ECONOMY OF TOMORROW

FRIEDRICH EBERT STIFTUNG

Green Jobs in Asia: Achievements, Strategies and Potentials

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- The study provides an overview of development trends and environmental performance as well as policy strategies to promote green growth in seven Asian countries - China, India, Indonesia, Philippines, South Korea, Thailand and Vietnam.
- Despite emerging green growth strategies and green industries in the region, Asian economies are far from becoming green, resource-efficient and sustainable.
- The emerging discourse on green growth and climate change offers both opportunities as well as new challenges for promoting a broader greening of Asian economies.
- There are various entry-points and recommendations for policy action, including an appropriate institutional framework and fiscal incentives as well as the support to environmental innovations and decent green job creation.

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Foreword

Since the start of a new FES regional working line in support of the "Economy of Tomorrow" – a project set up in early 2011 in the context of the new FES strategy for Asia and the Pacific – different dimensions and layers of future economic models have been discussed amongst Asian and European experts and policy-makers. The global Green Economy and Green Jobs have started from a normative standpoint and – since a couple of years now – have been translated into political tools and more technical aspects at international conferences by experts as well as implementing and monitoring agents. However, especially in Asia, there is still a lot of uncertainty about the underlying structural changes, the challenges for the governments and the citizens, as well as the socio-economic impacts of a potential green transformation. Out of a social democratic perspective, based on the values of social justice and international solidarity, a number of questions have arisen which have only been partly addressed until now. As a political foundation, FES sees its role in facilitating the important and sometimes controversial public debates about the different dimensions of economic transformation, with a special focus on the role of trade unions, civil society organizations and political parties in creating political coalitions needed for change.

With a series of country studies on the potentials and prospects of "Green Jobs in Asia", FES, in cooperation with the Environmental Policy Research Centre (FFU) at Freie Universität Berlin, has aimed at exploring options for economic development strategies in Asia that depart from the path of high resource consumption, while generating sufficient employment opportunities to ensure social sustainability. It has focused on identifying entry-points for green job creation, including the greening of existing jobs and the development of new job opportunities in emerging green industries. Thereby it has sought to make a contribution to efforts aimed at building a green economy that is both environmentally sustainable and socially inclusive. The studies have followed a common methodology to explore the potentials for green jobs creation and policies for their support. The Green Jobs country studies have been debated at national workshops with different actors and partners from FES (varying for each FES country office), representing different government institutions, political parties, trade unions, the media, and actors from across civil society. The results from the different country studies (and national workshops) were discussed comparatively at a Regional Green Jobs Forum organized by FES Indonesia in Singapore in March 2012. This report is the final result of a process which has started in 2011, offering a comparative analysis of all the existing country papers, a transfer of best practices between the analysed countries and conclusions about the most important aspects in the promotion of Green Jobs in Asia.

As international experiences have shown, the development of green jobs goes hand in hand with a more comprehensive transformation of economic structures towards a more resource-efficient and environmentally-friendly development model. In industrialized economies, this transformation entails a shift from existing modes of production to more eco-efficient processes and technologies. In the energy sector, for instance, this implies a transition from a fossil fuel dominated energy supply to a system based on renewable sources. In Asian countries, this transformation of energy systems will go hand in hand with further expansion of energy production. At least initially, the expansion of renewable energy supplies does not necessarily mean that conventional energy production will be reduced. In other words, while certain challenges faced by industrialized countries and the emerging economies of Asia may be similar, there are also important differences. These differences are highly-relevant for the development of approaches for green job creation. They imply different opportunities and challenges for developing green jobs and may necessitate different types of interventions.

Regardless of the challenges individual countries are facing, it is increasingly evident that the development of a green economy will require an important role for the State. The government plays an essential role in steering investments towards technologies and industries that make the economy less resource- and energy intensive. Greening the economy requires the creation of a regulatory framework that provides the needed incentives to reduce resource consumption, while stimulating investments in the needed technological capacities to achieve these reductions. Moreover, an important element is the development of the appropriate knowledge and skills in the labour force to match the requirements of a green economy. The challenge is to design strategies that effectively achieve these environmental and technological objectives without jeopardizing needed advances in socio-economic conditions. While difficult in an industrialized context, this poses a particular challenge in the context of emerging and developing economies where human development gains remain out of reach for large sectors of the population. Green job creation, therefore, represents a particularly pressing concern in these countries. This will require more active integration of different policy objectives, so that policies aimed at socio-economic development do not conflict with environmental goals and vice versa. Moreover, important synergies may be exploited by better coordinating central policies with local planning practices. If local governments are not in tune with changes initiated at the central level, risky investments in new technologies or business models may not come to fruition.

Ultimately, in emerging and developing economies, one of the keys to a broader social and political acceptance lies in finding appropriate tools and models for a just transition. Processes of economic transformation always produce both winners and losers, and the latter have to be integrated with alternative solutions and incentives in order to create opportunities for the whole society. This report wants to offer its contributions to the ongoing international debates, whereas FES will continue supporting the discussions and developments of political strategies for its partners and like-minded actors. Within the FES Asia regional working line in support of the "Economy of Tomorrow", the debates about the strategies and policies required in order to promote Green Jobs will be continued and further deepened. The whole process of producing this report, from developing the objectives and terms, holding a regional workshop until overseeing and analyzing the different national country papers would not have been possible without the extremely good and fruitful cooperation with Dr. Klaus Jacob, Research Director, and Rainer Quitzow, Research Fellow, both from FFU Berlin, as well as all the highly valuable contributions from Dr. Wu Libo, Executive Director at the Center for Energy Economics and Strategic Studies at Fudan University.

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July 2013

Introduction

Over the past decades, Asia has witnessed a remarkable process of economic development. A strongly export-oriented development model has yielded the so-called "Asian Miracle", which has transformed a large part of the region into the world's most important manufacturing hub. Trade dependence in the Asia-Pacific region, as measured by the ratio of merchandise exports to GDP, has almost tripled in the past twenty years and now stands at 31% (UNESCAP, 2012, p.xi). This remarkable economic success story has been accompanied by a simultaneous rise in resource consumption and increasing pressures on the environment. The region has recently become the world's largest consumer of resources (UNEP, 2011, p. 23), and the material intensity of economic development in the Asia-Pacific region is more than three times the global average (UNESCAP, ADB, & UNEP, 2012, p.34). Similarly, pollution levels are rising in tandem with the rapid growth in economic output. As indicated by these trends, economic development in the region has largely taken precedent over the long term need to protect environmental resources. Governments have focused attention on boosting economic growth and preserving social stability, while neglecting to establish corresponding capacities for preserving environmental quality.

In recent years, however, mounting environmental pressures have raised the awareness in the region that new strategies for promoting economic prosperity will be needed in the future. It is increasingly recognized that a development model based on the export of relatively low-value added and resource intensive products is no longer a viable growth trajectory. This fact has been further underlined in the wake of the 2008 financial crisis, which highlighted the risks of Asia's high exposure to Western consumer markets (Association of Academies of Sciences in Asia, 2011). Moreover, increasing scarcity of natural resources, including fossil fuels, have drawn further attention to the limits of the resource-intensive growth model of the past decades. Finally, the international debate on climate change is increasing the pressure on Asian countries to decouple future economic growth from rises in greenhouse emissions. This is coupled with a particular vulnerability of the region to the effects of climate change and the need to devise corresponding adaptation strategies.

To confront these multiple challenges, the concept of green growth and green economic development are gaining increasing traction both globally and among Asian policy makers. As defined by the OECD, green growth "means fostering economic growth and development, while ensuring the natural assets continue to provide the resources and environmental services on which our well-being relies. To do this, it must catalyse investment and innovation which will underpin sustained growth and give rise to new economic opportunities" (OECD, 2011a, p.9). On the one hand, this definition acknowledges the fact that in the medium and long-term the environmental carrying capacity of the planet represents a binding constraint for economic development. On the other, it identifies the potential economic opportunity offered by green innovations. The Global Green Growth Institute, launched by the Korean government in cooperation with a number of international private and public partners, is even more explicit about the importance of "new ideas, transformational innovations and state-of-the art technology" (Global Green Growth Institute, 2011, p.8) for driving future green growth.

The pressing need for greening economic growth is also supported by a recent World Bank (2012) report, which views green growth as "necessary, efficient and affordable" (p.3). However, the report also points out a host of challenges and potential impediments to green growth. Most importantly, it is highly dependent on policies, which realign incentives so that investments in environmentally-friendly technologies and business models become viable. Such policies may be difficult to introduce, due to challenges related

to political or social acceptability as well as the lack of the needed institutional infrastructure for adjusting economic incentives. Moreover, green technologies are often characterized by the need for high upfront investments in capital goods and public infrastructure, and they often require policy support to enable new markets for environmental innovations.

While a challenging task in highly developed economies with strong public administrations and a high innovative capacity in the private sector, greening economic development in emerging and developing economies must go hand in hand with the further strengthening of broader governance capacities and the overall business environment. The World Bank (2012), therefore, calls for green growth policies that are tailored to unique country capacities and take into account differing levels of economic development and technological sophistication. At the same time, it is acknowledged that fairly little is known about the effectiveness of different types of green growth policies in different types of developing and emerging country contexts (Dutz & Sharma, 2012).

Despite these challenges, Asian countries have been at the forefront of this new paradigm for economic development. In 2005, Asian leaders adopted the Seoul Initiative on Environmentally Sustainable Economic Growth (Green Growth) at the 5th Ministerial Conference on Environment and Development in Asia and the Pacific. Moreover, the Asia and Pacific region leads the developing world in terms of green patents and green exports (Dutz & Sharma, 2012, p.4).

Objectives and Structure of the Report

Against the background of these emerging trends, the Asia Department at the Friedrich-Ebert Stiftung has initiated a study process, which takes stock of related developments in seven Asian countries – China, India, Indonesia, Philippines, South Korea, Thailand and Vietnam. For each of these countries a local consultant team has prepared a report on key domestic trends and issues. The aim of these national reports was to shed light on how green growth policies are being tailored to the challenges and needs of these different Asia economies and to identify entry points to support and further strengthen emergent green development trajectories in the individual countries and in the region as a whole. The following report provides a synthesis of the results, which have been captured in these country-level studies.

The report is divided into four sections. The first section begins with an overview of trends in resource consumption and environmental performance in the region, placing it in a global context. After this broad overview, it takes stock of economic development trajectories in the seven selected countries and analyses their link to changes in resource consumption and environmental degradation. It highlights key similarities and differences in economic development paths and how they have affected environmental outcomes. Having outlined past trends and the related environmental challenges, section 2 of the report provides an overview of the emerging strategies for promoting green growth in the selected countries. It identifies a number of drivers for these developments and discusses how these relate to the different levels of economic development and other country-specific characteristics. Section 3 addresses the economic and employment gains associated with green economic development in the region. It provides a brief overview of the international debate on green jobs and progress in measuring the employment impacts of green growth. This is followed by a review of existing data on green investment and green job creation in the selected countries. Finally, section 4 explores priorities and entry-points for policy action in support of green growth in the region.

With this evidence on the environment-economic developments and potentials in the region, policy makers should be enabled to fuel the discourses on future Asian industrial and environmental policies. In particular the links between greening the economy and its potentials for job creation are potentially important leverages in the political discourses in these countries.

