

# POLICY NOTE ON ASIA

ENERGY CHALLENGES AND  
BUSINESS OPPORTUNITIES  
IN ASIA



INVESTMENT  
ENERGY RISK MANAGEMENT  
INFRASTRUCTURE INNOVATION  
POPULATION GROWTH MIDDLE CLASS  
GREEN GROWTH COMMODITIES  
SKILLS REGULATIONS TRADE  
PRODUCTIVITY  
INDUSTRIALISATION  
CREDIT

# Energy Challenges and Business Opportunities in Asia

This policy note provides insights and policy recommendations from the private sector on energy opportunities and challenges in Asia. The analysis builds on discussions at the OECD Emerging Markets Network (EMnet) meeting on doing business in Asia, “Energy Challenges and Business Opportunities”, held on 14 March 2017 at the OECD headquarters in Paris. It examines the latest macroeconomic and energy trends and provides overview of recent energy policies, highlighting how policy makers are supporting private-sector-led investments in energy generation and energy technologies.

Key messages include:

- Emerging Asia’s energy needs are expected to surge with demand more than doubling in India and Southeast Asia from 2013 to 2040. China is expected to continue to be the largest energy consumer globally.
- Asia provides impressive growth opportunities for both energy and non-energy companies looking to invest in energy generation, energy efficiency or related technologies.
- Energy infrastructure shortages are one of the biggest barriers to growth in Southeast Asia and India. Underdeveloped transmission and distribution grid infrastructures are constraining the benefits of increased generation capacity.
- In contrast, China is facing excess capacity and pollution challenges and is prioritising clean energy and improved efficiency.
- Barriers continue to inhibit investment decisions. Public sector reforms to ease investment restrictions and efforts to lower administrative hurdles can improve Asia’s investment outlook.
- Despite a rapid ramp up in coal energy production, renewable energy will attract the majority of new private investments due to favourable policies and ambitious renewable targets.
- Increased access to affordable long-term finance will unlock further investment from the private sector that will be critical to closing the infrastructure gap in the region.
- The public and private sector will need to further work together to overcome the skills shortage arising from the massive growth in green jobs in the region.

## OECD DEVELOPMENT CENTRE

The Development Centre of the Organisation for Economic Co-operation and Development (OECD) was established in 1962 and comprises 27 member countries of the OECD and 25 non-OECD countries. The European Union also takes part in the work of the Centre.

The Development Centre occupies a unique place within the OECD and in the international community. It provides a platform where developing and emerging economies interact on an equal footing with OECD members to promote knowledge sharing and peer learning on sustainable and inclusive development. The Centre combines multidisciplinary analysis with policy dialogue activities to help governments formulate innovative policy solutions to the global challenges of development. Hence, the Centre plays a key role in the OECD's engagement efforts with non-member countries.

To increase the impact and legitimacy of its work, the Centre adopts an inclusive approach and engages with a variety of governmental and non-governmental stakeholders. It works closely with experts and institutions from its member countries, has established partnerships with key international and regional organisations and hosts networks of private-sector enterprises, think tanks and foundations working for development. The results of its work are discussed in experts' meetings as well as in policy dialogues and high-level meetings, and are published in a range of high-quality publications and papers for the research and policy communities.

For an overview of the Centre's activities, please see [www.oecd.org/dev](http://www.oecd.org/dev).

## OECD EMERGING MARKETS NETWORK

Emerging Markets Network (EMnet) is an OECD-sponsored initiative dedicated to the private sector. Managed by the OECD Development Centre, the Network fosters dialogue and analysis on emerging economies and their impact on global economic, social and environmental issues.

EMnet gathers top executives (chief executive officers, vice presidents, managing directors, chief financial officers, heads of strategy, chief economists) of multinational companies from diverse sectors, willing to engage in debates with high-level policy makers, including heads of state and ministers, and OECD experts.

EMnet events are closed to the public and media and operate under Chatham House rule to encourage open and dynamic discussions on doing business in Africa, Asia and Latin America.

To learn more about EMnet, please see <http://www.oecd.org/dev/oecdemnet.htm>.

## ACKNOWLEDGEMENTS

This Policy Note was written under the guidance of Bathylle Missika, Head of the Partnerships and Network Unit and Senior Counsellor to the Director (a.i), and Lorenzo Pavone, Deputy Head of the Partnerships and Network Unit and EMnet Co-ordinator (OECD Development Centre). The report was prepared by EMnet team members Kate Eklin, Policy Analyst (OECD Development Centre) and Hannah Rothschild, EMnet Trainee (OECD Development Centre).

The analysis is based on discussions at the EMnet meeting held on 14 March 2017 at the OECD headquarters in Paris. This meeting was co-organised by EMnet and the INSEAD Emerging Markets Institute. Particular thanks go to INSEAD Emerging Markets Institute for co-organising the EMnet Asia meeting.

Insights from Federico Bonaglia (Deputy Director, OECD Development Centre) and Kensuke Tanaka (Head of Asia Desk, OECD Development Centre) helped to refine this note. Thanks also go to Prasiwi Ibrahim, David Carnegie, as well as Juita Mohamad of the OECD Development Centre's Asia Desk, for their contributions. The report also benefitted from comments from Siddhartha Roy (Chief Economist at Tata), Anne Miroux and Lourdes Casanova (Johnson Emerging Markets Institute, SC Johnson College of Business at Cornell University).

Finally, special thanks go to Grace Dunphy and Sonja Märki (OECD Development Centre) for their valuable assistance throughout the drafting and publishing process.

The opinions expressed and arguments employed here are the sole responsibility of the authors and do not necessarily reflect the official views of the member countries of the OECD or its Development Centre, or of EMnet members.

This document, as well as any data and map included herein, are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

## ABBREVIATIONS AND ACRONYMS

<b>ADB</b>	Asian Development Bank
<b>AIIB</b>	Asia Infrastructure Investment Bank
<b>ASEAN</b>	Association of Southeast Asian Nations
<b>CCS</b>	Carbon capture and storage
<b>CEEF</b>	Clean Energy Equity Fund
<b>CLM</b>	Cambodia, Lao PDR and Myanmar
<b>CNG</b>	Compressed natural gas
<b>CPEC</b>	China-Pakistan Economic Corridor
<b>ETS</b>	Emission trading system
<b>FDI</b>	Foreign direct investment
<b>GEIDCO</b>	Global Energy Interconnection Development and Cooperation Organization
<b>ICT</b>	Information and communication technology
<b>IEA</b>	International Energy Agency
<b>IFC</b>	International Finance Corporation
<b>LCR</b>	Local content requirements
<b>LNG</b>	Liquefied natural gas
<b>Mtce</b>	Million tons of coal equivalent
<b>NDB</b>	New Development Bank
<b>OECD</b>	Organisation for Economic Co-operation and Development
<b>PPA</b>	Purchasing power agreement
<b>PV</b>	Photovoltaic
<b>SGCC</b>	State Grid Corporation of China
<b>T&amp;D</b>	Transmission and distribution
<b>TPES</b>	Total primary energy supply
<b>TPP</b>	Trans-Pacific-Partnership
<b>TPSDI</b>	Tata Power Skill Development Institute
<b>UHV</b>	Ultra-high voltage

## *Table of contents*

<b>Asia's economic and business overview.....</b>	<b>7</b>
Introduction .....	7
Economic growth will remain robust in Emerging Asia .....	7
Investors continue to be attracted to the region .....	9
Trade integration continues but more work remains to be done .....	10
<b>Energy challenges in Asia.....</b>	<b>11</b>
Challenges vary across the region.....	11
Fossil fuels will be the dominant energy source through to 2040.....	12
Asia takes the lead in renewable energy investment and expansion.....	14
<b>Public policies to expand energy in Asia.....</b>	<b>17</b>
Infrastructure expansion is supporting private investment in energy .....	17
Public policies to support investment in renewable energy.....	19
Public policies to reduce fossil-fuel subsidies and price emissions.....	22
<b>Business insights on energy challenges and evolving opportunities .....</b>	<b>23</b>
Asia's renewable energy market is attracting the private sector .....	23
Investment in Asia still faces roadblocks .....	25
Financing Asia's energy expansion .....	27
New skills are needed for a growing energy sector .....	30
<b>Conclusion .....</b>	<b>32</b>



# ASIA'S ECONOMIC AND BUSINESS OVERVIEW

## Introduction

Emerging Asia will continue to grow at a steady pace and energy demand will surge across Asia in the coming decades which will require significant investment from local and international firms. The International Energy Agency (IEA) projects large increases in Total Primary Energy Supply (TPES) in the region. The TPES is an indicator of energy demand and consumption and is expected to rise by 60% between 2013 and 2040 in Emerging Asia (i.e. the People's Republic of China, hereafter, "China"), India and the ten Association of Southeast Asian Nations (ASEAN) member countries. This growth in demand can be attributed to a number of socio-economic factors, including robust and sustained GDP growth, an increasing population, and an expansion of energy access and industrial needs (OECD, 2017a).

This surge will generate several energy challenges in terms of energy access, security and infrastructure. Private investment will be pivotal to unleash Asia's growth potential. Domestic large firms and multinational corporations are already playing a key role in scaling up investment; however technical, administrative and economic barriers continue to hinder higher investment flows into the region (OECD, 2017a).

## Economic growth will remain robust in Emerging Asia

Growth in Asia is resilient. Emerging Asia is expected to grow by 6.3% on average for the period of 2018-22 (Table 1.1). Growth in China will continue to slow and a 6.2% average growth is expected over the same period. While private consumption and investment continue to drive growth, risks remain due to excess capacity and weaknesses in the financial markets. India's growth in 2018 is expected to average 7.3% with private consumption, foreign investment and public spending underpinning this trend. Within the ASEAN-5<sup>1</sup>, the Philippines and Viet Nam are expected to lead economic growth. In the Philippines remittances-driven private consumption and potential increase in infrastructure spending are expected to support growth. For Viet Nam, consumption and exports are the key drivers. Indonesia's growth is expected to remain stable, driven by strong private consumption and an improved enabling environment for investment. Malaysia's average growth will decline softly with private consumption and robust foreign investment largely supporting economic activity. Thailand's growth is expected to improve, due to higher trade and investment flows. The CLM economies (Cambodia, Lao PDR and Myanmar) will continue their strong growth path through 2022 with average 2018-22 growth rates expected to reach 7.2%, 7.1% and 7.3% respectively (OECD, 2018).



Table 1.1. Real GDP Growth in ASEAN, China and India

	Annual percentage change			
	2016	2017	2018-22 (average)	2011-15 (average)
<b>ASEAN-5 countries</b>				
Indonesia	5.0	5.0	5.4	5.5
Malaysia	4.2	5.5	4.9	5.3
Philippines	6.9	6.6	6.4	5.9
Thailand	3.2	3.8	3.6	2.9
Viet Nam	6.2	6.3	6.2	5.9
<b>Brunei Darussalam and Singapore</b>				
Brunei Darussalam	-2.5	0.0	0.5	-0.1
Singapore	2.0	3.2	2.3	4.1
<b>CLM countries</b>				
Cambodia	6.9	7.1	7.2	7.2
Lao PDR	7.0	6.9	7.1	7.9
Myanmar	5.9	7.2	7.4	7.3
<b>China and India</b>				
China	6.7	6.8	6.2	7.9
India	7.1	6.6	7.3	6.8
Average of ASEAN-10	4.8	5.1	5.2	5.1
Average of Emerging Asia	6.4	6.4	6.3	7.1

Note: The cut-off date is 31 October 2017. ASEAN and Emerging Asia are the weighted averages of those of the individual economies in these groupings. Data for India, Lao PDR and Myanmar follow fiscal years. The projections of China, India and Indonesia for 2017 are based on the results from the OECD Economics Department's Short-Term Economic Prospects (STEP) Meeting in October 2017.

Source: OECD Development Centre, MPF-2018 (Medium-term Projection Framework). For more information on the MPF, please see [www.oecd.org/dev/asia-pacific/mpf.htm](http://www.oecd.org/dev/asia-pacific/mpf.htm).

