxes at the sources, emission trading schemes and renewable portfolio standards (ADB-ADBI, 2013; Wermelinger, 2010). Carbon taxes and cap-and-trade are typical and common practices to put a price on pollutant emissions or emission rights but do not prevent rich companies to use conventional energy sources, such as oil, coal and gas, and could be a critical burden for smaller companies, particularly in developing economies. Renewable portfolio standards require electricity providers to procure a specified share of the total power generation from designated renewable sources while encouraging technological advancement in low-cost renewable energy. R&D tax credits aim to accelerate investment in innovative renewable energy technologies (Moinuddin and Bhattacharya, 2013).

A subsidy-like incentive policy, on the other hand, aims at reducing the costs of consuming energy and supports investment in renewable energy, including green public procurement, green financing through the creation of green bonds and soft loan schemes and feed-in-tariffs (FITs) (Wermelinger, 2010). Through green public procurement[9], governments can contribute to the financing needs associated with innovations and inventions of renewable energy technologies. In addition, distortionary subsidies for fossil fuel production and consumption must be removed (IEA, 2010), while financial institutions must facilitate the financing of small renewables projects and provide more accessible financial information. In this area, government support such as credit guarantee schemes is essential for their success.

Feed-in-tariffs (FITs) are perhaps one of the most widely adopted subsidy-like incentive policies to spur the uptake of indigenous renewable energy (REN 21, 2016; UNEP, 2012b), and 75 countries at the national level and 35 at the subnational level implemented FITs in the world as of 2015, which is three times as many as the number that adopted FITs in 2004 (REN21, 2016). FITs ensure investors receive payment for every kilowatt hour of electricity at predetermined rate that is generated from renewable energy sources over the entire length of the contract, normally for 15-20 years (NREL, 2010). The long-term guarantees inherent in FITs (or FIT subsidies for installations of renewable energy facility) provide tariff certainty that reduces financial risks while deploying small-scale renewable and low-carbon electricity generation technologies.

Households, small businesses and community organizations are among the major investors or beneficiaries of the scheme as onsite, yet small-scale, energy generation (such as a solar photovoltaic (PV) system or a wind/hydro turbine) creates a financial benefit such as savings on electricity bills and an additional payment for each unit of surplus electricity exported to the grid. A well-designed FIT is also likely to provide small and medium-sized enterprises (SMEs), whose competitiveness is significantly influenced by the costs of basic services such as electricity, with cost-containment energy generation opportunities and lead to their transition to sustainable and environmentally-friendly business. Strengths of the FIT schemes include: flexibility in its design (for example, eligibility, contract duration, purchase obligation and capacities); ensured long-term investment security; increased

[9] Green public procurement involves a public expenditure to purchase and provide environmentally-friendly public goods or services to businesses, communities and citizens that serve economic and social purposes.

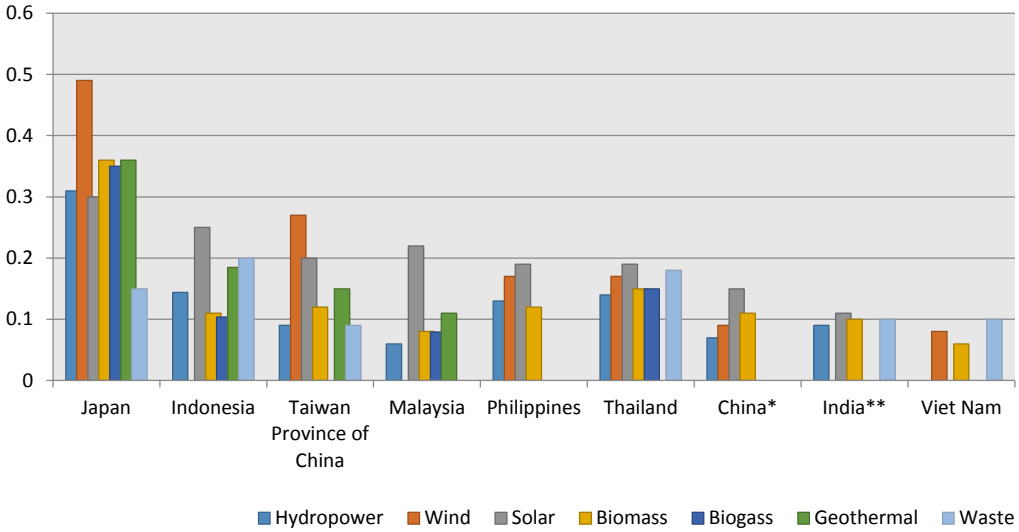
competitiveness through R&D and innovations; increase in the number of players in renewable energy market; and creation of jobs (ESCAP, 2012).