1. Economic Transformation, Energy Use and Environmental Degradation in Asia

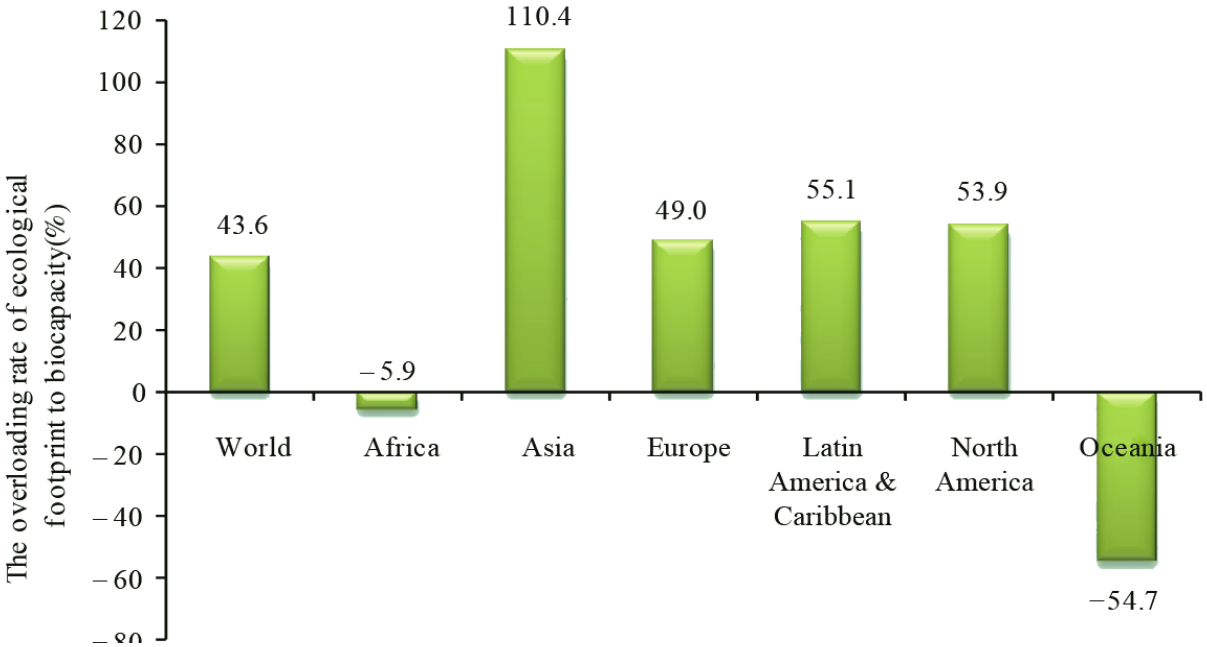
This section provides an analysis of the relationship between economic development, resource consumption and environmental pollution in Asia. It begins with a general overview of regional trends, placing them in a global context. Next a framework for explaining typical patterns of industrial development and its linkages to resource consumption and pollution in the region is presented. This framework is then used for comparing country-level performance across a number of key indicators. This empirical analysis reveals an important degree of adherence to the broad pattern predicted by the analytical framework but also key divergences. To explain the most important differences across the countries, a brief overview of country-specific development trajectories and how they have shaped specific trends in resource consumption and pollution are discussed.

1.1 Overview: Resource-intensive development in Asia

Between 1995 and 2005, consumption of biomass, fossil fuels, metal ores and construction minerals in the Asian region grew by approximately 50%. With this, its share of global material use has climbed to more than half of the world's total (UNESCAP et al., 2012, p.5-6). This is not only related to rapid increases in economic output and the region's growing share of global GDP. Economic growth in Asia is also disproportionately resource-intensive. Compared to the rest of the world, Asian countries require three times the input of resources to generate one unit of GDP. Similarly, energy intensity of economic activities has climbed well above the world average (see Figure I in the annex: Energy intensity per US dollar of GDP for the Asia-Pacific region and the rest of the world). This development reflects the regional and global trend that industrial production is increasingly shifting from more efficient centres of production, such as Japan, to more resource-intensive production centres, including China and other Asian countries (UNESCAP et al., 2012, p. xiv). While the share of industrial production in GDP has decreased to less than 25% globally, it has risen to more than 45% in East Asia (see Figure II in the annex: The percentage of industrial value added in GDP between Asia and the world). This growing share of the global production of goods has transformed the region into a key driver of the world's continuing increase in resource consumption. (see Figure III in the annex: Domestic material consumption in Asia and the world).

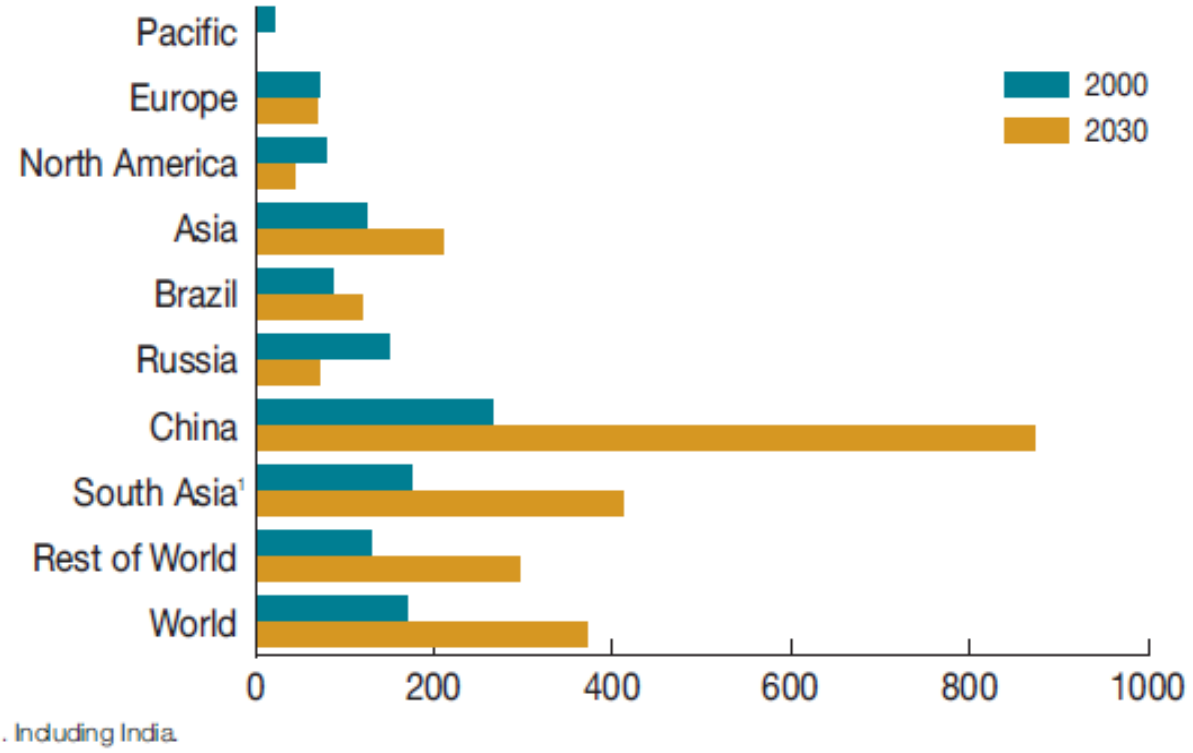
Simultaneously, it should be noted that the Asia-Pacific region still lags behind the rest of the world in terms of per capita resource consumption (see Figure IV in the annex: Domestic material consumption per capita in the Asia-Pacific region and the world). Moreover, Asian countries may account for an important share of the resource consumption embodied in the production of goods, however, this does not indicate what proportion of final goods are actually consumed in Asia (UNEP, 2011, p.30). Regardless of the locus of final consumption, however, the transformation of Asia into the world's centre of industrial production is having tremendous impacts on domestic environmental quality. According to estimations using data on ecological footprints and biocapacity (see Figure 1), Asia's ecological footprint, i.e. its yearly consumption

Figure 1 : The overloading rate of ecological footprint to biocapacity in global regions in 2006



Source : Association of Academies of Sciences in Asia (2011, p.28)

Figure 2 : Premature deaths from PM10 air pollution (per million inhabitants)



Source : OECD (2011b, p.4)

of resources, is more than twice the region's carrying capacity (or biocapacity) and more than double the world's average. Moreover, pollution levels in the region and in particular in China are having increasing effects on human health. Premature deaths from air pollution are well above European and American

averages. In China, the picture is particularly alarming with almost three times the number of deaths per million inhabitants compared to Europe and almost 1, 5 times the world average (see Figure 2).

1.2 Stages of economic transformation and the relocation of production and pollution centres: the Flying Geese Paradigm

Increasing levels of environmental degradation and resource consumption are closely related to the process of industrial development in Asia. Differences in the stages and patterns of industrial transformation across different Asian countries, therefore, also play an important role in explaining variations in the country's environmental performance. A popular metaphor for characterizing the Asian process of industrial transformation is the Flying Geese Paradigm (Yun, 2005). This postulates that the Asian nations are catching up with the more advanced economies through a regional hierarchy where the production of commoditized goods moves continuously from the more to the less advanced countries. The lead goose in this pattern is Japan; the second tier of economies consists of the so-called Asian Tigers (South Korea, Taiwan, Singapore and Hong Kong). After these two groups come the main ASEAN countries: The Philippines, Indonesia, Thailand and Malaysia. Finally, the least developed major nations in the region (China, Vietnam, India, etc.) make up the rear guard in the formation (see figures Figure V and Figure VI in the annex for the development of GDP per capita across the mentioned countries).

The industrial gradient shift between nations is accompanied by the internal adjustment of the industrial structure, demonstrating a certain degree of similarity across the mentioned countries. The transformation can be divided into three stages. The basic process can be described as follows:

Stage 1: Export-oriented strategy: Seizing the opportunity of economic transition in Western countries or more developed Asian economies, labour-intensive industries are transferred to the less developed Asian countries with more abundant and less expensive labour resources. During this stage, the labour-intensive light industry, as the core industry, rapidly increases its proportion of manufacturing in the economy.

Stage 2: Heavy industry strategy: During the second stage, in order to consolidate the economic basis, the gradually catching-up economies put more emphasis on the capital-intensive or resource intensive heavy industry, while remaining faithful to a strong export orientation. Correspondingly, the internal industrial structure is transformed as the share of heavy industry increases vis-à-vis light industry.

Stage 3: Science and technology oriented strategy: Next, industrial upgrading and increasing the share of value-added in the production process becomes a key concern. As a solution, more focus is placed on the technology-intensive and knowledge-intensive industries. Parallel to this, a considerable development of the tertiary industry takes place.

So far, the first and second tier economies of the Flying Geese Paradigm, namely Japan, Korea, Singapore, Hong Kong, Taiwan, have almost completed the transformation of their industrial structure and have reached the mature stage. Table 1 describes how this basic transformation process has taken place in the Korean context.

Table 1: Industrial structure adjustment in the Republic of South Korea

Korea		
Time	**Basic Strategy**	**Transformation of industrial structure**
Early 1960s	*Export-oriented light industry*	As a typical "economy of insufficient resources and capital", Korea seized the opportunity of the outward transfer of labour-intensive industry of the Western developed countries, actively participating in the international division of labour. It utilized its labour advantage and developed an export-oriented economy.
Early 1970s	*Heavy industry and chemical industry*	With support from the government, the focus of industrial development was shifted to heavy industry and chemical industry. Preferential policies for promoting ten strategic industries, namely, steel, non-ferrous metal, machinery, shipbuilding, automobile, electronics, petrochemical, cement, ceramics and fibre industry, were implemented to drive export and economic development.
After 1980s	*Export-oriented while advancing the industry structure*	Finally, efforts were made to shift from labour and capital-intensive industry to technology and knowledge-intensive industry and to optimize the industrial structure. In this period, the automobile, electronics and semiconductor sectors developed into the main industries in South Korea.

The demand for energy and the environment pollution differs significantly during these different stages of industrial restructuring. In general, at the export-oriented stage, energy demand of the labour-intensive industries is relatively small. However, due to low technical level and weak awareness of environmental protection, there may also exist environmental challenges, like low energy efficiency and rising environmental pollution. Entering the heavy industry stage, the capital intensive and resource intensive industries, such as steel, petrochemical and other industries with high energy consumption and serious environmental pollution, turn into a core element of economic development. In the final stage, the technology intensive and knowledge intensive industries with relatively low energy intensity and pollution become the drivers of new economic growth. Moreover, the share of tertiary industry increases, which reduces the overall resource- and energy intensity of economic development. Simultaneously, environmental consciousness and the environmental management improve. In other words, the readjustment of industrial structure between economies from different tiers, not only means the transfer of manufacturing centres, but it also represents a corresponding shift of energy consumption and pollution centres.