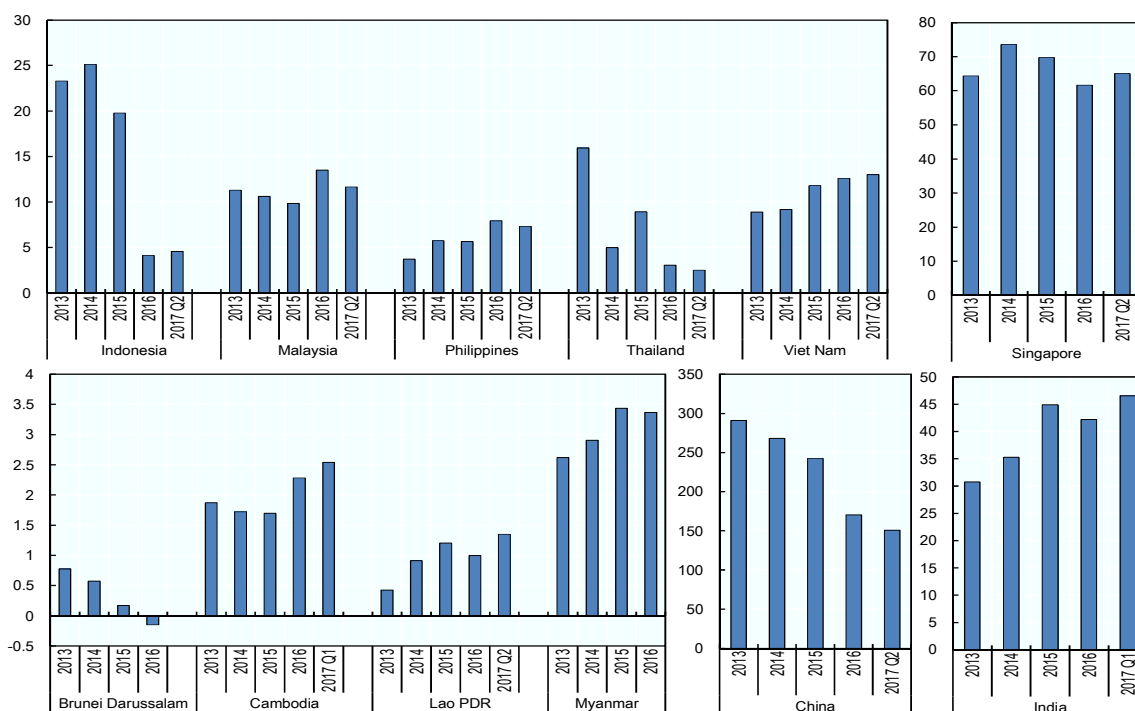
While growth is solid, there are downside risks. One of the risks to Emerging Asia's growth is a faster than expected monetary normalisation in advanced economies. Should interest rate differentials narrow sharply, capital outflow could ensue and can in turn increase currency depreciation pressures. Rising interest rates per se could also spell some difficulties for highly leveraged companies. Moreover, private-sector debt, as a proportion of GDP, has risen substantially in several Asian economies since 2010. China, Singapore and Hong Kong (China) have all seen large increases in both household and corporate debt (OECD, 2018). Finally, any rise in trade restrictions or an increase in global protectionism will create an additional element of risk. Given China's economic weight in the region, any sharp downturns in growth or trade activity can also have an effect on regional trends as a whole (Dizioli, et al., 2016).

## Investors continue to be attracted to the region

Foreign direct investment (FDI) trends are positive and expected to continue. Asia is increasingly becoming the preferred planned destination for future FDI, according to an UNCTAD survey of business executives. After the United States, China and India are top global prospective destinations for foreign investment. Furthermore, Indonesia, Thailand, the Philippines, Viet Nam and Singapore are all among the top-15 host economies for 2017-19 (UNCTAD, 2017).

FDI should continue to grow as trade volumes improve, domestic demand continues to grow and large infrastructure projects are developed. Governments are also pushing to develop information technology industries and are providing incentives to spur investment in the digital economy (OECD, 2018). Governments continue to reduce market access barriers and facilitate investment procedures. In India, retail trade manufacturing is fully liberalised and the bankruptcy code has been simplified. China is developing free trade zones which could be a source of additional investor interest. Viet Nam also undertook reforms in 2017 to improve the investment climate (OECD, 2018).

Figure 1.1. Net foreign direct investment in Emerging Asian countries, 2013-17  
USD billion



Note: Myanmar and India follow fiscal years ending March the following year. Quarterly data are annualised (i.e. 4-quarter sum as of the period indicated).

Source: OECD (2018), drawing from OECD Development Centre calculations based on CEIC, national sources, IMF International Financial Statistics database.

## Trade integration continues but more work remains to be done

2017 marked the 50<sup>th</sup> anniversary of ASEAN and progress towards the ASEAN Economic Community continues to advance. The ASEAN Trade in Goods Agreement has advanced, as countries like Cambodia, Lao PDR, Myanmar and Viet Nam reduced tariffs in 2017. The liberalisation of trade in services remains a priority. Although ASEAN ministers committed to liberalising services by 2015, progress has been slow and there remains work to be done. Trade facilitation is progressing through the ASEAN Single Window initiative which seeks to create a regional platform to exchange border documents for the public and private sector. It is already in operation in Indonesia, Malaysia, Singapore and Viet Nam and the platform in the Philippines is expected to become operational soon (OECD, 2018).

The Regional Comprehensive Economic Partnership (RCEP) free trade agreement has the potential to be a substantial undertaking that goes beyond the existing ASEAN-plus-one agreements<sup>2</sup> and can become a major driver of trade growth. The agreement will require considerable time to finalise, particularly given the large number of countries implicated<sup>3</sup> and the wide variance in development levels across economies. In addition, many countries lack free trade agreements with other participants which will require further efforts to set up new negotiations. The RCEP agreement notably lacks considerations for state-owned enterprises (SOEs) and for government procurement which reduce the likelihood of a level playing field for international and domestic investors. There are also gaps remaining regarding dispute settlements that remain to be clarified, which will limit the impact it terms of economic integration (OECD, 2018). Another major step towards integration, the Trans-Pacific-Partnership (TPP) agreement that was revived in January is expected to be an important driver of trade and potentially generate significant gains in exports for member countries, even without the participation of the United States (Alschner, Seiermann and Skougarevskiy, 2017).

## ENERGY CHALLENGES IN ASIA

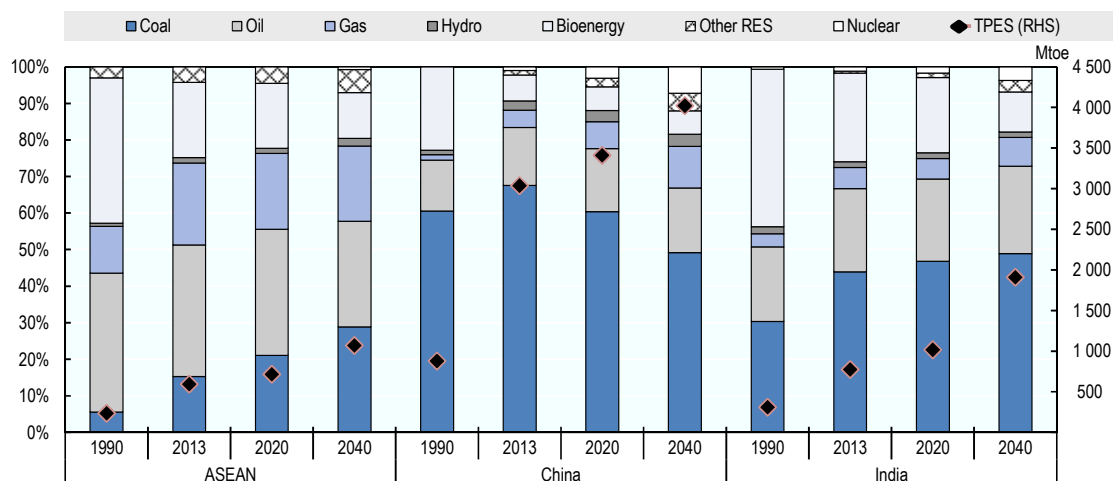
This chapter will focus on the particular issue of energy as a driver of growth for the region and will address opportunities and challenges that energy presents for Southeast Asia, China and India in the medium term.

### Challenges vary across the region

Southeast Asia, China and India show signs of positive economic momentum yet energy issues can be a driver of or, potentially, a drag on growth for the region. While energy is a fundamental factor for growth across Emerging Asia, substantial variation in natural resource endowments, existing infrastructure and technical capacities exist between countries. While the energy supply mix between China, India and Southeast Asia vary (Figure 1.2), energy demand and infrastructure capacities have also stark differences.

China will continue to have the largest share of energy demand in Emerging Asia in 2040; however, its share of the region's Total Primary Energy Supply will decline by 12% between 2013 and 2040 due to a ramp up in energy production in India and in ASEAN countries (IEA, 2015a; IEA, 2015b). India's energy supply has surged ahead with large increases in coal but also in solar and wind. Still, the energy infrastructure gap is holding back social wellbeing and corporate investment in manufacturing (OECD, 2017c). Southeast Asia will double its electricity demand from 2013 to 2040 (OECD, 2017a). To prevent shortages, energy supply needs to increase by 80% over the same period (IEA, 2015b). Consequently, Southeast Asia will face severe infrastructure constraints in the coming decades. The International Energy Agency (IEA) estimates that USD 2.5 trillion is needed to close the infrastructure gap with an additional USD 420 billion needed for investment in energy-efficiency investments (IEA, 2015c).

Figure 1.2. Total primary energy supply in ASEAN, China and India, 1990-2040

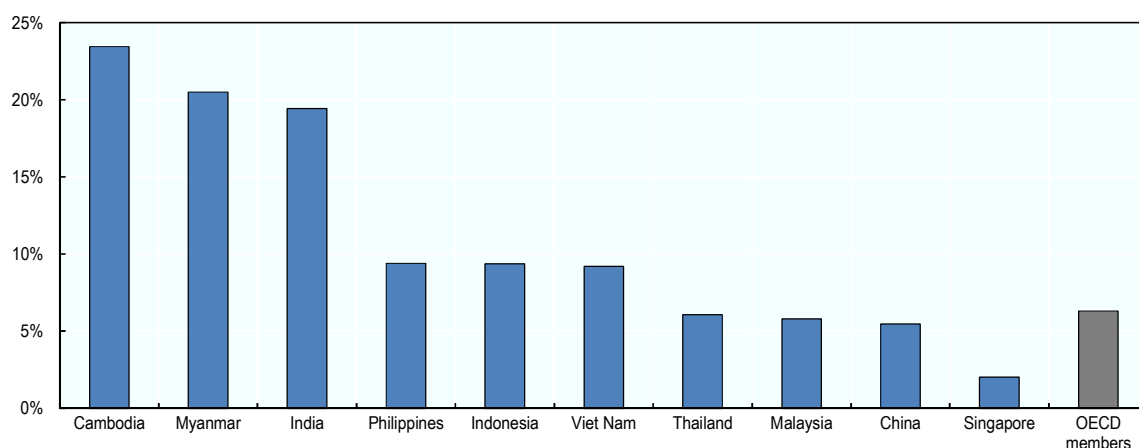


Note: Other RES include wind, solar PV, and geothermal. Calculations are based on IEA's New Policy Scenario.

Source: OECD (2017a), Economic Outlook for Southeast Asia, China and India; OECD Development Centre, based on IEA (2015a), World Energy Outlook 2015; IEA (2015b), World Energy Outlook 2015: Special Report on Southeast Asia.

The quality of energy infrastructure is just as vital as the quantity. Stressed grids and aging infrastructure have led to transmission and distribution (T&D) losses. Within Emerging Asia, Cambodia, Myanmar and India face considerable limitations to the quality of their grid infrastructure, while China's grid sees low losses due to high investment in technological innovations such as ultra-high voltage (UHV) transmission. Singapore, Malaysia and Thailand's low T&D losses also indicate robust grid infrastructure (Figure 1.3) (ADB<sup>4</sup>, 2017).

**Figure 1.3. Electric power transmission and distribution losses in selected Asian countries, 2014**

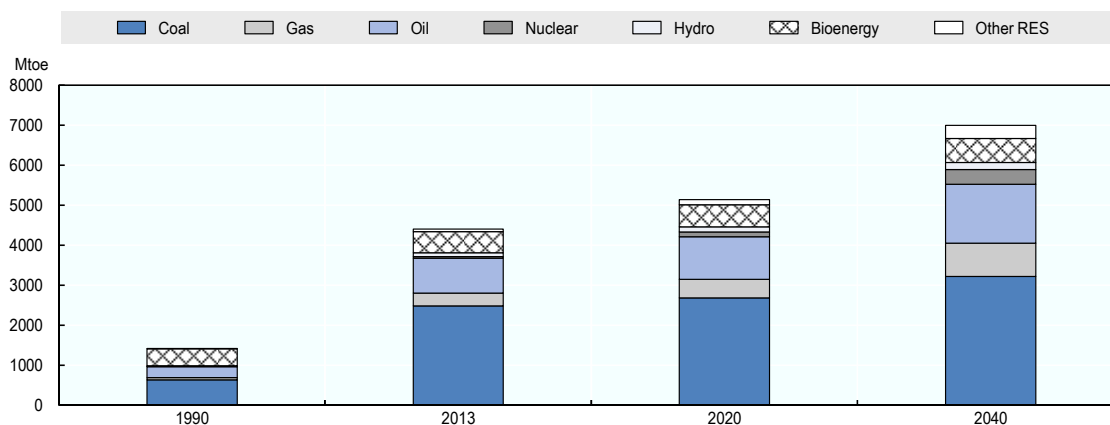


Source: Author's design based on World Bank (2014), World Bank World Development Indicators database (accessed 1 May 2017).