Since its first formulation in the United States in the 1970s and subsequent adoption in many European Union (EU) countries with initiatives in Germany and Switzerland in the early 1990s, many successful examples of dramatic renewable energy growth through effective FIT policies have drawn international attention and led to its recent introduction to developing countries.[10] In the Asia-Pacific region, a FIT is a relatively new policy scheme which has gained momentum since the late 2000s. As of 2016, five out of the 10 ASEAN member countries (i.e., Indonesia, Malaysia, the Philippines, Thailand and Viet Nam) implement FITs to promote growth in the uptake of renewable energy. China and India have also implemented FIT schemes operating either at the national or subnational level since their adoption in 2005 and 1993, respectively.

Figure 14 presents various renewable energy sources (i.e. hydropower, wind, solar, biomass, biogass, geothermal and waste) and their corresponding FIT rates among the ASEAN countries and some major examples in Asia. FITs vary widely in design from country to country, depending on the technology, capacity and location, and payment differentiation is principally based on the calculation of average costs to produce electricity based on the size of the plants and on varying costs for the investment, administration, operation and maintenance of each technology (Mendonça, *et al.*, 2010).

Figure 14: Maximum Feed-in-tariff rates for renewable energy sources by country

US dollars per kWh



Source: The authors based on data from GIZ (2016); IEA (2016b); the Ministry of Economic Affairs of the Republic of China (2015); the Sustainable Energy Development Authority of Malaysia (2016).

[10] The report by the European Commission published in 2008 shows that policies developed to promote renewable energy have been most effectively operated in those member States that use some forms of feed-in-tariff schemes (European Commission, 2008).

Notes: (*) FITs in China vary with the site of power generation, and the above figure represents a general estimation of FITs. (**) FITs in India vary state by state, and the above figure represents the FITs in Uttar Pradesh State for the fiscal year 2016. Data are the latest available.

In a bid to more accurately reflect market prices of energy, some governments (e.g., those of some EU countries) have recently set out to gradually switch from FITs to market-responsive auctioning.[11] The development and gradual fade-out of feed-in-tariffs indicate that FITs require sophisticated and diligent tailoring in their design and management. Setting the optimum level of tariffs for each renewable energy source is challenging as it must avoid imposing budgetary constraints and an excessive electricity price burden for end users while being effective enough to encourage investment. New FIT adopters in emerging Asia are required to be careful in policy design and make timely adjustments to the system to allow for new technological developments and avoid excessive costs and over-subscription.

6. Conclusion

To decouple economic growth from negative environmental impacts such as biodiversity loss, ecosystem degradation and the threat of climate change, which have largely resulted from increasing GHG emissions, particularly from the energy sector, the need for renewable energy sources and technologies has become evident. The adoption of environment-friendly modes of production through the use of renewable energy in many countries has proved that economic growth and preserving the environment can be simultaneously achieved. As emerging Asia is dealing with rapid economic growth and associated massive increases in GHG emissions, the active promotion and expansion of public and private investment in renewable energy is essential.

FDI in the renewable energy sector is a way to overcome such challenges as it has potential to create both direct benefits in terms of economic growth without environmental damage and indirect benefits in the form of acquisition of technology and expertise in the development and use of environment-friendly energy products and services. The creation of green jobs is another important benefit. Those benefits, however, are sustainable only when they are backed by targeted and conducive policies in both home and host countries of FDI, including good public governance, effective trade and investment promotion and facilitation and well-designed economic incentives.

[11] Market-responsive auctioning for renewable energy refers to a scheme where the government puts out a tender to install a certain capacity of electricity from renewable energy technologies. Applicants bid a price per kilowatt- hour for the energy, and the successful bidder meeting certain criteria with the most competitive price signs a power purchasing agreement with the government. Many EU countries with mature renewable energy markets, such as France, Germany and Poland, have blended FIT schemes with tender schemes to support larger-scale renewable energy projects in recent years, in response to European Commission (EC) State Aid guidelines that require a shift to renewable tenders for many projects by 2017 (REN 21, 2016).

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