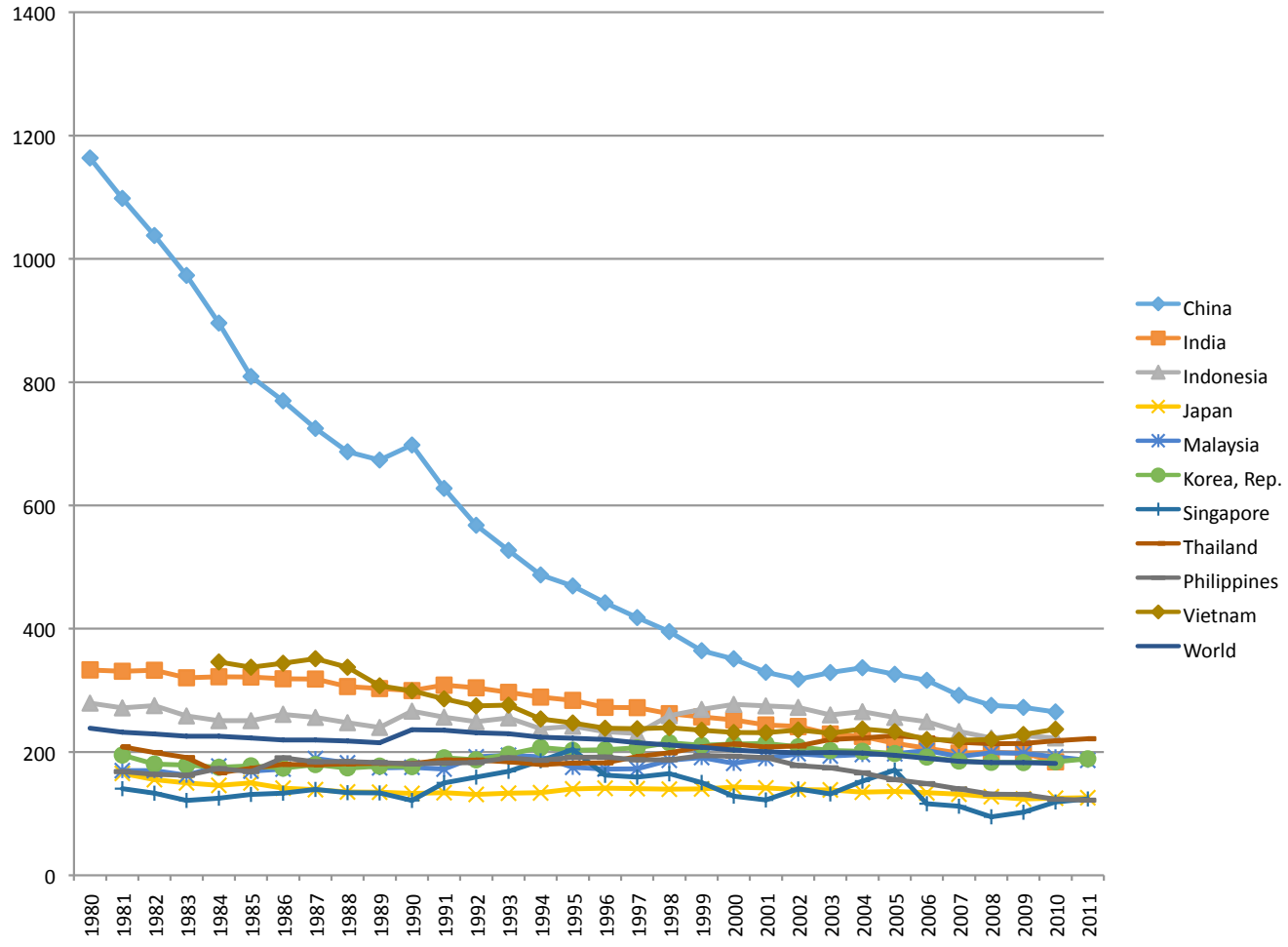
Taking this as its point of departure, the following section reviews trends in energy and resource consumption as well as key pollution indicators in a number of Asian countries. As the analysis reveals, grouping the Asian economies according to the Flying Geese Paradigm does provide important insights regarding the variation in energy use and pollution trends across the countries. At the same time, a number of deviations from the expected pattern are identified. While the focus of the analysis is on the selected countries, a number of other important regional economies are also considered.

1.3 Linking industrial development to trends in resource consumption

Energy use and $C0_2$ emissions

As indicated in Figure VII in the annex, the energy intensity of economic activities (presented as energy use per GDP) does broadly correspond to the different tiers outlined above, with Japan and the Asian Tigers (Singapore, Hong Kong, South Korea) demonstrating among the lowest energy intensities, especially in the 80s and 90s. The sharply decreasing energy intensity in China reflects it's above average growth in GDP. Conversely, until the late 1990s, Vietnam and India lagged behind the remaining countries both in terms of GDP per unit of energy use and GDP per capita. Meanwhile the ASEAN countries remained situated between the Tiger economies and the fourth tier economies, as would be expected. However, since the turn of the century the dynamic has changed markedly with a number of the middle and lower income countries departing from the expected pattern (see Figure 3). It is important to observe not only current levels of energy intensity but the various trajectories taken by the different countries.

Figure 3 : Energy use in selected Asian countries (kg oil equivalent per US $ 1000) (constant 2005 PPP)



Source : World Development Indicators, World Bank

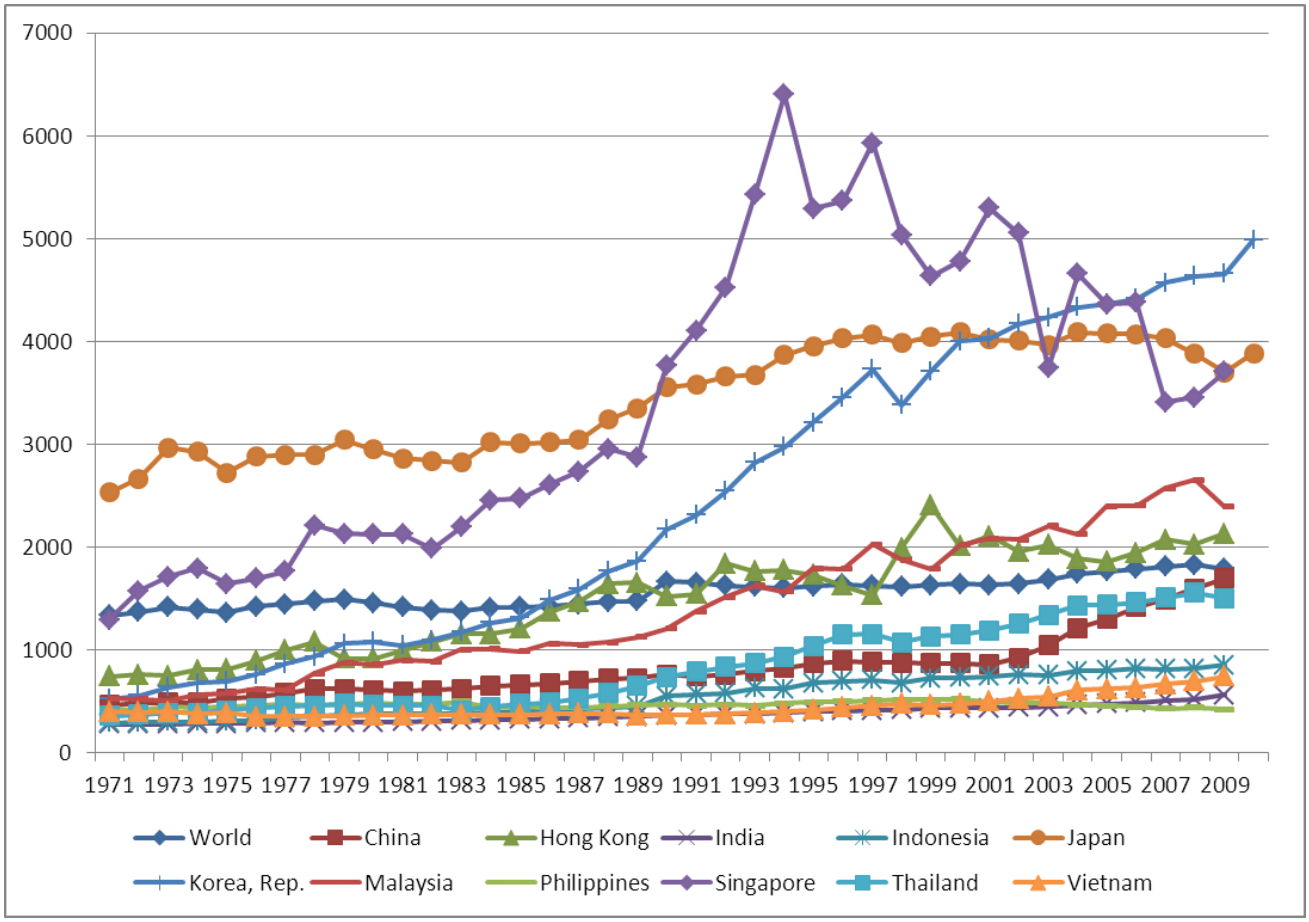
Firstly, China's GDP per capita has surpassed per capita output in Indonesia and the Philippines at the beginning of the century and more recently in Thailand, while its performance in energy intensity is still lagging behind. Despite significant improvements, China (recently joined by Vietnam) still produces the least economic output per unit of energy use. India's per capita economic output, on the other hand, has not yet caught up with that of third tier economies, despite its rapid growth in recent years. Instead India has caught up with the ASEAN group in terms of energy intensity. Moreover, it is notable that in the 1980s energy intensity in China was already around three times higher than in India, while GDP per capita in the two countries was still on par.

Among the ASEAN countries, energy intensity has remained largely flat with Indonesia underperforming the other three economies. Only the Philippines has shown significant improvements, reaching the level of Japan in 2009. Finally, while Japan, Hong Kong, Singapore and Korea have all reached high levels of GDP per capita, their energy intensities show significant variance. Japan's has shown modest but fairly steady improvement over time and has maintained its position as one of the leaders in energy efficiency. The island economies, Singapore and Hong Kong, on the other hand have had larger ups and downs but have remained strong performers, even surpassing Japan. Finally, Korea, with a GDP per capita significantly lower than the other first and second tier economies, has maintained an energy intensity close to that of Thailand and Malaysia (see Figure VII in the annex for the energy intensities of Japan and the Asian Tigers).

While trends in energy intensity paint a relatively favourable picture of the first and second tier economies, in absolute terms their energy consumption still remain significantly higher than that of the third and fourth tier economies (see Figure 4). This reflects the higher level of consumption in these countries. Energy use as well as CO_2 emissions (see Figure VIII: Per Capita CO_2 emissions) per capita is the highest in Singapore, Japan and Korea. Both Singapore and Japan appear to have stabilized energy use at slightly below 4000 kg of oil equivalents or even entered a decreasing trend, while Korea's energy use continues to increase albeit at a more modest pace than was the case before the Asian financial crisis. In 2007, it replaced Singapore as the economy with the highest per capita energy use in the region. Only Hong Kong has been able to stabilize its per capita energy use at a lower level, which is similar to the third tier economies.

Among the countries in the third and fourth tiers, two groups of countries emerge. Firstly, there are Malaysia, China and Thailand, where per capita energy use lies between 1500 and 2500 kg of oil equivalent and is thus relatively close to the World average. The countries in the second group, composed of Indonesia, Vietnam, India and the Philippines, all have a per capita energy use of less than 1000 kg of oil equivalent. Except for the Philippines, all countries are still increasing their per capita energy use, with China demonstrating a particularly strong increase over the past decade. Only the Philippines has followed an inverted U-shaped trajectory. At less than 450 kg of oil equivalents per capita its energy use today has returned to the levels of the early 1970s.