### **Fossil fuels will be the dominant energy source through to 2040**

Fossil fuels are expected to continue to be the most used energy source in Emerging Asia. Fossil fuels' share of total primary energy supply will only decrease from 83% in 2013 to 79% by 2040, despite ambitious plans to accelerate renewable energy production in the region (Figure 1.4). Throughout Emerging Asia, coal is the preferred energy source but this trend has already started to reverse in China with efforts to transition from fossil fuels to cleaner sources. The continued use of fossil fuels has also prompted the adoption of clean energy technologies to curb carbon emissions.

Figure 1.4. Emerging Asia's total primary energy supply by source, 1990-2040



Note: Other RES include wind, solar PV, and geothermal. Calculations are based on IEA's New Policy Scenario.

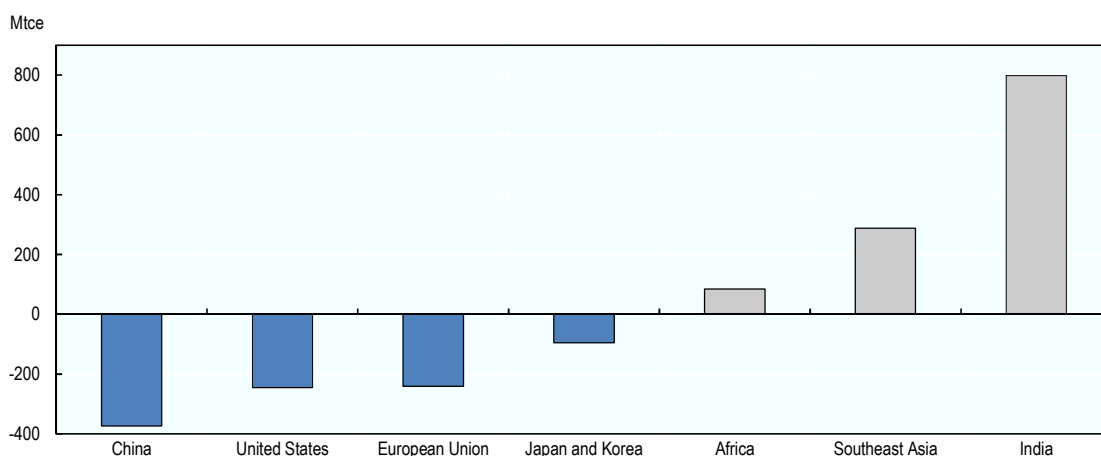
Source: OECD (2017a), *Economic Outlook for Southeast Asia, China and India*; OECD Development Centre, based on IEA (2015a), *World Energy Outlook 2015*; IEA (2015b), *World Energy Outlook 2015: Special Report on Southeast Asia*.

#### Coal demand rises in India and Southeast Asia while declining in China

Coal continues to be the dominant energy source in Emerging Asia. India and China led growth in global coal investment, which increased by an average of 4.7% per year from 2000-10 (IEA, 2016a). While coal investment declines globally, India and Southeast Asia are expected to continue to ramp up coal capacities to meet rapid demand growth as quickly as possible, while also increasing investment in renewables (Figure 1.5) (IEA, 2016a). Southeast Asia's coal demand will triple and see the fastest growth globally at an average of 4.4% per year from 2014 to 2040 (IEA, 2016a). In 2015, India surpassed China as the leading global coal importer and overtook the United States as the second largest coal consumer. India's coal consumption will rise from 540 million tonnes of coal equivalent (Mtce) in 2014 to reach 1 340 Mtce by 2040, equal to 48% of primary energy demand (IEA, 2016a).

In contrast, China's coal use is in decline after peaking in 2013. This is due to slower economic growth and a transition to less energy-intensive sectors. The IEA estimates that over-investment in coal reached 50% in 2012. To resolve over-capacity difficulties, China made a clear pledge to cut investment and transition away from coal as an energy source (IEA, 2016a). The construction of new coal power plants are also being halted; in 2017, 103 plants were cancelled to keep China's total coal generation capacity limited to 1 100 gigawatts (GW) (Forsythe, 2017). China's coal mining capacity will also be reduced by 150 million tonnes (OECD, 2017b). These actions ensure that coal use will decline by a further 13% by 2040 (IEA, 2016a). A reduction in coal will help to curb dangerous air pollution levels that have a severe impact on the country's health and safety. Furthermore, China's shift away from coal investment has allowed global GDP growth to decouple from increases in coal demand (IEA, 2016a).

**Figure 1.5. Change in coal demand by region 2014-40**



Source: IEA (2016a), *World Energy Outlook 2016*, OECD/IEA Publishing, Paris, <http://dx.doi.org/10.1787/weo-2016-en>.

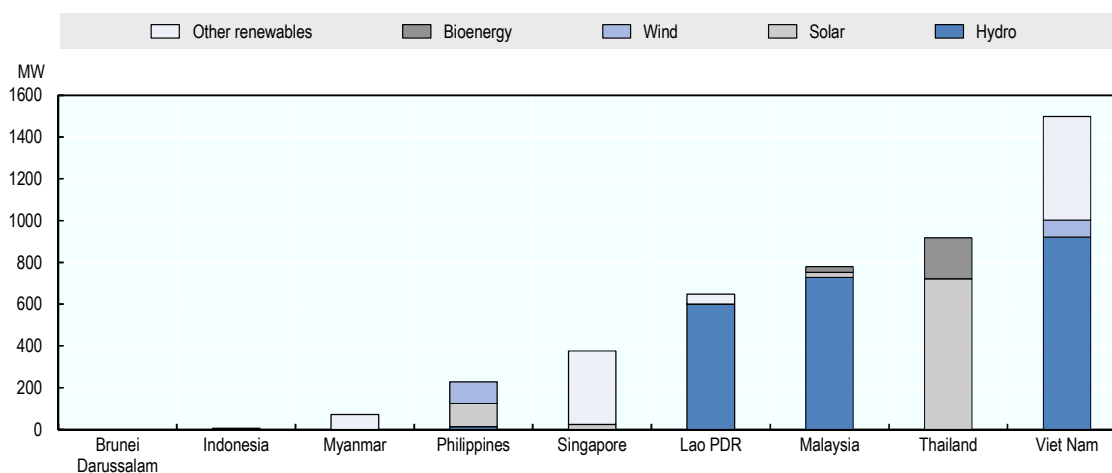
Notably, the IEA estimates that 50% of the coal infrastructure in use by 2040 will rely on outdated technology (IEA, 2015b). For this reason, the continued growth of investment in coal power, to ramp up energy supply, risks creating a surge in CO<sub>2</sub> emissions. Introducing climate-mitigation technologies, such as carbon capture and storage (CCS), as well as retrofitting existing coal infrastructure (IEA, 2016c) are necessary.

### **Asia takes the lead in renewable energy investment and expansion**

Asia has become the leading player in renewable energy, attracting more than half of global renewable energy investment (IEA, 2016a). Firms from Emerging Asia, particularly China, are also increasing their outward foreign direct investment in energy with a notable increase in renewable energy investment (Casanova and Miroux, 2017). Increases in renewable capacities will come from diverse sources (Figure 1.6). By 2021, a third of all solar photovoltaic (PV) capacity and onshore wind generation will be in China (IEA, 2016e). India has rapidly expanded renewables to become the fifth largest global renewable energy investor in 2015 with a focus on wind and solar

technology (OECD, 2017a). Renewables accounted for 17% of ASEAN's energy mix in 2016 (IEA, 2016e). Hydropower accounts for 70% of renewable generation in the region. Meanwhile geothermal generation is expanding in Indonesia and the Philippines, and Thailand's attractive policies led to a surge in solar PV capacity (IEA, 2016e).

**Figure 1.6. New installed capacity of renewable energy by energy source in Emerging Asia, 2015**



Note: Other renewables includes waste, solid, other biofuels, biogas, geothermal.

Source: OECD (2017a), *Economic Outlook for Southeast Asia, China and India*; OECD Development Centre, based on IRENA (2016), *Renewable Capacity Statistics 2016*, and Federal Ministry for Economic Affairs and Energy (2016), *Thailand Solar PV Policy Update 05/2016*.

China is the main overall investment destination, followed by India and Thailand. China attracted the most global investment, totalling USD 90 billion in 2015 with 70% going to solar and wind generation (IEA, 2016c). USD 10 billion was invested in India in 2015, marking a 20% increase from the previous year (IEA, 2016c). Thailand attracted the third-largest share of investment in renewables amounting to USD 1 billion. Indonesia was also able to attract USD 11.9 billion in greenfield foreign direct investment (FDI) in renewables between 2003 and 2016 (OECD, 2017a).

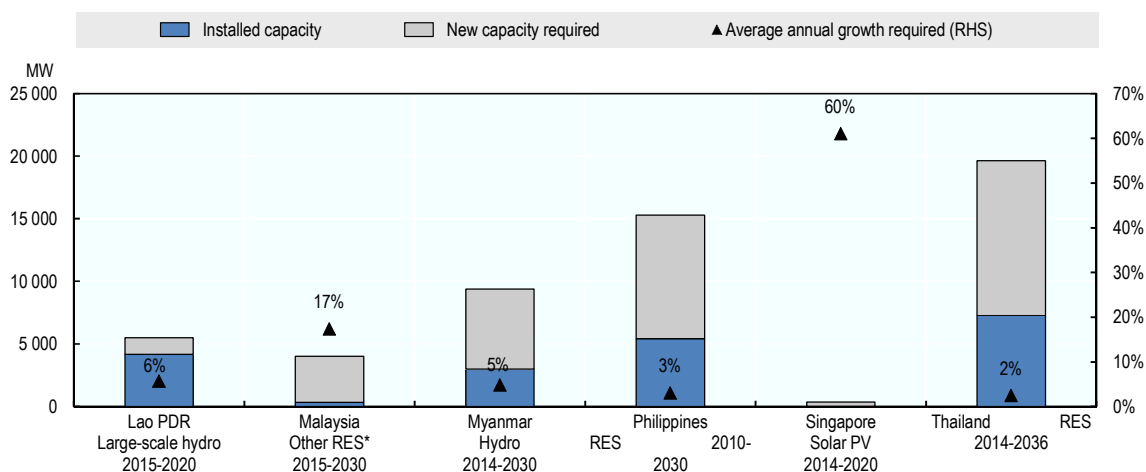
The rapid scale-up in renewable investment has contributed to a decrease in costs making the sector more competitive. For example, India's solar capacity increased by a factor of eight while contract prices halved (IEA, 2016c). The increased competitiveness of renewables can also be reflected in the rising of outward FDI from Emerging Asia. While traditional energy investments in fossil fuels have continued, China and India have shown particular growth in outward FDI in renewable and alternative energies (Casanova and Miroux, 2017).



However, expectations will need to remain realistic due to technological and natural resource constraints, despite Asia's progress in expanding the share of renewables in primary energy demand and success in attracting global investment. Technological limitations such as inefficient battery storage capabilities suppress fully maximising renewable resources. Regional disparities in natural resource endowments hinder more forcefully adopting renewable energy (IEA, 2015c).

This growing market has been supported by global trends and political support from governments. Following the Paris Agreement at the 21<sup>st</sup> Conference of the Parties (COP21), countries pledged to lower carbon emissions and increase renewable energy supply to contain the global rise in temperature to less than 2 degrees Celsius (2°C). China's COP21 announcement outlines plans to increase wind energy to 200 GW and solar to 100 GW by 2020 (IEA, 2016a). India plans to expand renewable energy capacity to 175 GW by 2022 (IEA, 2015b). ASEAN has committed to reaching 23% renewable in their energy mix by 2025 (IRENA & ACE, 2016). On national levels, Southeast Asian countries, with the exception of Cambodia, have adopted individual energy targets. For example, Lao People's Democratic Republic (hereafter, "Lao PDR") and Myanmar set targets aimed at building up the hydropower sector specifically (Figure 1.7) (OECD, 2017a). These targets, in addition to physical infrastructure expansion plans and policies encouraging private participation in renewable energy markets highlighted in the next section, will help to ensure that renewable energy continues to be an attractive investment opportunity. Finally, despite the June 2017 announcement that the United States will cease to implement the Paris Agreement (White House, 2017); Asian economies remain engaged with their climate change goals. In July 2017, G20 economies also reaffirmed their commitment to the Paris Agreement (G20, 2017).