Figure 4 : Per capita energy use in selected Asian countries (kg of oil equivalent)

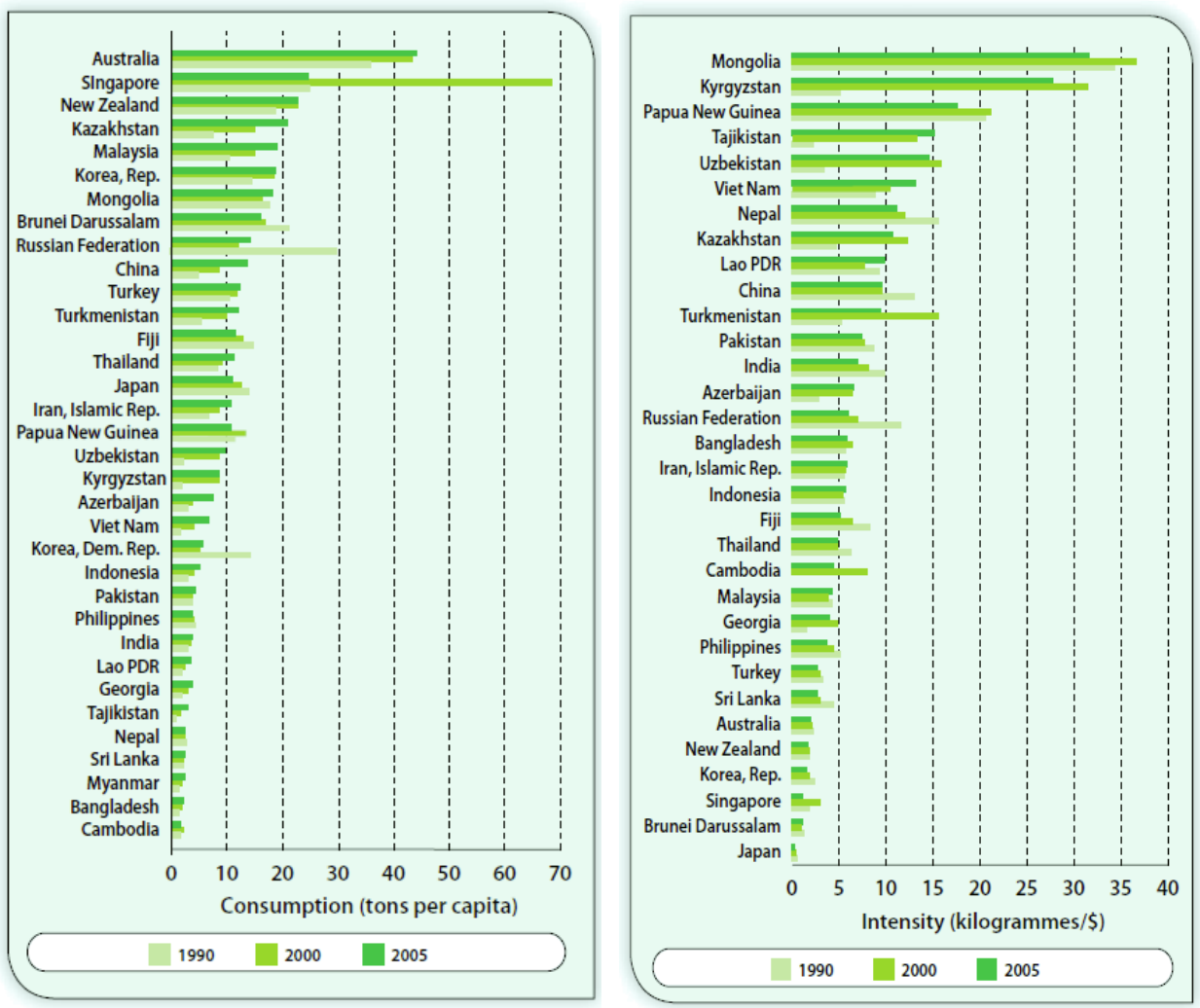


Source : World Development Indicators, World Bank

Material use

As shown in Figure 5, the trends in per capita material use and material intensity broadly mirror the distribution observed for energy consumption in the selected countries. Again the first and second tier economies have the highest consumption levels, which are well above the global average, despite having lower levels of material intensity. With the exception of Malaysia, which surpasses even Korea, the third tier economies use only about half the amount of materials per capita compared to the first and second tier economies and are all below the global average. Again China has caught up with the third tier economies, while the material use in the Philippines has declined and now stands at approximately the same level as in India.

Figure 5 : Domestic material consumption per capita and material intensity in Asia-Pacific countries (tons per capita / kg per US$)



Source : UNESCAP, ADB & UNEP (2012, p.31/35)

1.4 The role of country-specific development models

The previous section has shown that to a significant degree differences in energy use and material consumption do reflect differences in the level of economic development. However, despite this broad resemblance, a number of deviations have been pointed out. In the following section, an attempt is made to explain some of these deviations based on variations in natural endowments and the chosen development model. Key characteristics of the seven countries in terms of natural endowments and development model are briefly sketched out and then related to resource use.

Korea, outlined in Table 1, is a classic case of the Flying Geese Paradigm. Manufacturing industries have been leading the economic development in Korea. They were able to grow due to support from government, including policies to ensure low energy costs. Its use of iron and steel, cement, fertilizer and electricity are among the highest in the world. Despite shifts towards more technology-intensive development, the resulting economic development has been and remains relatively resource-intensive. The Korean economy remains heavily dependent on fossil fuel energy (84%) (Presidential Commission on Green Growth, 2009, p.13). High energy-consuming industry makes up 38% of the entire consumption, which

exceeds the OECD average (22%). Typical high energy-consumption industries are steel, petro chemistry, cement, paper, and non-ferrous metal industries. These and manufacturing, which includes shipbuilding and car making industries, make up 75% of the entire energy consumption (Samsung Energy Research Insitute, 2008). Nevertheless, scarce resource endowments and limited land has driven some efforts to use resources more efficiently, and to establish recycling as a major activity so as to decrease dependence on imported raw materials. Since the late 1990s, Korea has been able to bring down energy intensity to a level close to the World average, although per capita energy consumption has continued to increase and remains above the OECD average (OECD World Indicators, 2011).

Indonesia differs in important ways from the Korean trajectory of economic development as it entered its process of industrialization not only with surplus labour but also abundant natural resources, including significant petroleum reserves. The income generated from oil in the 1970s enabled the country to pursue investments in heavy industry before having fully developed its light manufacturing industry. Moreover, the surplus generated in the petroleum sector reduced the pressure to pursue an export-oriented strategy early on in its development. Only after a downturn in crude oil prices in the 1980s did the country shift to a more export-oriented development of its light manufacturing industry (Aswicahyono, Hill & Narjoko, 2011). Additionally, Indonesia's vast forestry and mineral reserves have remained an important driver of economic development. The forestry sector and related industries represent 3,5% of national GDP and more than 8% of manufacturing value-added, while mining represents more than 10% of GDP. As a result, biomass and mineral consumption still capture a significant share of Indonesian resource consumption. Deforestation represents one of the most important environmental challenges in the country. Finally, the agricultural sector with almost 15% of GDP and food processing with almost 25% of manufacturing value-added also remain important pillars of the economy (UNIDO Statistical Country Brief, Indonesia).

Thailand has followed a more typical pattern of industrial development, moving from labour-intensive manufacturing, such as food processing and textiles and clothing production, in the 1960s and 1970s to increasingly capital intensive manufacturing activities in the 1980s (Dhanani & Scholtès, 2002; Warr, 2011). Per capita value-added in manufacturing activities using medium or high-level technology increased from $167 in 1985 to $585 in 1998, which corresponds to 18 and 40% of total manufacturing value-added, respectively. Most of this growth took place in the area of machinery and transport equipment, accounting for over 30% of manufacturing value-added in 1996 (Frankema & Lindblad, 2012, p.308). In terms of energy consumption, the manufacturing and transport sector make up the bulk of the country's energy use, each accounting for approximately one third of the total. Despite the increasing importance of the industrial sector, it should be noted however that the food and beverage industry still accounts for approximately 15% of value-added in the manufacturing sector and more than 30% of energy consumption, indicating the important role this sector continues to play in the Thai economy (UNIDO Statistical Country Brief, Thailand).

The Philippines has followed a unique development trajectory among the selected ASEAN countries. It has not followed the path of progressive industrial upgrading. After a period of modest industrial development in the 60s and 70s under a regime of import-substitution industrialization (ISI), its industrial sector actually decreased its share of GDP over the 1980s and 1990s. Instead its service sector has grown to approximately 55% of GDP, while the industrial sector has stabilized at about 32% of GDP. This has gone along with sluggish growth in the 1980s and 1990s, though picking up since the turn of the

century. Economic development over the past two decades has been dominated by a dynamic business process outsourcing (BPO) industry as well as consumption fuelled by high levels of remittance inflows (Asian Development Bank, 2012). This service- and consumption-led growth explains the low levels of energy and material intensity exhibited by the Filipino economy. Manufacturing in the Philippines has been dominated by relatively low-value added electronics and food and beverages sectors. The electronics sector has become the most dynamic sector in terms of exports, surpassing the agricultural sector as top foreign exchange earner in the mid-1990s. Its overall contribution to the economy is less significant, however, due to its high import content (Asian Development Bank, 2012; Reyes-Macasaquit, 2009).

India is typically not considered a core country in the Flying Geese Paradigm as it has not pursued an explicitly export-oriented development model. Beginning in the 1950s, India pursued a highly State-driven ISI strategy focused on the development of heavy industry, and until the 1980s trade in the Indian economy was tightly controlled. In the mid-80's, however, a process of progressive trade and economic liberalization was initiated (Das, 2003). However, similar to the Philippines, growth has been concentrated in the service sector with IT and BPO services representing important sources of foreign exchange earnings. As a result, services have increased their share of GDP from 40% in 1980 to 55% in 2010, while the share of industry has remained fairly stable accounting for slightly over a quarter of economic output (World Development Indicators, World Bank). Moreover, Indian industry is relatively concentrated in basic industries, like chemicals (15%), basic metals (18%), basic non-metallic materials (10%) and petroleum products (10%), while manufacturing is still dominated by the food and beverage and textile sectors, accounting for more than 15% of industrial output (UNIDO Statistical Country Brief, India). Finally, while India, supported by its high share of services, has been catching up to the regional average in overall energy intensity of economic activities, sectoral energy intensity in the industrial sector is comparatively high, surpassing even China (World Development Indicators, World Bank).

China began its development in a similar way as India, focusing on the development of heavy industry in the post-War period. Until the beginning of the reform period, China's industrial development was concentrated in a few basic industries. As such, its economic development trajectory also does not fully comply with the basic pattern of the Flying Geese Paradigm. With the implementation of market-oriented reforms in the 80s and 90s, however, a host of previously neglected sectors, mostly in light, labour-intensive manufacturing, began to grow rapidly (Brandt, Rawski, & Sutton, 2008). Gains in GDP per unit of energy can thus be partly attributed to the shift from more energy-intensive, heavy industry into lighter manufacturing industries (Kambara, 2009). Towards the turn of the century, this pattern changed again, as the most labour-intensive sectors began to drop from the list of top performing industries (UNIDO Statistical Country Brief, China). Instead more capital- and resource-intensive industries have re-emerged as important growth sectors, as China has invested heavily in developing its infrastructure. This shift may help explain the fact that improvements in energy and material intensity in the 1990s levelled off and even reversed during the past decade. An additional contributing factor is the increasing level of personal consumption in China's rapidly growing middle class. At the same time advances towards more technology-intensive manufacturing, especially in the area of electronics and telecommunications equipment, have been made, promising improvements in energy intensity in the medium term (UNIDO Statistical Country Brief, China).

Vietnam has largely modelled its development path after the Chinese experience. It invested in heavy industry in the 70s and early 80s, although this did not lead to significant industrial development.

With the launch of its Đổi Mới (renovation) policies and the transition from a centrally planned economy to a socialist-oriented market economy, the focus shifted to accelerating economic growth via the promotion of manufacturing and agricultural development. The results were rapid gains in agricultural productivity and rapid, FDI-driven development of the manufacturing sector (Dapice, 2011; Rama, 2008; Van, 2012). The largest share of manufacturing is concentrated in the food and beverages sector with almost a quarter of manufacturing value-added and textiles with approximately 14%. Higher value-added activities, like electronics and equipment manufacturing, only account for less than 20% of manufacturing output. Meanwhile, energy- and pollution-intensive industries, like basic metals or the chemical sector, also increased their output and still represent almost a third of industrial output (UNIDO Statistical Country Brief, Vietnam). These industries remain inward-oriented and are dominated by relatively uncompetitive SOEs, which, until more recent liberalization efforts, have enjoyed fairly high levels of protection (Dapice, 2011). Finally, mining activities and crude oil production account for more than 8% of industrial output (UNIDO Country Statistical Profile, Vietnam). This dual economic structure helps explain Vietnam's relatively weak performance in terms of energy intensity of economic activities.

As these brief country profiles have demonstrated, a set of broadly similar development trajectories and related environmental challenges are counter-balanced by a number of country-specific factors. One important variation across countries relates to the relative weight of the manufacturing sector in driving economic output. In particular the Philippines and to a lesser degree India, where economic growth has been service-led, energy and resource-intensity is lower relative to the level of economic output. On the other hand, in India this is coupled with high levels of sectoral energy intensity in industry, making it an important challenge for balancing future economic growth with environmental considerations. Another key factor relates to the availability of natural resources. Here Indonesia stands out. Due to its relative wealth in petroleum, minerals and forestry reserves, the country has pursued a development trajectory, which places heavy emphasis on the exploitation of these natural resources. Reducing deforestation and fossil fuel consumption thus present a particular challenge in the country.