**Figure 1.7. Targets for installed capacity in renewable energy in selected ASEAN member states**



Note: RES=renewable energy source, \*Other RES include biogas, biomass, small-scale hydropower and solar PV. The average annual percentage point increase was calculated from the initial year to the end of the period.

Source: OECD (2017a), *Economic Outlook for Southeast Asia, China and India*; OECD Development Centre, based on national energy plans and Intended National Determined Contributions (INDCs).

## **PUBLIC POLICIES TO EXPAND ENERGY IN ASIA**

For energy supply to keep up with the growth in demand, Asian governments will need to attract further private investments from both local and multinational firms. Sub-national, national and regional initiatives to expand energy infrastructure grids provide strong building blocks for further private investment. In addition, governments have used policy reforms to promote renewable energy investment, ease administrative hurdles and facilitate a transition to a greener economy. The transition to cleaner energy sources is accompanied by cuts in fossil-fuel subsidies and support for carbon pricing.

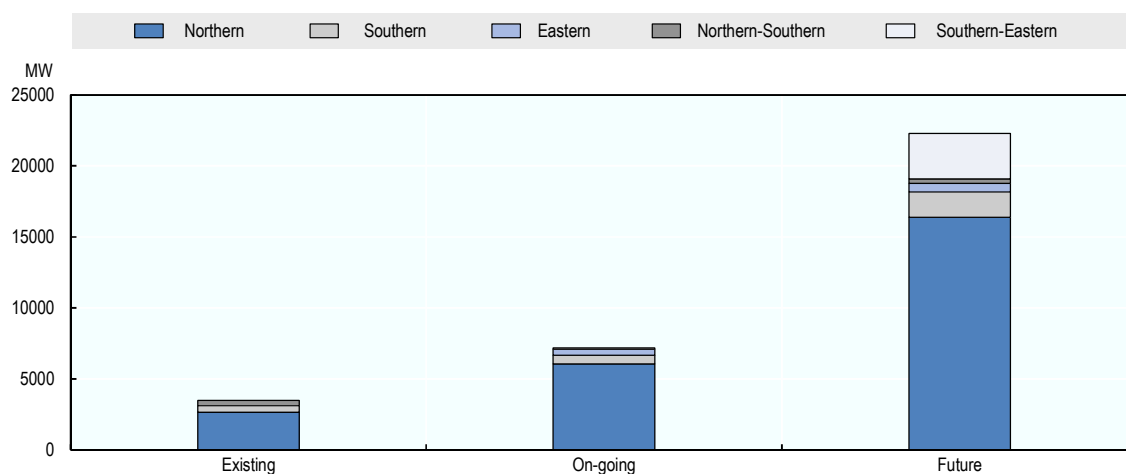
### **Infrastructure expansion is supporting private investment in energy**

Asian governments have prioritised energy infrastructure expansion. This increase in generation capacities and grid networks will improve energy access and security and help to improve the region's investment climate. Poor energy supply is cited as the number one obstacle to growth for firms in Southeast Asia, alongside other barriers such as access to finance, corruption and political risks (ADB, 2016).

Public efforts to expand grid policies are critical to support energy supply increases. The time needed to build grid infrastructure can be considerably longer than installing renewable generation capacities. Thus, even if investment in renewables expands, the increase in energy supply may not be realised if the necessary grid infrastructure is lacking (IEA, 2016a). Finally, participants in the EMnet meeting highlighted how local authorities and local energy agencies have an important role to play to ensure effective and reliable power distribution.

Policies for regional integration initiatives such as the ASEAN Connectivity Masterplan 2025, which includes plans for the ASEAN Power Grid (APG) and the Trans-ASEAN Gas Pipeline (TAGP), can further help catalyse infrastructure growth and attract private investment. The APG has a completed capacity of over 5 000 megawatt (MW) already with an additional 3 300 MW planned to be added to become operational between 2018 and 2021 (Figure 1.8). Progress for the TAGP has been slow, though the creation of liquefied natural gas (LNG) terminals, which can be constructed without the same need for regional co-operation, has progressed faster than the expansion of physical gas in recent years. To expand regional energy infrastructure, governments will need to work together to achieve better synchronisation of legal, regulatory and technical standards (OECD, 2017a).

Figure 1.8. Transmission capacity of the ASEAN Power Grid



Source: OECD (2017a), Economic Outlook for Southeast Asia, China and India; HAPUA Secretariat (2014), *ASEAN Power Grids Interconnection Projects for Energy Efficiency and Security of Supply*, [http://www.carecprogram.org/uploads/events/2014/Regional-Energy-Trade-Workshop/Presentation-Materials/009\\_104\\_209\\_Session3-3.pdf](http://www.carecprogram.org/uploads/events/2014/Regional-Energy-Trade-Workshop/Presentation-Materials/009_104_209_Session3-3.pdf).12 <http://dx.doi.org/10.1787/888933443628>.

Sub-regional projects have also become more frequent and domestic multinational firms are playing a key role in this expansion. India has pursued sub-regional grids through its 2006 Integrated Energy Policy by connecting generation capacities in Bhutan and Nepal to consumption centres in India through inter-state distribution networks. China has led efforts in expanding grid infrastructure through ultra-high-voltage transmission. China is using their state-owned multinational enterprise, the State Grid Corporation of China (SGCC), to lead grid development. The size and strength of State Grid is particularly notable as it is the world's largest utility and second-largest company in the world, according to the Fortune Global 500 ranking (Fortune, 2017). (Box 1.1)

Governments in Asia acknowledge that investment in off-grid and micro-grid energy technologies may be a more cost-efficient option to close the energy access gap for remote areas disconnected from existing infrastructure (IEA, 2016a). Governments encourage such off- and micro-grid options in areas where grid extension costs are very high. For example, Indonesia's 1 000 Islands programme aims to develop hybrid solar-diesel off-grid energy infrastructure in the outer Indonesian islands (IEA, 2015b). The private sector views off-grid solutions as an opportunity for growth due to their flexibility. Engie, a French multinational focused on electricity, natural gas and energy services, has partnered with Electric Vine industries to invest USD 240 million over five years to build smart solar PV micro-grids for 3 000 villages in Indonesia, providing electricity to 2.5 million people (Engie, 2017).

### Box 1.1. China's national and international transmission expansion

China has become a leading player in grid expansion in Asia, driven by their state-owned multinational enterprise, State Grid Corporation of China (SGCC). As the world's largest utility, SGCC has developed ultra-high-voltage (UHV) technology that has facilitated the rapid transmission of renewable energy over long distances. Projected UHV project plans consist of 89 000 km of grid networks by 2020; however, as of 2015, only 11 900 km were in operation.

These investments will facilitate energy transmission from the resource-rich western provinces to major demand centres in the east. Thus, renewable energy investment in rural areas will be able to access consumers in high-demand manufacturing regions, overcoming the geographic boundaries impeding energy targets for decarbonisation set by the government.

This technology is expected to further integrate China's national grid as well as help to connect other grids. Global Energy Interconnection Development and Cooperation Organization (GEIDCO), an NGO based in Beijing focused on sustainable energy development, aims to promote SGCC's grid and the 5+1 strategy that will connect five grids (Northeast Asian, Southeast Asian, Middle Asian, South Asian, West Asian) to the China grid. This grid interconnection will help to transmit clean energy produced in northern China, Mongolia and the Russian Federation to China and Japan as well as increase the development of grid infrastructure in South and Southeast Asia. GEIDCO envisions the creation of similar regional grids on other continents through the creation of development plans, standardization of technical requirements and by promoting international co-operation on research and innovation. These grids could eventually be merged to create a trans-continental "Global Energy Interconnection" (GEI)

Sources: GEIDCO (2016), *Intracontinental Interconnection*, [http://www.geidco.org/html/qnycoen/col-2015100789/-column\\_2015100789\\_1.html](http://www.geidco.org/html/qnycoen/col-2015100789/-column_2015100789_1.html); IEA (2016c), *World Energy Investment Report 2016*, OECD/IEA, Paris, <http://dx.doi.org/10.1787/9789264262836-en>; International Electrotechnical Commission (IEC) (2016), *Global Energy Interconnection*, White Paper, <http://www.iec.ch/whitepaper/pdf/iecWP-globalenergyinterconnection.pdf>; The Lantau Group (2016), *UHV Lines: Shaping the Future of China's Power Sector Landscape*, [http://www.lantaugroup.com/files/tlg-china\\_uhv\\_jan16.pdf](http://www.lantaugroup.com/files/tlg-china_uhv_jan16.pdf). Xinhua (2017), "Asian Energy Interconnection Inevitable For Cleaner Future: Chinese Expert", China Daily, 18 January, [http://www.chinadaily.com.cn/business/2017-01/18/content\\_27988738.htm](http://www.chinadaily.com.cn/business/2017-01/18/content_27988738.htm).

### Public policies to support investment in renewable energy

With grid infrastructure in place, a number of policies have helped to encourage private investment in renewable energy including feed-in tariffs, efficient pricing mechanisms and tax breaks. In addition, energy efficiency and renewable energy expansion is further supported by fossil-fuel subsidy reforms and carbon pricing (Table 1.2).

**Table 1.2. Renewable energy policy supports in Emerging Asia**

Country	Economic support policies and fiscal incentives								Regulatory support	
	Feed-in tariff	Capital Subsidy grant or rebate	Public investment, loans or grants	Tax relief	Net metering	Auction schemes	Carbon Pricing	RPS	RE Act/Law (REA)/(REL)	RE Action Plan/Roadmap
<b>ASEAN</b>										
Brunei Darussalam										
Cambodia										
Indonesia	✓	✓	✓	✓		✓			2014 Geothermal	Roadmap NRE 2015-25
Lao PDR				✓						
Malaysia	✓	✓	✓	✓		✓			2011 REA	2010 FIT RE Action Plan
Myanmar				✓						
Philippines	✓	✓	✓	✓	✓			✓	2008 REA	NREP 2011-30
Singapore		✓		✓						
Thailand	✓	✓	✓	✓						AEDP 2015-36
Viet Nam	✓	✓		✓						REDS 2015-30
<b>China and India</b>										
China	✓	✓	✓	✓		✓	✓		2005 REL	13 <sup>th</sup> FYP 2016-20
India	✓	✓	✓	✓	✓	✓	✓			

Source: OECD (2017a), Economic Outlook for Southeast Asia, China and India; OECD Development Centre, based on ASEAN Centre for Energy (2016), ASEAN: Renewable Energy Policies; REN21 (2016), Renewables 2016 Global Status Report.

Feed-in tariffs are a vital tool used by most Emerging Asian countries. Feed-in tariffs provide long-term purchasing power agreements (PPAs) to energy producers often with guaranteed access to the grid and priority dispatch (Table 1.3). As such, feed-in tariffs are able to reduce both price and volume risks for investors. Thailand's Adder programme, launched in 2007, featured attractive fixed feed-in premiums for solar energy through PPAs, which saw solar PV investment expand rapidly. Subsequently, Thailand introduced a new feed-in tariff scheme in 2015 (OECD, 2017a). Meanwhile, other Southeast Asian nations, such as Viet Nam and Indonesia, have not yet set feed-in tariffs that are attractive enough for investors (IEA, 2016c).

Table 1.3. Comparison of FIT systems in ASEAN-5, China and India

Country	Technology						Tariff differentiation					Funding			Design features		
	Bioenergy	Geothermal	Hydropower	Municipal waste	Solar PV	Wind power	Capacity size	Location	Technology	Voltage of grid	Peak/Off-peak	Rate payer	Tax payer	State electricity board	Duration(years)	Guaranteed grid access	Degression rates
<b>ASEAN-5</b>																	
Indonesia	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓			20		
Malaysia	✓	✓	✓		✓		✓		✓			✓			16-21	✓	✓
Philippines	✓		✓		✓	✓			✓			✓			12-20	✓	✓
Thailand	✓		✓	✓	✓	✓	✓	✓	✓			✓			10-20		
Viet Nam						✓					✓	✓			20		
<b>China and India</b>																	
China	✓		✓		✓	✓		✓	✓			✓			20	✓	
India*	✓		✓	✓	✓	✓	✓	✓	✓				✓		13-35	✓	

**Recent policy highlights:**

- **Indonesia: New government decree on solar FITs in July 2016**
- **Thailand: Replaced Adder programme with FIT PPAs in 2015**

Note: \*FIT systems have been introduced on a state-level in India.

Source: OECD (2017a), Economic Outlook for Southeast Asia; OECD Development Centre, based on ASEAN Centre for Energy (2016), ASEAN: Renewable Energy Policies; Federal Ministry for Economic Affairs and Energy (2015), Wind Energy in Viet Nam: Potential, Opportunities and Challenges; Government of India Ministry of New and Renewable Energy (2015), Augmentation and Maintenance of the Indian Renewable Energy and Energy Efficiency Policy Database (IREED): March 2015 Summary Sheet – Policies and Regulation; The Climate Group (2015b), RE100 China Analysis: April.

Policy instruments that are designed to achieve efficient energy pricing will help to attract private investors. Accurate tariff setting, particularly for renewable energy through FITs or long-term PPAs, will increasingly be done through competitive auctions. China, India and Indonesia have already used this tool to uncover accurate production costs for renewable energies and set feed-in tariffs accordingly (OECD, 2017a). Competitive auctions have reduced contract prices for renewable energies. Better pricing has reduced the risk outlook for renewable energy and decreased financing costs (IEA, 2016e).

Time-of-day pricing can also decrease pricing risks for investors. It helps to limit supply shortages by encouraging energy users to self-regulate around peak and off-peak energy times. Thailand, for example, differentiates between peak and off-peak pricing and has improved the investment outlook by increasing revenues for renewable producers who are active during off-peak hours and works in conjunction with FIT policies (OECD, 2017a).

Tax breaks and financial incentives are helping to draw renewable investment into Asia. India offered a ten-year tax holiday for companies that would be able to feed renewable energy into the grid before March 2017 (KPMG, 2015). India offers further tax and fiscal incentives by limiting taxes on engineering and construction procurement that can amount to 10-20% of renewable project costs (KPMG, 2015). Viet Nam lowered its corporate tax from 22% in 2014 to 20% in 2016 and increased competition laws. China offers a corporate tax rate of 15% for new technology companies in solar, wind, geothermal and biomaterial energy. China includes value-added tax (VAT) refunds on the sale of wind power, self-produced solar PV and bioenergy as an additional incentive for investment in renewable energy (KPMG, 2015).

### **Public policies to reduce fossil-fuel subsidies and price emissions**

Asian governments also recognise that to make renewable energy investment attractive, fossil-fuel subsidies will need to be removed. This policy shift was facilitated by lower oil prices as well as by the political momentum arising from regional co-operation initiatives, the Group of Twenty (G20) pledge to phase-out inefficient fossil-fuel subsidies, which includes China, India, Indonesia, Japan, and Korea, as well as COP21 commitments. In addition, carbon pricing and emission trading systems will incentivise more green investments in Emerging Asia.

Many governments in the region have already started phasing out fossil-fuel subsidies. In 2014, fossil-fuel subsidies in Southeast Asia totalled USD 36 billion but proved to be inefficient at targeting poor and vulnerable households (IEA, 2015b). Since then, Indonesia, Malaysia, Myanmar and Thailand have been very effective at phasing out fossil-fuel subsidies. Indonesia and Malaysia removed gasoline and diesel subsidies. Thailand regulated prices for compressed natural gas (CNG) in July 2016 (IEA, 2016a). India slashed its fossil-fuel subsidy expenditures from USD 38 billion to USD 19 billion between 2014 and 2015, while its subsidies for renewable energy increased by almost 40% to USD 2 billion (IEA, 2016a).

Taxes on carbon emissions will also affect energy prices. However, only India and China have implemented carbon pricing policies to date. China will roll out its national cap and trade carbon emissions system in 2017, after a number of successive emission trading system (ETS) pilots. China's national ETS targets four billion carbon tonnes worth of emissions and can have a substantial global impact as China is responsible for 27% of all carbon emissions (OECD, 2017b). This will have wide-ranging effects on the country's economy as the ETS will cover six sectors across all provinces, with implications for 10 000 businesses (Hongliang, 2016). It is also likely that other emerging economies in Asia will follow suit and develop their own individual ETS.

## **BUSINESS INSIGHTS ON ENERGY CHALLENGES AND EVOLVING OPPORTUNITIES**

Participants at the EMnet business meeting agreed that Asia is at the heart of future opportunities for growth, including in the energy sector. A number of countries, including India, Myanmar and Indonesia, are undertaking policy reforms to attract private companies to bridge the infrastructure gap (OECD, 2017a). Ongoing progress in removing restrictive regulations and introducing more transparent legal frameworks has improved Asia's attractiveness for business. This section features insights from the EMnet Asia meeting held in Paris on 14 March 2017 and explores where the private sector sees new opportunities for energy investment, particularly in renewable capacity expansion. It highlights barriers hindering investment, including unpredictable policies, regulatory constraints, limited financing tools and skills mismatches. Ultimately, it provides recommendations and solutions from business leaders' perspectives.

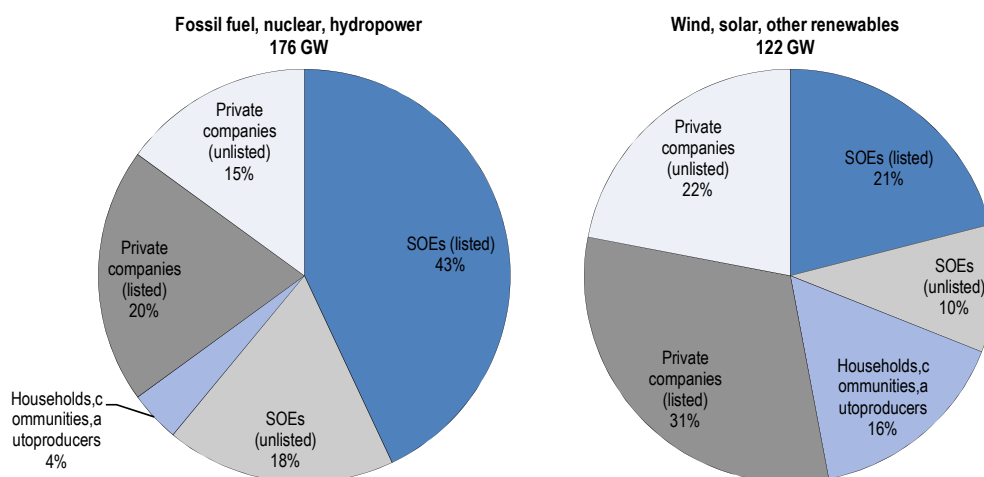
### **Asia's renewable energy market is attracting the private sector**

Energy expansion in emerging economies has principally been demand driven (IEA, 2016a). This is clearly the case for Asia's thriving energy sector. An ongoing surge in energy demand provides attractive opportunities for both large-scale global energy companies and small independent power producers. Participants highlighted that the slowdown in energy demand in other global economies has added to Asia's attractiveness as a main investment location. In addition, clear renewable energy targets set by governments are sending a signal to companies looking for long-term investment opportunities (OECD, 2017a).

The private sector favours investment in the renewable energy sector. After telecommunications, the power sector is the second-largest destination for private investment in infrastructure in Developing Asia<sup>5</sup>, based on analysis by the Asian Development Bank (ADB, 2017). China, India and Indonesia attracted more than 60% of the region's greenfield FDI inflows in renewable energy (OECD, 2017a). Globally, 55% of renewable power generation capacities are owned by private companies, compared to only 35% private ownership of fossil-fuel generation capacities (Figure 1.9) (IEA, 2016c).



Figure 1.9. Ownership of global power generation capacity commissioned in 2015



Note: SOE = state owned enterprise; plants with mixed ownership are fully attributed to the majority owner.

Sources: IEA (2016c), World Energy Investment Report 2016. Calculations based on Platts (2016), World Electric Power Plants Database; Bloomberg LP (2016), Bloomberg Terminal; Bloomberg New Energy Finance (BNEF) (2016a), Renewable Energy Projects.

Asia is attracting the highest amount of private investment due to decreasing technology costs and innovation capacities. For example, solar PV technology costs in China are 15% lower than the global average (IEA, 2016c). This rise in investment is producing new opportunities for the private sector. For example, the Spanish wind turbine company Gamesa has invested heavily in Asia. This confidence has paid off as the company has realised substantial growth with a 34% market share in India. The region now constitutes 50% of Gamesa's sales, mainly in India, the Philippines and China (Reve, 2016). Asian firms are also increasingly looking to the energy markets for outward FDI both within neighbouring Asian countries and beyond. There is strong growth in outward FDI from both China and India in renewable energies (Casanova and Miroux, 2017).

### Non-energy companies see new opportunities in the energy sector to generate more profits

The investment potential of Asia's energy demand and growing consumer base will not only benefit energy companies; other international companies not traditionally involved in the energy sector are becoming new players as energy producers. Diversification into energy is a strategic way for companies to access new revenue streams or cut costs by reducing energy consumption from the grid. Examples of companies that have entered the energy market include Indian multinational conglomerate Tata and Tereos, a French sugar, starch and ethanol company. Tata Power, a Tata group subsidiary, has an installed capacity of over 10 000 MW, a third of which is renewable, making it India's largest renewable energy company (Tata Power, 2017a). High energy needs encouraged Tereos to find alternatives to fossil fuels by including co-generation facilities in their corn and wheat facilities in China. There, the company uses by-products to generate renewable energy, cut energy costs and reduce carbon emissions (Tereos, 2016).

### Technology has opened up new market opportunities in environmental technologies

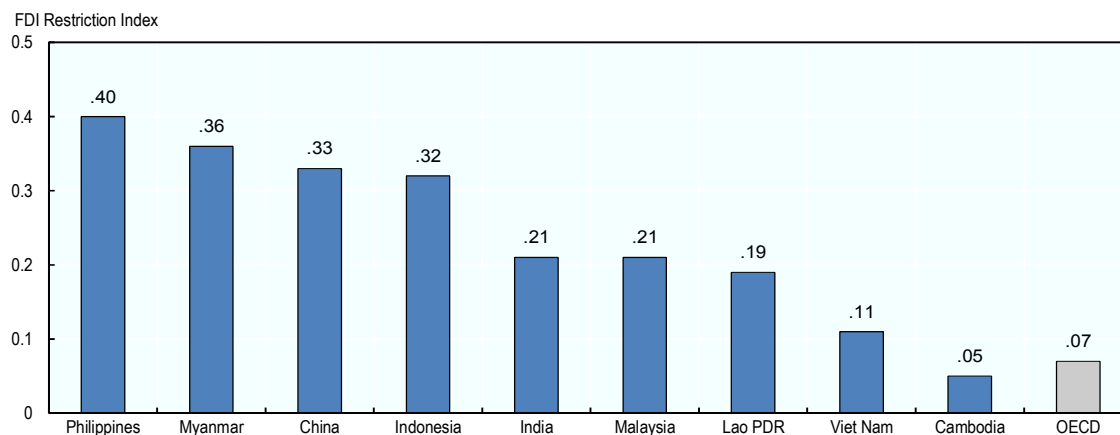
The private sector is well placed to lead innovation in environmental technology and energy efficiency solutions. The region's continued expansion of fossil fuels, predominantly coal, will create a large market for carbon capture and storage (CCS), technologies and techniques that allow for CO<sub>2</sub> to be captured, transported and stored. While EMnet participants were concerned about the high costs of these technologies, further national commitments to climate change adaptation and stringent emission limits are expected to support the development of new and more efficient environmental technologies.

Energy digitalisation is also being led by the private sector to increase energy efficiency through smart technologies such as sensors, smart grids and digital management systems, especially in cities. In 2016, Singapore signed partnership deals worth USD 10 million with five private companies through the Singapore Power Centre for Excellence. The centre was launched in 2015 to support innovative energy pilot projects. Companies such as GE's Grid Solutions, NEC and IJENKO will provide smart grids and energy analytic platforms for cities (GE, 2016; IJENKO, 2016).

### Investment in Asia still faces roadblocks

While showing promising growth, investment in Emerging Asia continues to face policy hurdles including policy unpredictability, restrictions on foreign ownership and stringent local content requirements (LCR) that can significantly restrict foreign investment (Figure 1.10). Participants at EMnet Asia 2017 highlighted these aspects as barriers to business expansion and provided insights on how governments can improve the overall investment climate.

Figure 1.10. FDI Restriction Index in selected Asian countries



Note: Includes all types of restrictions.

Source: Author's design based on OECD (2016b), *FDI Regulatory Restrictiveness Index* (accessed 15 May 2017).

### **Predictable policies and stable environments can facilitate investment**

Participants at EMnet Asia 2017 stressed the need for a predictable policy framework to attract more private investment in the energy sector (OECD, 2015b). Short-term policies and retroactive changes make investors wary about the unforeseen impact these sudden shifts can have on long-term fixed investments, such as power plants or grid enlargements. Even if policies are made transparent and comprehensive, participants highlighted specific areas of concern including energy prices, grid access and carbon pricing. These three aspects crucially influence the private sector's long-term planning for investments as they impact the prospects of future returns.