2. Towards Green Growth: Strategies and Drivers

Different levels of economic development as well as the country-specific factors outlined in the previous section places each of the selected countries before a unique set of opportunities and challenges for greening its economic development path. Despite these differences, the goal of green economic development has been taken up by governments in all the selected countries. The following section provides an overview of the various strategies to promote green economic development in the selected countries and discusses possible drivers for the chosen approaches. The section begins with a brief overview regarding the state of policies to promote green growth, in particular climate and renewable energy policies. Following this, the key policy drivers for green growth strategies in the region are presented, exploring linkages to country-specific factors, such as natural resource endowments, development strategies and level of economic development.

2.1 A Brief overview of policies to promote green growth

Among the selected countries, Korea has been at the forefront of developing a green growth strategy, which corresponds to its leadership position in terms of economic development and technological sophistication. It has not only launched its National Strategy for Green Growth for 2009 to 2050 and its corresponding Five Year Plan for Green Growth (2009 – 2013), but it has been instrumental at promoting the discussion on green growth at the international level. It has launched the Global Green Growth Institute with the participation and support of a diverse set of governmental and non-governmental stakeholders, and it has played an important role at the regional and global level in establishing various multilateral initiatives on green growth.

Among the other selected countries, only Vietnam and Indonesia have launched dedicated national green growth strategies. In both cases, these are closely aligned with the countries' climate change strategies and are coordinated by the related institutional arrangements, i.e. Vietnam's National Committee on Climate Change and Indonesia's National Council on Climate Change. In Korea, which has not created a separate climate strategy or council, the strategy is overseen by the Presidential Committee on Green Growth. As such, Korea is the only country where policies addressing climate change are fully integrated into the country's green growth strategy. The remaining countries have all created climate change strategies or programs. Moreover, with the exception of the Philippines all the selected countries have formulated emission reduction or other climate change-related targets. These mainly refer to reductions in energy intensity or emission reductions in reference to a business-as-usual (BAU) scenario. Only Vietnam has committed to a net reduction of greenhouse gas emissions (see Table 2).

Table 2: Climate change-related targets in the selected countries

China	India	Korea	Indonesia
Reduction of carbon intensity by 17% and energy intensity by 16% by 2015; Reduction of carbon intensity by 40-45 % by 2020	Reduction of energy intensity by 20-25% in 2020 over the 2005 levels	Reduction of greenhouse gas emissions 30% below BAU by 2020	Reduction of greenhouse gas emissions by 26% below BAU by 2020; 41% with international assistance
Thailand	**Vietnam**	**Philippines**	
Reduction of energy intensity by 25% from 2005 to 2030	Reduce greenhouse gas intensity by 10-15% by 2020; Reduce greenhouse gas emissions by 2-3% per year until 2030	No target	

In addition, all the selected countries have embarked on some form of renewable energy policy and have implemented corresponding instruments, such as feed-in tariffs, quota systems or other types of investment incentives (see Table 3). In most countries, these policy instruments are embedded in a strategic plan aimed at developing renewable energy. India is the only country with a ministry dedicated to the development of new and renewable energy, which is also responsible for the Strategic Plan for the Growth

of Renewable Energy. In China, the Development Plan for Renewable Energy, published by the National Energy Administration, is embedded in the planning process for the 12th Five-Year Plan Period. Similarly, the Thai energy ministry has developed its Alternative Energy Development Plan, and the Renewable Energy Management Bureau within the Filipino Department of Energy is overseeing a National Renewable Energy Program. In Korea, the Ministry of Knowledge Economy is responsible for the 3rd Basic Plan for New and Renewable Energy Technology Development and Usage/Distribution. Vietnam and Indonesia do not have a current strategy for renewable energy development. In Vietnam, a draft National Master Plan for Renewable Energy was developed in 2009, but has not been approved by the Prime Minister.

As the figures in Table 3 indicate, there is a significant degree of variation across the countries, both in terms of progress and targets. Similarly, the share of different renewable sources differs from country to country, a point which is taken up below.

Table 3: Overview of Renewable Energy Policies and Status

	China	India	Indonesia	Thailand	Vietnam	Philippines	Korea
Renewable Energy Policies and Planning							
Renewable Energy Strategy / Plan	+	+		+			
Feed-in Tariff	+	+	+	+		+	
Quota system (including RPS)	+	+	+			+	+
Competitive bidding		+	+			+	
Other investment incentives	+	+	+	+	+	+	+
Biofuel Mandate	+	+	+	+		+	+
Renewable Energy Shares in Electricity Mix and Corresponding Targets							
Renewable share in installed capacity in 2009 (excl. hydro)*	**4,7 %**	**7,0 %**	**3,6 %**	**1,7 %**	**0,1 %**	**12,8 %**	**1,3 %**
Share of hydro in installed capacity in 2009*	**21,8 %**	**20,9 %**	**14,9 %**	**7,4 %**	**36,2 %**	**21,1 %**	**2,0 %**
Renewable Target (in electricity production)**	**30% by 2015 (non-fossil)+**	**10% by 2012**	**15% by 2025**	**11 % by 2011; 14% by 2022**	**5% by 2020**	**40% by 2020**	**6% by 2020++**
Largest source of RE (excl. hydro)	**Wind**	**Wind**	**Geo-thermal**	**Biomass**	**Wind**	**Geo-thermal**	**Wind**

* Based on CIA fact book. Expressed as share of the country's total generating capacity. ** Unless otherwise indicated, based on REN 21 Global Status Report 2012 (REN21, 2012). Targets may vary in scope, e.g. may include or exclude hydro power.
+ State Council White Paper on Energy Policy (State Council of the PRC, 2012); ++ Presidential Commission on Green Growth (2009) National Green Growth Strategy and Five Year Plan

2.2 Green growth as a strategy for attaining technological leadership and sustaining export-led growth

In China and Korea, policies to promote green economic development are strongly intertwined with the countries' innovation and industrial policies. Green technologies have been identified as strategically important industries, in which these countries aim to capture leadership positions. In both countries, green growth is, therefore, partly a continuation of their export-oriented development strategies and builds on ambitious goals in the development of their technological capabilities.

In Korea, the "creation of new growth engines" is one of the three core pillars of the country's National Strategy for Low Carbon and Green Growth for the period of 2009 to 2050. This long term strategy is complemented by a corresponding Five-Year Plan for 2009 to 2013, an important development-era industrial policy tool, which has been revived in this context. The plan has incorporated the government's Strategy for New Growth Engines launched in January 2009 and targets 27 "core technologies", for which it earmarks $2 billion for R&D and commercialization (Presidential Commission on Green Growth, 2009). Moreover, as indicated above, the country's Basic Plan for New and Renewable Energy is led by the Ministry of Knowledge Economy and sets not only deployment targets, but also includes the goal of attaining 15% global market share and US$36,2 billion in exports by 2015 (Invest Korea, 2013).

Similarly, in China, an important element of its traditional 12th Five Year plan (2011 – 2015) is the promotion of seven so-called "strategic emerging sectors", including the energy conservation and environmental protection industries, the new energy industry and the new energy automobile industry (Boyd & Copsey, 2011). As pointed out in the China 2030 report, published jointly by the World Bank and China's Development Research Center of the State Council, they represent high-value added sectors with significant export potential (World Bank & Development Research Center of the State Council, 2012, p.236). The Five Year Plan further highlights the potential of technological leapfrogging in these sectors and aims to increase their share of national GDP to 8% within the plan period. It proposes the need for an integrated approach for the purpose of "mastering core industry technologies and accelerating large-scale industry development" (Chapter 10, 12th Five-Year Plan). The importance of these seven sectors for China's high-tech industrial policy is further underlined in a separate Five-Year Plan for National Strategic Emerging Industries. Released by the State Council in 2012, it places them in the context of a new industrial revolution and the competition for a leadership position within this context. It details additional industrial policy targets for each of the sectors for 2015 and 2020 and proposes corresponding policy measures.

2.3 Renewable energies and energy efficiency as instruments to enhance Energy Security

Measures to promote energy efficiency and renewable energy development represent a key component of the transition to a low-carbon, green economy. The key driver for this, however, may not be the expected climate benefits. Rather, in a number of countries, increasing energy security concerns have played an important role in advancing policies in these areas. As pointed out by a UNESCAP (2008), increasingly volatile prices for oil and other fossil fuels coupled with rapidly rising demand for energy has brought the issue to the attention of policy makers in the region (p 3). In 2002, fossil fuels provided more than 75% of the domestic energy consumption in China, India, Indonesia, the Philippines and Thailand, making them particularly vulnerable to these market developments (UNESCAP, 2008, p.7).

In India, in particular, energy security concerns are closely interlinked with pressing economic development issues. The supply of reliable energy has been identified as one of the key bottlenecks for sustaining the country's rapid process of economic growth (Dubash, 2011). Average annual shortages of approximately 8% and a peak deficit of approximately 10% (Central Electricity Authority, 2012, p.15), represent an important constraint to further industrial development. In addition, estimates of domestic coal reserves have been adjusted down from 200 years to 30 to 40 years, implying a growing exposure to volatile international markets in the coming decades (Dubash, 2011).

One approach to tackling these supply constraints has been to invest in enhancing energy efficiency, in particular in the industrial sector. In 2001, the Indian government passed the Energy Conservation Act followed in 2002 by the establishment of the Bureau of Energy Efficiency (BEE). After 10 years of capacity building supported by the BEE, the country recently launched an innovative trading scheme, called "Perform, Achieve and Trade" (PAT), to promote energy efficiency. The scheme is based on energy efficiency standards for important industrial consumers of electricity. To comply with these standards, companies may either lower energy consumption to the required level, or they may buy so called Energy Savings Certificates from over-achieving firms. The PAT scheme is the core pillar of the National Mission on Enhanced Energy Efficiency, which aims to avoid 19 GW of electricity capacity addition.

Since passing the Electricity Act in 2003, the central government has also shown a stable commitment to renewable energy development with an initial focus on wind energy, as the most mature and more cost-efficient option (excluding hydropower). These efforts laid the foundation for the development of an Integrated Energy Policy 2006, which clearly spells out the need to draw on "all available fuel options and forms of energy, both conventional and non-conventional" to meet the rising energy needs of the country (Dubash, 2011). More recently, the government has launched a National Solar Mission under the auspices of the National Action Plan on Climate Change (NAPCC). As such, its important role for addressing climate change is, of course, acknowledged. However, this does not represent the dominant rationale of the government's solar energy strategy. The plan states that the "development of clean energy technologies, though primarily designed to promote energy security, can also generate large benefits in terms of reducing carbon emissions." (Prime Minister's Council on Climate Change, 2008, p.13). In other words, the reduction of greenhouse gas emissions are defined as important "co-benefits" rather than representing the central objective of renewable energy policy (Dubash, 2011).

Thailand's Renewable and Alternative Energy Development Plan (AEDP) for 2012 to 2021a similar stance. It highlights the expansion of renewable energy as a means for reducing the country's high dependence on fossil fuel imports. According to the AEDP, 60% of primary commercial energy demand is met by fuel imports, and oil imports account for 80% of domestic oil consumption (Government of Thailand, 2012, p.1). As a further benefit, it cites reductions in greenhouse gas emissions. However, it also emphasizes the voluntary nature of this initiative and underlines that Thailand is not yet subject to any obligations to limit the production of greenhouses gases. In Korea, climate change mitigation takes on a more central role in its green growth strategy. Nevertheless, energy independence is also cited as one of three core strategy objectives.

In China, energy security concerns may have played a less prominent role in driving renewable energy development. As argued above, renewable energy policy is closely aligned with the country's industrial policy goals. Moreover, until the late 1990s, energy security policy was mainly a foreign policy concern, aimed at securing access to foreign fossil fuel reserves, most importantly oil. However, Boyd (2012)

argues, that over the past ten years recurring blackouts, resulting from coal shortages at the local level, have raised awareness about the inherent risks of an energy intensive development model. This has given rise to ambitious targets to reduce energy intensity. The 11th Five Year Plan set the goal of reducing energy intensity of economic activities by 20%, followed by a 16% target in the current Five-Year Plan. These targets are pursued with a variety of instruments, including energy intensity targets for large industrial enterprises, reduction of fossil fuel subsidies, new taxes and tarifs on energy-intensive products and higher electricity prices for energy-intensive industries (Boyd, 2012).

2.4 Economic potentials and availability of natural resource help shape renewable energy policy

Another important factor shaping renewable energy policy is the domestic availability of natural resources as well as their potential to contribute to domestic economic development. Frequently, this complements considerations regarding the current cost-effectiveness of a particular renewable energy option, though not always.