With the marginal costs of renewable energy continuing to decline, combined with more accurate energy tariffs, energy prices are expected to decrease. However, how this will impact private energy producers who have signed long-term PPAs remains uncertain. Should governments enforce energy tariff reductions, companies may face increased difficulty to repay investment costs. Current policies for competitive bidding auctions for energy projects are also pushing down energy prices to very low levels, which decrease the prospective return on investment in the energy sector. This combination is creating uncertainty and potential future risk.

FIT policies have been used as a mechanism to attract private energy producers into the grid through guaranteed grid access. However, after reaching renewable contribution goals, certain countries are removing support policies that prioritise private producers. For investment to continue, countries need to clarify the extent and lifespan of FIT policies as well as make sure that any policy changes regarding subsidies and grid access are foreseeable for companies making long-term investments (OECD, 2015b).

Carbon pricing will also benefit from predictable and transparent planning. Policy instruments like ETS or carbon taxes will help companies internalise the environmental costs of carbon emissions. Participants are in favour of carbon pricing and ETS and are aware that it will help to generate a more competitive and equal energy market. In 2016, the Indian multinational Mahindra & Mahindra was the first company in Asia to implement an internal carbon pricing at USD 10 per tonne of carbon emitted. The carbon price will help the company achieve its pledge of a 25% reduction in greenhouse gas emissions in three years (Mahindra & Mahindra, 2016).

### **Restrictions on foreign investment remain a challenge to attract investment**

Foreign ownership restrictions for energy projects have been highlighted as an important barrier to FDI in Asia. For example, energy projects in the Philippines only allow a 40% foreign equity stake (OECD, 2017a). In Malaysia, energy companies may not exceed 49% foreign ownership if they wish to be eligible for FITs. Indonesia also inhibits foreign companies from participating in FIT bidding schemes unless they partner with local firms for tax registration purposes (OECD, 2017a). Policies limiting foreign ownership can act as a substantial deterrent for private sector investment in energy infrastructure as well as for FDI overall. Allowing majority ownership for foreign firms can attract regional and international multinational investors who are willing to share investment risks and provide new technology and innovations. On the opposite end of the spectrum, some countries have opened up the renewable sector to full foreign ownership in an effort to rapidly increase capacities. For example, Myanmar allows 100% foreign ownership in hydropower as it attempts to increase energy capacities in the sector.

### Local content requirements need to be aligned with domestic capacities

Local content requirements (LCRs) are policies set by governments that require firms to use domestically manufactured goods or domestically supplied services to operate in an economy (OECD, 2016a). However, LCRs can act as a constraint on foreign investment (OECD, 2015a). The OECD's *Policy Guidance for Investment in Clean Energy Infrastructure* specifies that personnel requirements and other related LCRs may limit an important source of investment by preventing the integration of independent power producers in the energy industry. LCRs can pose the following problems for foreign investors: 1) Strong LCRs make investors dependent on the capacity and quality of local supply chains. 2) It may prevent cost-competitiveness as investors may not be able to import lower-cost inputs from other markets. 3) It poses a technology risk by requiring investors to use local technology from local manufacturers that may be more expensive and less effective than technology from more developed markets (OECD, 2015b).

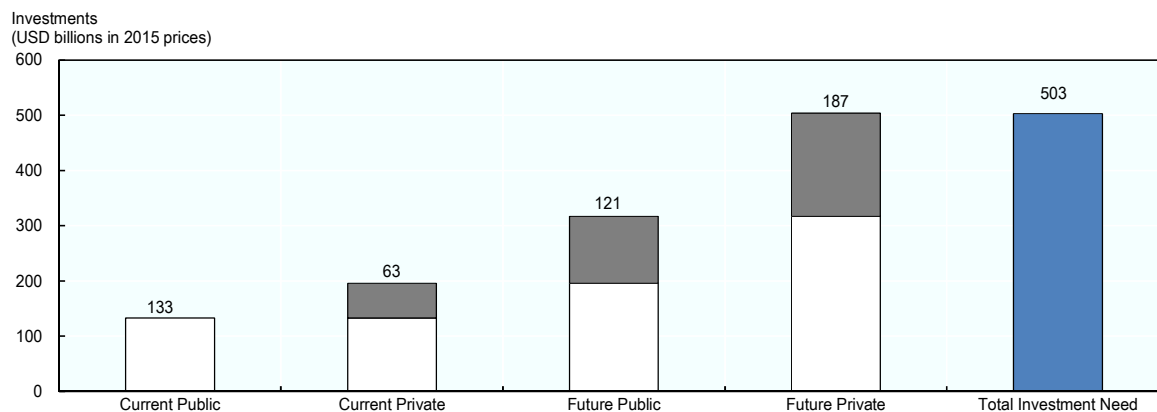
Companies at the EMnet Asia business meeting felt that certain LCRs may prevent foreign investment. This is because local manufacturing capacities may be at a lower standard or that the quality of input goods is insufficient. This can lead to inefficiencies, higher costs or poorer final products. While acknowledging the potential valuable contribution of LCRs for economic development, companies suggested that they should be carefully adapted to the local context to benefit both domestic communities and foreign investors.

Some countries in Asia have more capacity and better developed value chains to ensure that LCRs are not prohibitive for foreign investors. Participants suggested that India and China are markets in which LCRs are manageable. Sometimes, less developed economies decide not to implement LCRs as the government recognises that it does not have the local capacity required. Myanmar, for example, has made exemptions for LCRs in its oil and gas sector to attract foreign investment (IEA, 2015b). Participants highlighted that LCRs will not lead to substantial job creation necessarily, as manufacturing jobs account for less than 40% of total job creation in the clean energy sector (OECD, 2015a).

### Financing Asia's energy expansion

Financing gaps for infrastructure investment in Asia are considerable. The Asian Development Bank estimates that Developing Asia<sup>5</sup> requires USD 503 billion of infrastructure investment to meet future needs but faces an investment gap of USD 308 billion between 2016-20 – the majority of which the private sector is expected to meet (ADB, 2017). However, private investment in infrastructure in Asia only amounted to an estimated USD 63 billion in 2016 (Figure 1.11) (ADB, 2017).

**Figure 1.11. Meeting the Investment Gaps: Selected ADB Developing Member Countries\*, 2016–2020**



Note: \*Selected countries include: Afghanistan, Armenia, Bangladesh, Bhutan, Cambodia, India, Indonesia, Fiji, Kazakhstan, Kiribati, Kyrgyz Republic, Malaysia, Maldives, Marshall Islands, Federated States of Micronesia, Mongolia, Myanmar, Nepal, Pakistan, Papua New Guinea, Philippines, People's Republic of China, Sri Lanka, Thailand, Viet Nam.

Source: ADB (2017) *Meeting Asia's Infrastructure Needs*; ADB (2016a); Country sources; Investment and Capital Stock Dataset, 1960–2015, IMF; Private Participation in Infrastructure Database, World Bank; World Bank (2015a and 2015b); World Development Indicators, World Bank; ADB estimates.

However, companies looking to Asia for investment expressed that underdeveloped financial markets create difficulties for private investment. The lack of long-term finance for critical energy projects remains an obstacle that prevents many projects from taking place. Participants highlighted that this is due to local banks preferring short-term maturities, but other limitations include a lack of banking competition, poor risk assessment for projects and an aversion for lending to new actors such as foreign private firms (OECD, 2015b). Asia's need for infrastructure is vital and a number of innovative financing tools such as green bonds are helping to improve the outlook for investment opportunities. However, participants highlighted how a shortage of accessible local financing options for infrastructure projects in Asia can expose investments to currency risk if foreign capital is utilised. Furthermore, investment projects in risky geopolitical areas struggle to attract sufficient capital to break ground and will require strong partnerships to find financing solutions.

### Public finance and new tools to attract private investment

Multilateral development banks such as the Asian Development Bank (ADB) provide an important source of financing. In total, these multilateral banks supported 2.5% of infrastructure investment in Developing Asia. This percentage increases to over 10% if China and India are excluded. The ADB sees infrastructure as an essential sector for growth and will increase its annual loan and grant approval to USD 20 billion per year by 2020 (ADB, 2017). There are also new players among multilateral development banks, notably the New Development Bank (NDB) and the Asia Infrastructure Investment Bank (AIIB) launched in 2015 and 2016 respectively. The NDB, sometimes known as the BRICS development bank, is jointly owned by Brazil, the Russian Federation, India, China and South Africa. The New Development Bank has a strong focus on

infrastructure, particularly clean energy, water and transport (NDB, 2017). It is also using green financing instruments such as green bonds (NDB, 2017). The AIIB is led by China and aims to expand infrastructure and support regional connectivity projects. As part of its draft energy sector strategy *Sustainable Energy for Asia*, the AIIB will support renewable and clean coal investments in developing countries to promote sustainable infrastructure, cross-country connectivity and private capital mobilisation (AIIB, 2017).

Governments are looking into how to leverage public funding to attract private investment, including through blended finance. For example, the Indian government has set up the Clean Energy Equity Fund (CEEF) for both private and public companies (USD 2 billion) to attract investment into renewable energy generation for New Delhi. This project is part of a wider renewable energy programme that seeks to attract USD 175 billion in investment (Das, 2016). Domestic green investment banks have prioritised renewable energy expansion with a focus on solar PV and wind generation (OECD, 2016c).

The development of green bonds is another way to stimulate private investment in renewable energy and green technologies. Green bonds are fixed income securities that are pledged to projects with a positive environmental impact. Globally, the market for green finance has grown rapidly with USD 95 billion of investment capital raised in 2016 through green bonds compared to USD 3 billion in 2011 (OECD, 2017d). Green bonds can help increase available finance for infrastructure in Asia but it is still in its infancy in the region. However, Hong Kong has outlined a strategy to become a regional green finance hub (Box 1.2). Hong Kong is not the only Asian economy looking to grow its green financial market. Japan, Indonesia, Malaysia and Singapore have made progress on their own initiatives (FSDC, 2016). As of 2016, China has also issued several green bonds to the value of USD 8 billion, some of which are backed by renewable energy assets (IEA, 2016c).

### Box 1.2. Hong Kong as a green finance hub for Asia

Hong Kong, China sees green finance as an opportune area for growth to increase its standing in the international bond and project finance market. The Financial Secretary's budget speech for 2016/17 highlighted that the government will support the development of Hong Kong's bond and infrastructure financing markets. This commitment was influenced by the People's Bank of China's estimate that over USD 1.5 trillion will be needed in China alone to finance green projects during the 13<sup>th</sup> Five Year Plan.

Hong Kong's green bond market will leverage financial capital for renewable energy investment. This capital will be crucial to achieve the goals outlined in Hong Kong's Climate Action Plan 2030+ that include reducing per capita carbon emissions from 6.2 tonnes to 2.3-3.8 tonnes and cutting overall carbon emissions by 26-36% by 2030. Notable green bonds that were issued in 2016 in Hong Kong include a USD 500 million bond (2.875%) from Link Asset Management Ltd. It was the first green bond from an Asian property company and will be used to develop an energy-efficient office development in East Kowloon. MTRCL, the Hong Kong rail network operator, issued a ten-year USD 600 million green bond (2.5%) to speed up investment in environmental performance.

Sources: Environment Bureau of Hong Kong, China (2017), Hong Kong's Climate Action Plan 2030+. [www.climate-ready.gov.hk](http://www.climate-ready.gov.hk); Financial Services and Development Council, Hong Kong (FSDC) (2016), *Hong Kong as a Regional Green Finance Hub*. FSDC Paper no. 23. <http://www.fsdcc.org.hk/sites/default/files/Green%20Finance%20Report-English.pdf>.

### **Exposure to currency risk remains a challenge for infrastructure investment**

EMnet participants noted currency risk concerns regarding infrastructure investment in Asian markets. Financing roadblocks caused by underdeveloped or illiquid local credit markets can be eased by facilitating international borrowing for local infrastructure projects. While funds for infrastructure from international capital markets are increasingly becoming available, borrowing substantial sums in a foreign currency increases a project's exposure to currency risk.

At present, participants highlighted that currency risk mitigation tools are underdeveloped in Emerging Asia. Still, a number of mechanisms can be put in place to limit exchange rate volatility risks including: private insurance for currency risk coverage, partial credit guarantees as well as syndicated loans to ensure that at least a portion of an infrastructure project is funded by local credit institutions (OECD, 2015b).

### **Risky regions in Emerging Asia face additional challenges**

Participants emphasised how political uncertainty can limit private investment in energy infrastructure projects. To overcome hesitations around geopolitical risks, partnerships between the public and private sector as well as other institutional actors can ensure that these projects break ground. An example includes the 720 MW Karot hydropower plant in Pakistan led by the independent power company China Three Gorges Corporation (CTGC). The International Finance Corporation (IFC) invested USD 100 million for a 15% equity stake in the USD 1.7 billion project that aims to reduce Pakistan's large power deficit (Birmingham, 2017). Other project partners include China Export Import Bank, China Development Bank and Silk Road Fund. The project is part of the wider China-Pakistan Economic Corridor (CPEC) that has contributed to a more stable risk environment for Pakistan (IFC, 2016; Energy Business Review, 2017).

## **New skills are needed for a growing energy sector**

Job creation and skills development are vital aspects of the growing renewable energy market in Emerging Asia. Foreign Direct Investment (FDI) is contributing to rapid growth in green jobs. As a result, the private sector faces a considerable skills shortage when hiring local labour. Manufacturing components for renewable energy, managing and maintaining infrastructure, and using new technologies will require a rapid scaling of skills capacities. To ensure that Emerging Asia's workforce is better adapted to the future needs of employers, the public and private sector have to look into new and innovative ways to further work together to bridge the skills investment gap.

### **The current shortage of relevant skills can limit the growth in green jobs generated by the renewable energy sector**

Expansion in the energy sector can contribute to job growth throughout Emerging Asia. Boosted by private investment in the renewable sector, green jobs in China, India and Japan already employed 4.3 million people in 2015 (IRENA, 2016). Overall, Asia's global share of renewable energy jobs rose to 60% in 2015, up from 51% in 2013 (IRENA, 2016). In comparison, the number of jobs created through FDI in traditional fossil fuel energy sectors has declined (OECD, 2017a). Skills geared towards renewable energy and energy technology will be increasingly important. For example, India's goal of reaching 100 GW of solar energy production

by 2020 holds massive potential for job creation. Up to 1.1 million job opportunities could be created, and at least 30% would be for skilled labour (IRENA, 2016). This highlights the need for training schemes that develop the appropriate skills to implement energy projects.

Participants at the EMnet Asia meeting highlighted that a shortage of necessary skills is inhibiting opportunities for further growth. For energy projects to increase productivity, companies will need to find labour locally with the right set of skills. Companies are competing with other sectors such as Information and Communication Technology (ICT) and transport for workers with transferable skills applicable in the energy industry.

Analysis by the Council on Energy, Water and Environment and the Natural Resource Defence Council's survey of 40 solar companies in India noted similar findings. 83% of companies said that the largest impediment facing the labour market was that skilled workers were difficult to find. A diverse set of skills in renewable energy needs to be developed to fill jobs in manufacturing, business development, data management, design and construction (CEEW and NDRC, 2016).

Furthermore, finding staff for energy infrastructure investments in areas facing geopolitical risks can be challenging. Heightened safety concerns could lead to labour shortages with potential candidates being unwilling to work in these areas.

### **Technology advancements mean that energy workers will need digital skills**

The rapid adoption of digital energy tools will mean that the labour market in Asia will need to develop new skills and invest in skills adaptation for changing roles. The digitalisation of energy will increase the demand for skills in engineering, computer literacy and digital security. Digital technology itself, such as wearables, could reskill and upskill workers in this field by assisting them with technical aspects of their jobs (Spelman, 2016). Data management will become a critical skill needed by companies as smart grids and digital management become an integral part of the energy sector.

### **The private and public sectors can work together to improve training**

Public-private partnerships could help to decrease the skills mismatch arising from the rapid energy transition in Asia. In that survey of 40 solar companies, questions about renewable energy skills found that 70% of workers are taught skills by internal training programmes run by companies, while only 46% received formal vocational training and 16% learnt skills at academic institutions (CEEW and NDRC, 2016). However, companies and governments can work together to improve training programmes and help to ensure that workers' skills are developed to match the private sector's needs. Tata Power, for example, provides a market-driven response through the Tata Power Skill Development Institute (TPSDI). It has trained 11 000 youth in critical skills needed in the power sector through four training hubs across India (Tata, 2017).

Governments are aware that current public training programmes are insufficient. Solar companies in India also highlighted that training facilities are located too far from where workers are needed (CEEW and NDRC, 2016). To overcome this, online courses and educational materials are becoming key tools for training workers for the new skills needed in energy sectors (Spelman, 2016). For example, in 2017 the Indian government announced the launch of an online training certification for solar technicians (NIWE, 2016).



## CONCLUSION

Energy is at the centre of business opportunities in Asia, while continuing to be a challenge. Continued robust economic growth has expanded the region's consumer base and driven up energy demand, thus creating vast opportunities. For the business sector, renewable energy holds great potential due to the abundance of natural resources as well as strong political support from across sectors, as governments aim to bridge the investment gap with private capital or through blending resources. Opportunities abound in power generation, energy efficient production, and the development of technological solutions that will help to improve energy access, efficiency and security, including smart grids, sensors and environmental technologies. Firms outside the energy sector are also becoming energy producers to generate revenues or reduce costs.

Asian firms and newly-created development institutions are also showing leadership in developing energy infrastructure and making it top priority. Asian multinationals, particularly those from China and India, are expanding investment in energy not only within their home countries but also within the region and beyond. Recently-created multilateral development banks such as the New Development Bank and the Asian Infrastructure Investment Bank are prioritising energy infrastructure development. Divergent energy capacities will have an impact on business opportunities in Asia. Companies looking to expand manufacturing capacities, particularly in Southeast Asia and India, will need to be wary of strained infrastructure capacity. While investors in China may not face critical infrastructure shortages, they will need to be aware of changing policies and stricter environmental regulations as the economy matures and growth slows.

Ongoing progress is necessary on removing barriers for investment. This involves overcoming administrative hurdles and ownership restrictions and improving policy stability and access to finance. Yet, the rapid growth of energy capacities and the political support for a regional transition to a sustainable low-carbon future signal that new investment opportunities in Asia will continue opening up for the private sector.

## Notes

- <sup>1</sup> ASEAN-5 member states include Indonesia, Malaysia, the Philippines, Singapore and Thailand.
- <sup>2</sup> ASEAN-Plus-One agreements are a series of accords establishing Free Trade Areas between the ASEAN member states and some of the world's major economies such as: China, Japan, Korea, Australia, New Zealand and India.
- <sup>3</sup> RCEP member states include Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Viet Nam, Australia, China, Korea, India, Japan and New Zealand.
- <sup>4</sup> The Asian Development Bank (ADB) includes 45 member governments as part of Developing Asia and but has excluded India and China from this analysis. Developing Asia includes the following countries: Central Asia: Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, Uzbekistan; East Asia: People's Republic of China, Hong Kong (China), Korea, Mongolia, Chinese Taipei; South Asia: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka; Southeast Asia: Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, Viet Nam; The Pacific: Cook Islands, Kiribati, Marshall Islands, Federated States of Micronesia, Nauru, Palau, Papua New Guinea, Samoa, Solomon Islands, Timor-Leste, Tonga, Tuvalu, Vanuatu.
- <sup>5</sup> See previous note for the list of the 45 countries that form part of "Developing Asia", according to the Asian Development Bank (ADB).

## References

- Alschner, w., Seiermann, J., Skougarevskiy, D. (2017), *The Impact of the TPP on Trade Between Member Countries: A Text-As-Data Approach*, ADBI Working Paper 745, Tokyo: Asian Development Bank Institute, <https://www.adb.org/publications/impact-tpp-trade-between-member-countries-text-data-approach>.
- Andrews-Speed, P. (2016), *Connecting ASEAN through the Power Grid: Next Steps, Policy Brief No.11*, Singapore: Energy Studies Institute, <http://esi.nus.edu.sg/docs/default-source/esi-policy-briefs/connecting-asean-through-the-power-grid-next-steps.pdf?sfvrsn=4>.
- ASEAN Centre for Energy (2016), *ASEAN – Renewable Energy Policies*, ASEAN Centre for Energy, Indonesia, <http://www.aseanenergy.org/resources/publications/asean-renewable-energy-policies/>.
- ASEAN Centre for Energy (2015), *ASEAN Plan of Action for Energy Cooperation (APAEC) 2016-2025, Phase I: 2016-2020*, ASEAN Secretariat, Jakarta, [www.aseanenergy.org/wp-content/uploads/2015/12/HighRes-APAECOnline-version-final.pdf](http://www.aseanenergy.org/wp-content/uploads/2015/12/HighRes-APAECOnline-version-final.pdf).
- Asian Infrastructure Investment Bank (AIIB) (2017), *AIIB Energy Sector Strategy: Sustainable Energy for Asia*, Discussion Draft for Consultation, [www.aiib.org/en/policies-strategies/strategies/.content/index/Energy-Strategy-Discussion-Draft.pdf](http://www.aiib.org/en/policies-strategies/strategies/.content/index/Energy-Strategy-Discussion-Draft.pdf).
- Asian Development Bank (ADB) (2017), *Meeting Asia's Infrastructure Needs*, Mandaluyong City, Philippines: Asian Development Bank, [www.adb.org/sites/default/files/publication/227496/special-report-infrastructure.pdf](http://www.adb.org/sites/default/files/publication/227496/special-report-infrastructure.pdf).
- Asian Development Bank (ADB) (2016), *Asian Development Outlook 2016: Asia's Potential Growth*, Mandaluyong City, Philippines: Asian Development Bank, [www.adb.org/sites/default/files/publication/182221/ado2016.pdf](http://www.adb.org/sites/default/files/publication/182221/ado2016.pdf).
- Bermingham, F. (2017) "Pakistani Hydropower Plant Secures Financing", *Global Trade Review*, 27 March, <http://www.gtreview.com/news/asia/pakistani-hydropower-plant-secures-financing/>.
- Bloomberg LP (2016), Bloomberg Terminal (accessed 28 July 2016).
- BNEF (Bloomberg New Energy Finance) (2016a), *Renewable Energy Projects*, [www.bnef.com/](http://www.bnef.com/), (accessed 28 July 2016).
- Casanova, L. and A. Miroux (2017), *Emerging Markets Multinationals Report 2017: Emerging Multinationals in a Changing World*, Emerging Markets Institute, Johnson School of Management, Cornell University, [www.johnson.cornell.edu/Emerging-Markets-Institute](http://www.johnson.cornell.edu/Emerging-Markets-Institute).