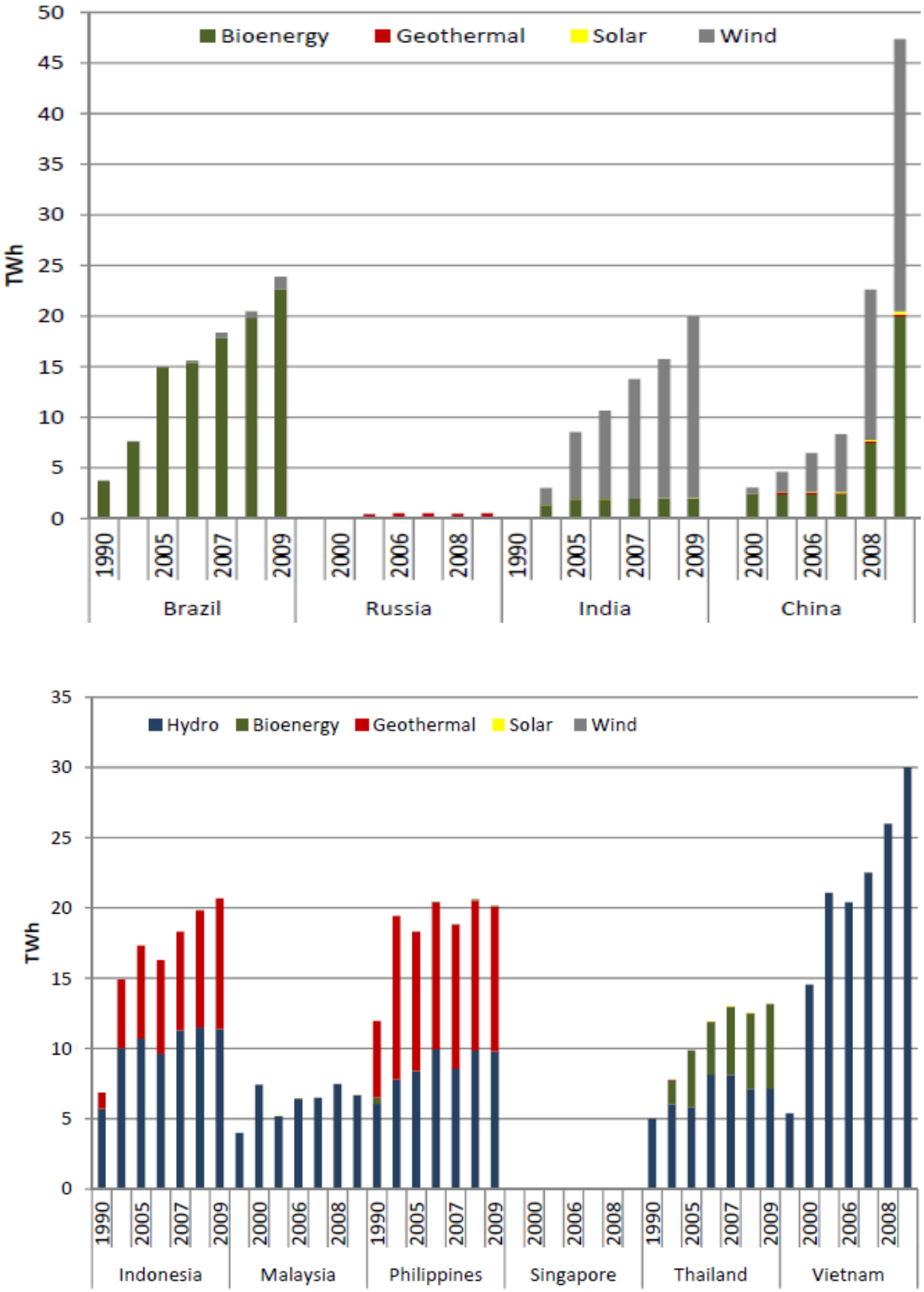
In Thailand, for instance, solar energy has taken precedence over the deployment of wind energy, typically the more cost effective of the two alternatives. In the Renewable and Alternative Energy Development Plan (AEDP) for 2012 to 2021, the government targets 2 GW of solar energy and only 1,2 GW of wind energy (Government of Thailand, 2012). Given similar development potential for both energy sources, a focus on wind, the more mature and cost-effective technology option, might be expected. The focus on solar energy may, therefore, be explained the existence of an emergent solar module manufacturing industry, including production of modules and cells. In addition, Thailand has an export-oriented industrial cluster focused on the production of metal-grade silicon, with plans to install facilities allowing the production of solar grade silicon in the future (Thailand PV Status Report, 2011). This not only increases the sector's economic potential for the country but also provides it with a political voice. Correspondingly, the AEDP includes plans to further develop the upstream segment of the solar energy value chain.

The promotion of biofuels is another area where Thailand and other Southeast Asian countries have placed an important emphasis. Biofuels represent not only an option for reducing independence from fossil fuel imports, but they also offer important potential for economic development, in particular in rural areas. In the long term, Thailand aims to become a regional export hub for biofuels and related technologies (Damen, 2010, p.6). Correspondingly, the AEDP presents a set of both demand- and supply side measures for the promotion of both bioethanol and biodiesel. Bioethanol is supported by an E10 mandate (applied only to 91 octane gasoline), subsidies for E20 and tax incentives. Additionally, cars suitable for the use of E20 and E85 bioethanol receive a subsidy of approximately $1000 and $1500 per vehicle, respectively. Biodiesel is supported by a B5 mandate in addition to similar tax incentives. These demand-side measures are complemented by R&D subsidies for the development of second and third generation bioethanol, for developing alternative feedstocks for biodiesel as well as an Oil Palm Industrial Development Plan.

Thailand is not alone in its efforts to support rural economic development through an ambitious biofuel policy. The Philippines passed its Biofuels Act as early as 2006, two years ahead of the Renewable Energy Act of 2008. The law introduces progressively increasing blending mandates for biodiesel and bioethanol, currently standing at 2% (B2) and 10% (E10), for diesel and gasoline, respectively. Additionally, it offers a number of tax exemptions and endorses priority financing for biofuel producers. Indonesia is also seeking to exploit its potential in biofuel production, although policies are less consistent. Blending mandates were lowered after their introduction and are less ambitious than in Thailand and the Philippines. They stand at 2,5% for biodiesel and 3% for bioethanol (Asian Institute of Technology, 2012). This may be

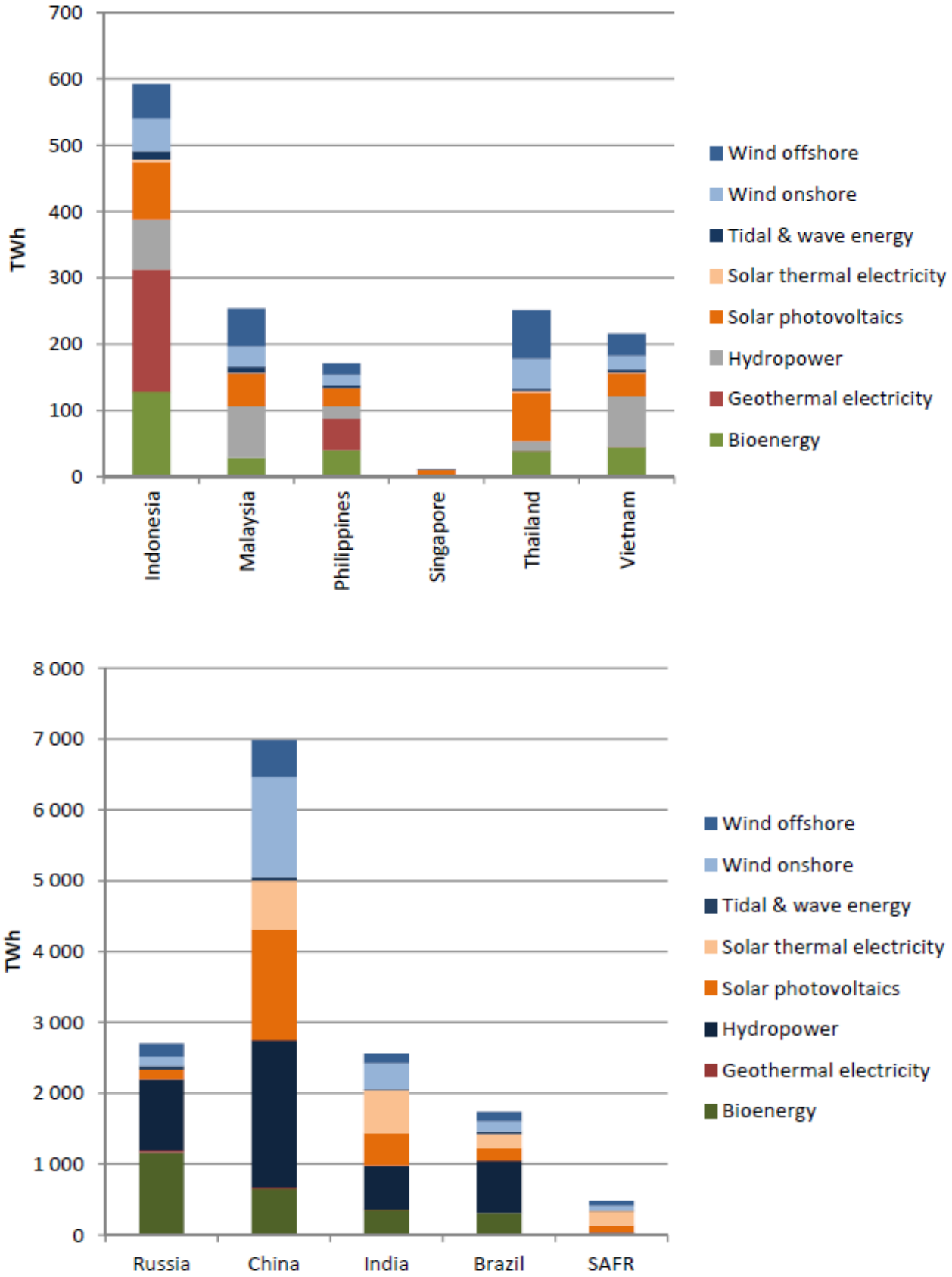
related to the relatively abundant supply of fossil fuel resources, which remain subsidized by the government. Nevertheless, Indonesia, like Thailand, is among the top ten biofuel producers globally.

Figure 6 : Installed capacity of renewable energy by source, 2011



Source : International Energy Agency (2011)

Figure 7 : Renewable energy potential by 2030 in selected Asian countries



Source : International Energy Agency (2011)

Both Indonesia and the Philippines have also shown a strong commitment to the exploitation of their geothermal resources, corresponding to the important potential for this energy source in both these countries. Indonesia has an estimated 27 GW of geothermal potential, which amounts to approximately 40% of the global resources (World Bank, 2011, p. 2), while in the Philippines experts believe that almost 4,5 GW of geothermal resources are available. The Filipino efforts date back to the 1970s and geothermal energy production currently stands at almost 2 GW, placing it second only to the US (World Bank & AusAID, 2010, p.88). The country is planning to add an additional 1200 MW in the next ten years. Despite its vast potential, Indonesia, with an installed capacity of 1189 MW, has lagged behind the Philippines. With the passing of a geothermal law in 2003, however, the government has signalled a growing commitment to the sector. Although implementation of the law has been hampered by a number of factors, including difficulties in raising the needed financing, weak implementation of the geothermal law and overall capacity constraints (World Bank, 2011, p.4), the government remains committed to developing almost 10 GW of geothermal power by 2020.

Finally, in China, policies to promote the domestic solar industry have been primarily export-oriented. Initially, driven by industrial policy at the local and provincial levels, China's solar manufacturing industry has achieved a remarkable growth story. Faithful to the country's export-led growth model, this was accomplished although China's domestic market represented only a fraction of global demand. By 2011, Chinese manufacturers had attained over 50% of cell and module production, while domestic generation capacity represented merely 4% of the world market (Fraunhofer ISE, 2012). In recent years, however, there are strong indications that the existing manufacturing capacity is driving the Chinese national government to take bolder steps towards expanding its domestic market. The target of adding 20 GW in solar energy production in the current Five-Year Plan period (2011-2015) could make China the fastest growing solar energy market in the world. Given the large overcapacities in China's manufacturing industry, this ambitious target may even be raised further. In late 2012, the media reported that the government is considering to double its target to 40 GW (Beetz & Feng, 2012).