- Council on Energy, Environment and Water (CEEW) and Natural Resources Defense Council (NDRC) (2016), *Filling The Skill Gap In India's Clean Energy Market: Solar Energy Focus*, India, [www.nrdc.org/sites/default/files/renewable-energy-solar-skill-gap.pdf](http://www.nrdc.org/sites/default/files/renewable-energy-solar-skill-gap.pdf).
- Das, K. (2016), "India to Launch Clean Energy Equity Fund of Up to \$2 Billion", Reuters, 2 November, <http://in.reuters.com/article/india-renewables-idINKBN12X0UC>.
- Dizioli, A., Guarjardo J., Kluyev, V., Mano, R., Raissi, M. (2016), "Spillovers from China's Growth Slowdown and Reblancing to the ASEAN-5 Economies", *IMF Working Paper* 14/52, International Monetary Fund, Washington, <https://www.imf.org/external/pubs/ft/wp/2016/wp16170.pdf>.
- Energy Business Review (EBR) (2017), "IFC to Invest in 720MW Karot Hydropower Project in Pakistan", 15 March, <http://hydro.energy-business-review.com/news/ifc-to-invest-in-720mw-karot-hydropower-project-in-pakistan-150317-5763520>.
- Engie (2017), "ENGIE Reaffirms its Commitment to Invest and Build a New Generation of Sustainable and Clean Energy Solutions in Asia Pacific", Press Releases, 29 March, [www.engie.com/en/journalists/press-releases/commitment-energy-solutions-asia-pacific/](http://www.engie.com/en/journalists/press-releases/commitment-energy-solutions-asia-pacific/).
- Environment Bureau of Hong Kong, China (2017), *Hong Kong's Climate Action Plan 2030+*, [www.climateready.gov.hk](http://www.climateready.gov.hk).
- Financial Services and Development Council, Hong Kong (FSDC) (2016), *Hong Kong as a Regional Green Finance Hub*. FSDC Paper no. 23. [www.fsd.org.hk/sites/default/files/Green%20Finance%20Report-English.pdf](http://www.fsd.org.hk/sites/default/files/Green%20Finance%20Report-English.pdf).
- Forsythe, M. (2017), "China Cancels 103 Coal Plants, Mindful of Smog and Wasted Capacity", New York Times, 18 January, <https://www.nytimes.com/2017/01/18/world/asia/china-coal-power-plants-pollution.html>.
- Fortune (2017), Fortune Global 500, Time Inc., Fortune website, <http://fortune.com/global500/> (accessed September 2017).
- G20 (2017), *G20 Leaders' Declaration: Shaping an Interconnected World*, July 7-8, Hamburg, [www.g20.org/gjpfeldokumente/G20-leaders-declaration.pdf](http://www.g20.org/gjpfeldokumente/G20-leaders-declaration.pdf).
- GE (2016), "GE and Singapore Power are Innovating the Grid for a Future Ready Singapore", Press Release, 16 August, <https://www.gegridsolutions.com/press/gepress/GE-and-Singapore-Power-are-innovating-the-grid.htm>.
- GEIDCO (2016), *Intracontinental Interconnection*, web page [http://www.geidco.org/html/qnycoen/col2015100789/column\\_2015100789\\_1.html](http://www.geidco.org/html/qnycoen/col2015100789/column_2015100789_1.html).
- Government of India, Central Energy Authority (CEA) (2016), *Draft National Electricity Plan*, Volume 1, [http://www.cea.nic.in/reports/committee/nep/nep\\_dec.pdf](http://www.cea.nic.in/reports/committee/nep/nep_dec.pdf).
- Government of India Ministry of New and Renewable Energy (2015), Augmentation and Maintenance of the Indian Renewable Energy and Energy Efficiency Policy Database (IREED): March 2015 Summary Sheet – Policies and Regulation.
- Hongliang, H. (2016) "Carbon Trading in China Unlikely to go National by 2017", China Dialogue, 12 January, [www.chinadialogue.net/blog/8538-Carbon-trading-in-China-unlikely-to-go-national-by-2-17/en](http://www.chinadialogue.net/blog/8538-Carbon-trading-in-China-unlikely-to-go-national-by-2-17/en).
- IEA (2016a), *World Energy Outlook 2016*, OECD/IEA Publishing, Paris, <http://dx.doi.org/10.1787/weo-2016-en>.
- IEA (2016b), *Energy Technology Perspectives 2016*, OECD/IEA Publishing, Paris, [http://dx.doi.org/10.1787/energy\\_tech-2016-en](http://dx.doi.org/10.1787/energy_tech-2016-en).
- IEA (2016c), *World Energy Investment Report 2016*, OECD/IEA, Paris, <http://dx.doi.org/10.1787/9789264262836-en>.
- IEA (2016d), *Energy Efficiency Market Report 2016*, OECD/IEA, Paris. [www.iea.org/eemr16/files/medium-term-energy-efficiency-2016\\_WEB.PDF](http://www.iea.org/eemr16/files/medium-term-energy-efficiency-2016_WEB.PDF).
- IEA (2016e), *Medium-Term Renewable Energy Market Report 2016*, IEA, Paris, [www.iea.org/bookshop/734-Medium-Term\\_Renewable\\_Energy\\_Market\\_Report\\_2016](http://www.iea.org/bookshop/734-Medium-Term_Renewable_Energy_Market_Report_2016).
- IEA (2015a), *World Energy Outlook 2015*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/weo-2015-en>.
- IEA (2015b), *World Energy Outlook 2015: Special Report on India*, OECD Publishing, Paris, [https://www.iea.org/publications/freepublications/publication/IndiaEnergyOutlook\\_WEO2015.pdf](https://www.iea.org/publications/freepublications/publication/IndiaEnergyOutlook_WEO2015.pdf).

- IEA (2015c), *World Energy Outlook 2015: Special Report on Southeast Asia*, OECD Publishing, Paris, [https://www.iea.org/publications/freepublications/publication/weo2015\\_southeastasia.pdf](https://www.iea.org/publications/freepublications/publication/weo2015_southeastasia.pdf).
- International Electrotechnical Commission (IEC) (2016), *Global Energy Interconnection*, White Paper, <http://www.iec.ch/whitepaper/pdf/iecWP-globalenergyinterconnection.pdf>.
- IFC (2016), "IFC Works to Improve Hydropower Sector in Pakistan", Press Release, 18 April, [http://www.ifc.org/wps/wcm/connect/industry\\_ext\\_content/ifc\\_external\\_corporate\\_site/hydro+advisory/news/press+releases/ifc+works+to+improve+hydropower+sector+in+pakistan](http://www.ifc.org/wps/wcm/connect/industry_ext_content/ifc_external_corporate_site/hydro+advisory/news/press+releases/ifc+works+to+improve+hydropower+sector+in+pakistan).
- IJENKO (2016), "Singapore Power Centre of Excellence Commences Collaboration with 5 Industry Partners Including IJENKO", Press Release, 16 August, [http://blog.ijenko.com/2016/08/16/singapore-power-centre-of-excellence-commences-collaboration-with-5-industry-partners-including\\_ijenko/](http://blog.ijenko.com/2016/08/16/singapore-power-centre-of-excellence-commences-collaboration-with-5-industry-partners-including_ijenko/).
- IRENA (2016), *Renewable Energy and Jobs 2016 Annual Review*, [http://www.irena.org/DocumentDownloads/Publications/IRENA\\_RE\\_Jobs\\_Annual\\_Review\\_2016.pdf](http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Jobs_Annual_Review_2016.pdf).
- IRENA & ACE (2016), *Renewable Energy Outlook for ASEAN: A REmap Analysis*. International Renewable Energy Agency (IRENA), Abu Dhabi and ASEAN Centre for Energy (ACE), Jakarta. [http://www.irena.org/DocumentDownloads/Publications/IRENA\\_REmap\\_ASEAN\\_2016\\_report.pdf](http://www.irena.org/DocumentDownloads/Publications/IRENA_REmap_ASEAN_2016_report.pdf).
- Khadka, N. S. (2012) "South Asia's Energy Crisis Demands Collective Action", BBC News, 12 August, <http://www.bbc.com/news/business-19107372>.
- KPMG (2015), *Taxes and Incentives for Renewable Energy*, KPMG International, <https://assets.kpmg.com/content/dam/kpmg/pdf/2015/09/taxes-and-incentives-2015-web-v2.pdf>.
- Mahapatra, S. (2017), "India Launches Online Training Course on Solar Energy Which Costs Just \$8.79", Clean Technica, 16 January, <https://cleantechnica.com/2017/01/16/india-launches-online-training-course-solar-energy-costs-just-8-79/>.
- Mahindra & Mahindra (2016), "Mahindra & Mahindra First Indian Company to Announce Carbon Price," Press Release, 7 October, <http://www.mahindra.com/news-room/press-release/mahindra-and-mahindra-first-Indian-company-to-announce-Carbon-Price>.
- National Institute of Wind Energy (NIWE) (2016) "Launching of Online Training Program for Solar Photovoltaic Design & Installation", Press Release, 12 December, [http://niwe.res.in/assets/Docu/Press\\_report\\_on\\_solar%20energy%20\\_13.12.2016.pdf](http://niwe.res.in/assets/Docu/Press_report_on_solar%20energy%20_13.12.2016.pdf).
- NDB (2017), Investor Presentation, August, [www.ndb.int/wp-content/uploads/2017/01/NDB-IP-August-2017.pdf](http://www.ndb.int/wp-content/uploads/2017/01/NDB-IP-August-2017.pdf).
- OECD (2018), *Economic Outlook for Southeast Asia, China and India 2018: Fostering Growth Through Digitalisation*, OECD Publishing, Paris, <http://dx.doi.org/9789264286184-en>.
- OECD (2017a), *Economic Outlook for Southeast Asia, China and India 2017: Addressing Energy Challenges*, OECD Publishing, Paris. <http://dx.doi.org/10.1787/saeo-2017-en>.
- OECD (2017b), *OECD Economic Surveys: China 2017*, OECD Publishing, Paris, [http://dx.doi.org/10.1787/eco\\_surveys-chn-2017-en](http://dx.doi.org/10.1787/eco_surveys-chn-2017-en).
- OECD (2017c), *OECD Economic Surveys: India 2017*, OECD Publishing, Paris, [http://dx.doi.org/10.1787/eco\\_surveys-ind-2017-en](http://dx.doi.org/10.1787/eco_surveys-ind-2017-en).
- OECD (2017d), *Mobilising Bond Markets for a Low-Carbon Transition*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264272323-3-en>.
- OECD (2016a), *Economic Impact of Local Content Requirements*, Trade Policy Notes, <https://www.oecd.org/tad/policynotes/economic-impact-local-content-requirements.pdf>.
- OECD (2016b), *Green Investment Banks: Scaling up Private Investment in Low-carbon, Climate-resilient Infrastructure*, Green Finance and Investment, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264245129-en>.
- OECD (2015a), *Overcoming Barriers to International Investment in Clean Energy, Green Finance and Investment*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264227064-en>.

- OECD (2015b), *FDI Regulatory Restrictiveness Index*, <http://www.oecd.org/investment/fdiindex.htm> (accessed 15 May 2017).
- Platts (2016), *World Electric Power Plants Database*, Platts, Washington, D.C., [www.platts.com/products/world-electric-power-plants-database](http://www.platts.com/products/world-electric-power-plants-database) (accessed 27 July 2016).
- REN21 (2016), *Renewables 2016 Global Status Report*, Paris, REN21 Secretariat, [www.ren21.net/status-of-renewables/global-status-report/](http://www.ren21.net/status-of-renewables/global-status-report/).
- Reve (Wind Energy and Electric Vehicle Review) (2017), "Gamesa Reports €301 Million Profit in 2016 (+77%)", 23 February, [www.evwind.es/2017/02/23/gamesa-reports-e301-million-profit-in-2016-77/58891](http://www.evwind.es/2017/02/23/gamesa-reports-e301-million-profit-in-2016-77/58891).
- Reve (Wind Energy and Electric Vehicle Review) (2016), "Gamesa Climbs Two Places to Secure Fifth Place on the Global Wind Energy", 6 April, [www.evwind.es/2016/04/07/gamesa-climbs-two-places-to-secure-fifth-place-on-the-global-wind-energy/55845](http://www.evwind.es/2016/04/07/gamesa-climbs-two-places-to-secure-fifth-place-on-the-global-wind-energy/55845).
- Spelman, M. (2016), "How Will the Digital Revolution Transform the Energy Sector?", World Economic Forum, [www.weforum.org/agenda/2016/03/how-will-the-digital-revolution-transform-the-energy-sector/](http://www.weforum.org/agenda/2016/03/how-will-the-digital-revolution-transform-the-energy-sector/).
- Tata Power, (2017a), *Corporate Profile 2017*, India, [www.tatapower.com/corporate-profile.pdf](http://www.tatapower.com/corporate-profile.pdf).
- Tata Power (2017b), "Tata Power's TPSDI Trains Over 11,000 Youth Across India; Reaffirms its Commitment on National Youth Day", Press Release, 13 January, <https://www.tatapower.com/media-corner/pressrelease-2017/press-release-13-jan-2017.aspx>.
- Tereos (2016), "2015/2016 Annual Results and Outlook", Press Release, 7 June, <http://tereos.com/en/press/20152016-annual-results-and-outlook-1-april-2015-31-march-2016>.
- The Climate Group (2015), RE100 China Analysis: April, <https://www.theclimategroup.org/sites/default/files/archive/files/RE100-China-analysis.pdf>.
- The Lantau Group (2016), *UHV Lines: Shaping the Future of China's Power Sector Landscape*, [www.lantaugroup.com/files/tlgchina\\_uhv\\_jan16.pdf](http://www.lantaugroup.com/files/tlgchina_uhv_jan16.pdf).
- UNCTAD (2017), *World Investment Report 2017: Investment and the Digital Economy*, UN Publishing, Geneva, <http://worldinvestmentreport.unctad.org/world-investment-report-2017/chapter-1-global-investment-prospects-and-trends/>.
- White House (2017), Statement by President Trump on the Paris Climate Accord, Office of the Press Secretary, June 1, [www.whitehouse.gov/the-press-office/2017/06/01/statement-president-trump-paris-climate-accord](http://www.whitehouse.gov/the-press-office/2017/06/01/statement-president-trump-paris-climate-accord).
- World Bank (2014), World Development Indicators, <http://data.worldbank.org/indicator> (accessed 1 May 2017).
- Xinhua (2017), "Asian Energy Interconnection Inevitable for Cleaner Future: Chinese Expert", China Daily, 18 January, [www.chinadaily.com.cn/business/2017-01/18/content\\_27988738.htm](http://www.chinadaily.com.cn/business/2017-01/18/content_27988738.htm).

**For more information about the OECD Emerging Markets Network,  
contact the Secretariat:**

[dev.emnet@oecd.org](mailto:dev.emnet@oecd.org)

[www.oecd.org/dev/oecdemnet.htm](http://www.oecd.org/dev/oecdemnet.htm)

**EM»net**  
OECD EMERGING MARKETS NETWORK