2.5 Fiscal incentives for green growth strategies

Additional incentive for ambitious green growth strategies can be found in their potential to relieve budgetary pressures. Environmental taxation and the reduction of environmentally harmful subsidies offer a source for additional tax revenue and the reduction of fiscal deficits, respectively. Given the limited revenue from income-based taxes in many Asian countries, this fiscal dimension of green growth policies provides an additional motivation for governments to take action, although political resistance make progress particular challenging. Nevertheless, first signs that governments are recognizing the fiscal benefits of environmental taxation are emerging.

Vietnam, for instance, has introduced an environmental protection tax within the context of the country's Plan for Tax System Reforms and Modernization for the Period 2005 - 2010. According to Rodi et al. (2012), the tax has met with high levels of support among the public and stakeholders. This is partially related to a growing awareness of environmental degradation. Simultaneously, the tax revenue will supplement State budgets at both the central and regional level. These additional tax revenues represented an important incentive for the Ministry of Finance to support the initiative. The resulting Environmental Protection Law, which went into effect on January 1st, 2012, includes all types of fossil fuel-based energy consumption, including air travel and shipping, without extending any special exemptions. In addition, it extends to HCFCs, plastic bags and a number of chemical substances. The positive experience with the

introduction of the Environmental Protection Tax has even emboldened the Ministry of Finance to pursue similar legislation for the taxation of emissions (Rodi et al., 2012).

Strong fiscal arguments for greening the State budget are even more apparent in Indonesia. In its Green Paper on Economic and fiscal policy strategies for climate change mitigation in Indonesia (Ministry of Finance, 2010), the Ministry of Finance promotes a carbon tax/levy on fossil fuels in conjunction with a gradual removal of energy subsidies. Driven primarily by budgetary pressures, the phase-out of fuel subsidies represents a longstanding objective of the Indonesian government. With Indonesia becoming an oil importing country in 2004, this commitment has received additional urgency. However, due to strong resistance from the public and key stakeholders, the government has only been able to introduce a number of one time reductions, and fuel subsidies still represent approximately 13% of State expenditures (Koeberle, 2011). In this context, climate change mitigation does not represent the main motivation for the government's reform agenda. Nevertheless, potential co-benefits in terms of climate change mitigation may help strengthen the government's efforts to contain the fiscal impact of fossil fuel subsidies.

Similarly, in India, fossil fuel subsidies represent an important fiscal burden. Subsidies for diesel, kerosene and LPG amount to more than 1% of national GDP. The heavy fiscal burden led the government to install an Expert Group On A Viable and Sustainable System of Pricing of Petroleum Products (Government of India, 2010), which was led by former member of the Planning Commission, Kirit Parikh. In its final report, the Expert Group summarizes the motivation of its task in purely economic and fiscal terms, stating that a sustainable pricing policy for petroleum products "should limit the fiscal burden on government and keep the domestic oil industry financially healthy and competitive" (Government of India, 2010, p.2). Potential co-benefits for low-carbon development are not addressed. In another Expert Group on Low Carbon Strategies for Inclusive Growth (Planning Commission, 2011), also chaired by Kirit Parikh, potential emission reductions from the removal of fuel subsidies are estimated at 5 – 7%, though this does not figure as a prominent policy option within the report (Planning Commission, 2011, p.84). In other words, while strong synergies between economic and climate policy goals exist in practice, these co-benefits do not yet figure prominently in the government's discourse on the matter.

The government's recent decision to progressively deregulate diesel prices is, therefore, primarily a fiscal policy decision. Among the important benefits of the measure, however, will be the increasing competitiveness of renewables for captive electricity generation. Due to the country's structural shortages in the electricity supply, many business and home owners operate diesel-powered generators as a source of electricity to bridge the frequent power cuts. A rise in diesel prices makes the installation of captive solar energy or wind energy systems an increasingly attractive option. The market for captive generation of solar energy, for instance, is estimated at 15 GW (Bridge to India, 2011, p.11).

2.6 (International) Climate policy as a driver of green growth strategies

As the report has argued so far, progress in advancing a green growth agenda in Asian economies is being driven by a number of economic, fiscal and energy policy objectives. Climate benefits have been portrayed primarily as co-benefits rather than the primary motivators of policy action. That said, the international debate on climate change has clearly also had an important influence on the framing of policy debates and has provided impetus to the development of corresponding national targets and strategies. As indicated above, all the selected countries - with the exception of Korea, which has integrated climate policy in its green growth strategy - have launched climate strategies or action plans.

Climate mitigation policies are strongly linked to the development of renewable energy and energy efficiency and the most ambitious approaches are thus closely linked to the energy policy and industrial policy goals discussed above. However, broader climate policies are also emerging. Korea has passed legislation for a nationwide greenhouse gas emission trading scheme, which is to go into effect in 2015 (O'Donnell, 2012). China is currently experimenting with a number of provincial and city-level emission trading schemes (National Development and Reform Commission, 2012), and Thailand is planning a voluntary carbon market (IGES & Thailand Greenhouse Gas Management Organization, 2012). As mentioned above, Vietnam is the first country to introduce a tax on all types of fossil fuel-based energy sources. In addition, forestry preservation and afforestation schemes represent an important entry point for climate change mitigation in the majority of the selected countries. The most ambitious schemes are closely linked to the international REDD framework (addressed in more detail in the following section).

The emergence of these policies and strategies indicates that the international debate on climate change and the related pressure to contain increases in greenhouse gas emissions represent increasingly relevant policy drivers. Evaluating their overall importance remains difficult to assess, however. India, for instance, has taken a fairly comprehensive approach to climate policy in its National Action Plan on Climate Change. It has introduced eight so-called national missions, which focus on a range of issue areas, including forestry, water resources, urban development and sustainable agriculture. However, in practice, the missions to promote energy efficiency and solar energy, where important overlaps with energy policy objectives exist, have made the most substantial progress in advancing their stated objectives. The other missions remain in a preparatory stage (Byravan & Rajan, 2012). In other words, progress to date appears to indicate that energy policy goals continue to take precedent over other spheres of India's climate policy.

The domestic impacts of climate change represent an additional policy driver, which appears to be gaining in importance. The challenge of climate change adaptation is an important element in all the climate change strategies, including Korea's green growth strategy. It is reinforced by strategies for developing appropriate knowledge and information systems on the domestic impacts of climate change. The strategies in the Philippines and Vietnam explicitly declare adaptation as their first priority. In India and the Philippines, central governments have initiated State Action Plans on Climate Change and Local Climate Change Action Plans, respectively, both with a strong focus on climate change adaptation. Similarly, Thailand and Vietnam address the need to engage communities and local governments in developing and implementing adaptation measures.

2.7 International climate finance as an incentive for green growth strategies

An additional motivating factor for Asian countries to embark on green growth strategies is the promise of international climate finance, in particular in smaller countries with lower income levels. As pointed out in a report on The Landscape of Climate Finance (Buchner et al. 2011), public funds directed at climate-related projects and programs are mainly channelled through bilateral development agencies as well as bilateral and multilateral development banks. These international funds are estimated at $39 billion (2009), which is significantly more than the funding provided by carbon offset markets, most notably the Clean Development Mechanism (CDM), estimated $2,2 – $2,3 billion. However, it is significantly less than the upper bound estimates of private sector funding, for which calculations range from US$37 billion – US$72 billion.

In China and India, due to their large size, and Korea, as a leading industrialized country, public funding for climate change-related projects cannot be expected to play any significant role in shaping national policy strategies. Nevertheless, it might be acknowledged that China and India have been the

main beneficiaries of CDM projects, accounting for 36,4% and 23,4% of global projects respectively. The impact of these projects on China's national policy goals has been minimal, however (World Bank & Energy Research Institute of the NDRC, 2010). The largest contribution has come in the wind energy sector. In the period up to 2010, Chinese CDM projects accounted for more than 25% of wind energy capacity (World Bank & Energy Research Institute of the NDRC, 2010). Given the rapid development of the domestic market since then, it is likely that this share has significantly decreased since. In India, wind projects account for about a third of CDM projects, which translates into about a quarter of China's CDM-related wind capacity and about 10% of the India's installed capacity. These figures indicate that the CDM has played a role in providing additional financing to a significant number of wind energy projects in both India and China. It remains unlikely, however, that the CDM has provided an important incentive for formulating national policy targets.

Apart from these two global powerhouses, international climate finance represents a significant incentive for low and lower middle-income countries to embark on climate-related policy initiatives. In Vietnam, for instance, gaining access to international climate finance is an explicit goal of its climate change strategy. The strategy states, "Climate change will open doors to global multilateral, bilateral cooperation, through which developing countries like Vietnam can gain access to new financial and technology transfer mechanisms from developed countries."(Government of Vietnam, 2011, p.4). Correspondingly, Vietnam's National Target Programme to Respond to Climate Change, a medium-term action plan which is aligned with its long term climate strategy, has been closely coordinated with the international donor community. Together with the Japanese and French donor agencies, the Support Programme to Respond to Climate Change has been initiated to identify and harmonize climate-related development assistance programs. It offers a platform for policy dialogue between the Vietnamese government and multiple donor agencies and is coordinated by an International Coordination Committee where relevant ministries are represented.

In Indonesia, climate change rapidly gained in prominence on the national policy agenda when Indonesia hosted the United Nation's Bali Climate Change Conference. Since then Indonesia has formulated its climate target as a function of international financial support – 26% emissions reductions from the BAU scenario without support and up to 41% with international support. Efforts are focused in particular on reducing emissions from deforestation, a key pillar in Indonesia's climate and green growth strategies. In close cooperation with the UNFCC and the international donor community, Indonesia has formulated a REDD Strategy, which provides the basis for accessing donor financing aimed at combating deforestation and forest degradation (Indonesian REDD+ Task Force, 2012). Initially, an important source of funding will be the Norwegian government, which has pledged to provide up to US$1 billion of funding to support the strategy over a period of 7 to 8 years (Caldecott et al., 2011). Another important mechanism for financing climate change-related activities in Indonesia is the Indonesia Climate Change Trust Fund (ICCTF). The ICCTF provides a vehicle for linking international donor funding to Indonesia's investment needs under its climate change and green growth strategies. Next to forestry-related issues the fund targets mitigation activities in the energy and mining sector as well as adaptation measures.

In Thailand and the Philippines, climate financing strategies appear to be less developed than in Vietnam and Indonesia. This may be related to the very large scope for climate mitigation in Indonesia's forestry sector, on the one hand, and Vietnam's relatively low level of GDP per capita, on the other. Nevertheless, the Filipino Climate Change Action Plan also emphasizes the need to access international donor finance. The strategy points out that only limited donor financing has supported the country's

climate change efforts to date (Climate Change Commission, 2011). Moreover, it points out that the available financing has focused on mitigation rather than adaptation, although the latter represents the country's declared priority. In Thailand, which is significantly less dependent on donor finance, its climate financing strategy is primarily focused on CDM and the international carbon market.

2.8 Green growth as a driver of traditional environmental policy?

As outlined above, economic potentials, energy security concerns and the international debate on climate change are driving increasingly ambitious policies to promote clean technologies and low-carbon development in Asian countries. In the sphere of traditional environmental concerns - such as air and water pollution, soil degradation, waste management, etc. – physical pressures have been rising at a similar pace. However, these challenges appear to be taking a back seat to the priorities or energy and climate change, however. Environmental ministries in the region remain relatively weak players. Although environmental policies have been developed and improved in coherence over the past decades, environmental ministries and their implementing agencies frequently lack the capacity to enforce existing policies and regulations. In particular at the local level, institutions charged with overseeing environmental regulations and standards remain weak and are frequently unable to counterbalance powerful economic interests (Quitzow et al. 2013).

That said, green growth strategies may also be promoting some tentative improvements in the more traditional environmental policy arena. Firstly, Vietnam and Indonesia have integrated a number of broader environmental policy objectives in their green growth strategies. In addition to its emphasis on low carbon development, the Vietnamese strategy aims to boost compliance with existing environmental regulations, develop a new legal framework for recycling and waste treatment and promote more efficient use of natural resources. Additionally, the government has recently launched the development of a Green Industry Policy Framework, aimed at reducing the environmental impacts of existing industrial enterprises. Indonesia's strategy also focuses on climate and energy issues, but also addresses issues related to waste management, water resources, fisheries and sustainable agriculture. Despite its strong emphasis on climate policy objectives, Korea's Green Growth Strategy also contains elements of traditional environmental management. The strategy's largest single project is a 22.2 trillion-won investment in "The Four Major Rivers Restoration Project". To what extent this represents a commitment to protecting the environmental quality of the country's major waterways has been questioned by environmentalists, however. Critics argue that the planned dredging of rivers and construction of dams, mainly aimed at flood prevention, represent outdated water management techniques with negative environmental impacts (Normile, 2010).

International markets for green products may represent another incentive for greening activities in individual economic sectors. In Thailand, driven by rising international demand, a domestic certification for organic agricultural products was introduced in 2002 and has been accredited by the International Federation of Organic Agriculture Movements (IFOAM). In 2005, these developments led the government to launch its Organic Farming Development Strategic Plan. In the tourism sector similar trends are visible. Initiated by a public-private Board of Environmental Promotion of Tourism Activities, the so-called Green Leaf certification program has been adopted as a system for promoting and certifying good environmental practices in the tourism industry.

In China, an important step has been taken at the institutional level. In 2008, the State Environmental Protection was converted into the Ministry of Environmental Protection and attained a seat in the powerful

State Council (Qiu & Li, 2009). In addition, spending on environmental protection has risen from RMB 72 billion (US$ 11 billion) in 1998 to RMB 450 billion (US$ 68 billion) in 2008 (Jin & Mingyuan, 2011, p.166). Finally, in India, the enforcement of environmental standards was strengthened under the vocal leadership of Jairam Ramesh who headed the environment ministry from 2009 to 2011 (Janardhanan, 2010; Padma, 2011; Raman, 2010). Arguably, this momentum was reversed, however, when Ramesh was not only promoted to senior minister but also reassigned to the rural development ministry. In a recent decision, the environment ministry caved into the pressure from the prime minister's office and has allowed mining companies skip the mandatory public hearing process in a one-time 25% expansion of existing coal mining projects (Kumar, 2013).

In conclusion, although discussions on green growth may have increased the political salience of environmental concerns in the region, these issues remain pitted against powerful economic interests. In the case of low-carbon technologies, it is precisely their economic potential, which has unleashed an increasingly dynamic development of the sector. Despite recent advances, traditional environmental governance still lacks a comparable economic support coalition and thus continues to lag behind.

3. Emerging Green Industries and Green Jobs in Asia

In the previous section, an important emphasis has been placed on the economic drivers of green growth strategies. The following section provides an overview of existing empirical evidence of the economic and employment gains associated with green economic development Asia. The section begins with a brief overview of the international debate on green jobs and progress in measuring the employment impacts of green growth. This is followed by a review of existing data on green investment and green job creation in the selected countries.

3.1 Progress towards measuring the impact of green industries and green jobs

In it's report Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World, UNEP et al. define green jobs as "as work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high-efficiency strategies; de-carbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution" (UNEP et al. 2008, p.35-36). This definition spans a large number of economic activities related to greening existing industries, such as the production of pollution control devices or in-house R&D activities aimed at minimizing pollution and resource consumption. In addition, it includes the development or expansion of industrial sectors, which replace existing goods and services with more environmentally-friendly options, such as the expansion of rail transport at the expense of road-based transport or the development of renewable energy sources to replace fossil-fuel based energy sources.

Given the broad scope of activities that might potentially fall into this definition of green jobs, generating reliable and comparable data on green industries and green jobs is a challenging endeavour. OECD and Eurostat have developed definitions and methodologies for collecting statistical data on what is referred to as the Environmental Goods and Services Sector (EGSS). Early studies used data on environmental protection expenditures (i.e. the demand for environmental protection goods and services)

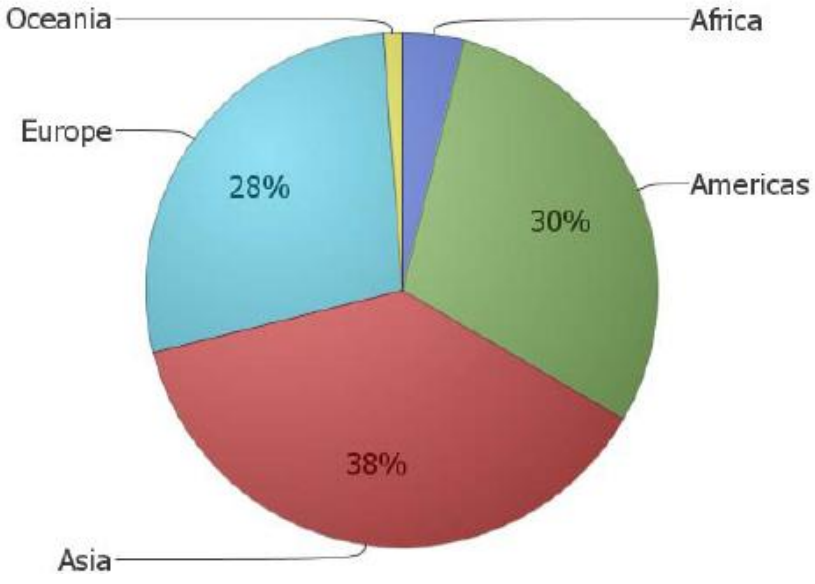
as a proxy for estimating the size and employment effects of the EGSS (see for example, Ernst&Young, 2006). This "demand-side" approach has been replaced by a "supply-side" approach based on a detailed classification system for identifying data on EGSS within existing statistical data or for collecting relevant data using specially designed surveys (Eurostat, 2009).

Using the Euro stat or similar approaches, a number of studies have estimated European and global trends in the development green industries, although a common methodology, enabling meaningful comparisons across countries, is still lacking. The German environment ministry's Environmental Technology Atlas (Bundesministerium für Umwelt, 2012) does not define green industries in terms of specific products, but in terms of six so-called lead markets: environmentally-friendly power generation and storage, energy efficiency, material efficiency, sustainable mobility, waste management and recycling and sustainable water management. These six industries had a global market volume of more than €2 trillion in 2011. In Germany, which accounts for 15% of the market, this translated into approximately 1,4 million green jobs. A report on Low-Carbon Environmental Goods and Services (LCEGS) commissioned by the UK's Department for Business, Innovation and Skill (BIS) takes a broader definition, including among other things nuclear energy and carbon finance (Department of Business Innovation and Skills, 2012). Using this broad definition, it estimates the world market for LCEGS at £3,3 trillion in 2010/11 or approximately 8% of global GDP. For the UK, sales are estimated at £122 billion, which translates into close to one million LCEGS jobs.

3.2 Green industries and green jobs in Asia

The UK's study also provides regional and country-level estimates of LCEGS sales. According to these estimates, Asian countries represent 38% of the world market, thus generating the largest share of global LCEGS sales (see Figure 8: Share of Low-Carbon Environmental Goods and Services Sales by Region). China with 13,1% and India with 6,2% of the global market are ranked 2nd and 4th in terms of overall sales. South Korea (14th), Indonesia (15th), Thailand (20th), the Philippines (25th) and Vietnam (33rd) are also among the top 50 countries (see table I in the Annex). The LCEGS sector as share of national GDP in the selected countries is equal to or above the world average, ranging from 8% in Korea to 21% in Vietnam.

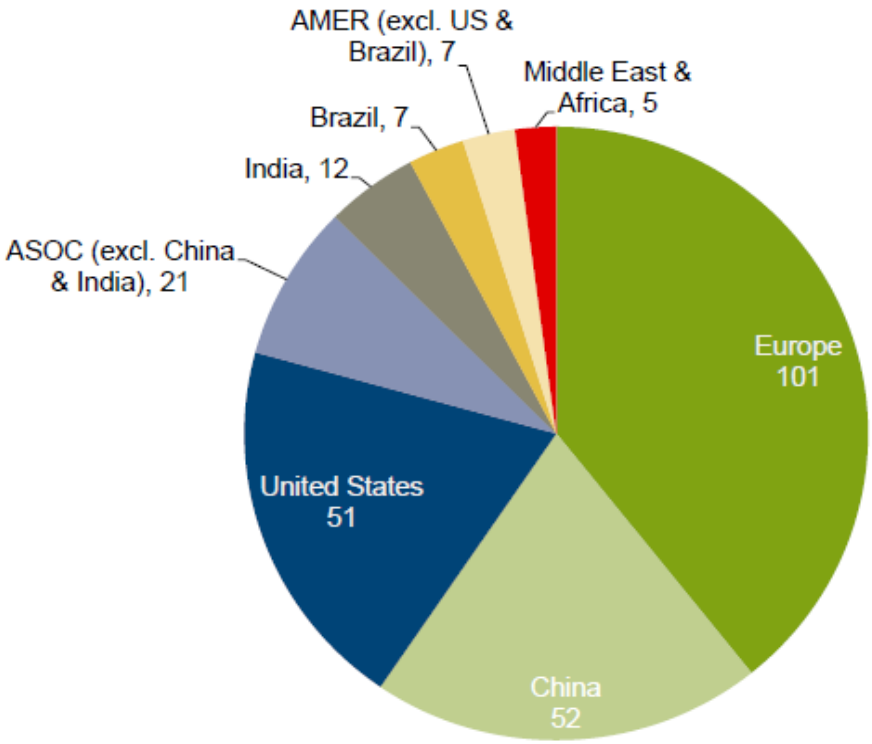
Figure 8 : Share of low-carbon environmental goods and services sales by region



Beyond these general estimates of green industrial output, little disaggregated data on green industries or green employment for the selected countries is available. An exception is the renewable energy sector, for which regional and country-specific investment data is available. As Figure 9 demonstrates, the sector is still dominated by Europe, which accounted for over one third of global investment equal to US$101 billion in 2011. This is followed by Asia with US$85 billion. The bulk of this investment went to China and India. China, which represents the largest single country for green investment, accounted for US$52 billion and India for US$12 billion in investment. The remaining countries in Asia all accounted for US$1 billion (Indonesia) or less in annual investment (see Figure 10; Invest Korea, 2013; UNEP et al. 2012).

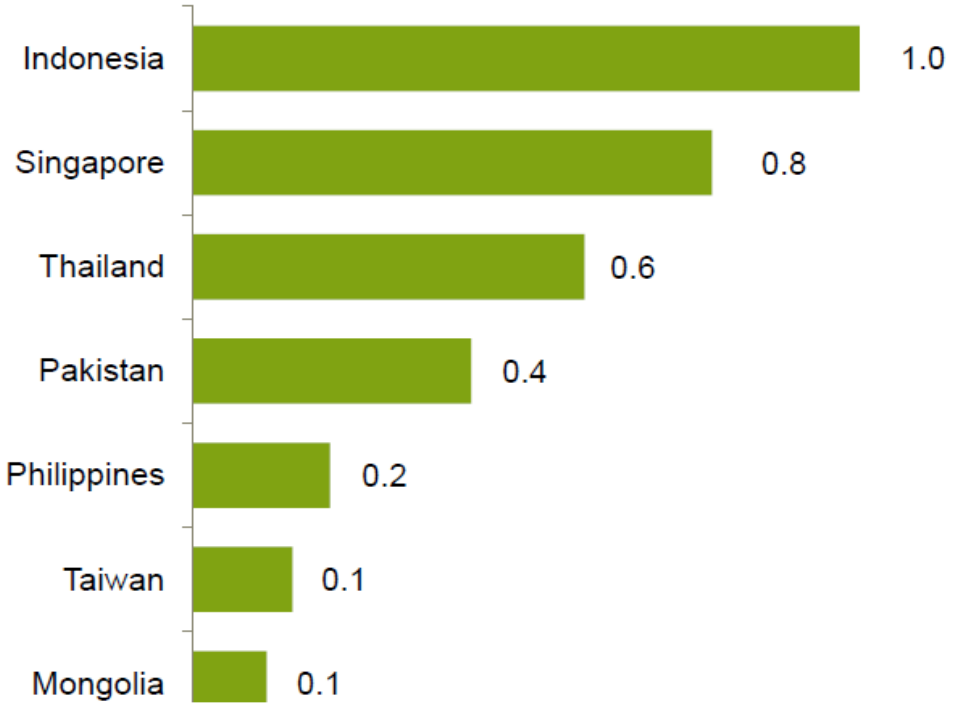
Employment data has been estimated for the renewable energy sector with a focus on wind and solar energy in China, India and Korea as well as the biofuel sector in a number of the selected countries. With China's rapidly growing share of the global renewable energy market, its employment in the sector has also grown rapidly. Based on data from 2006 to 2010, the Worldwatch Institute estimated that China had generated approximately 126,000 jobs in the wind energy sector. This estimation is based on a cumulative installed capacity of 40 GW and does not consider export-related job creation (Pan et al. 2011, p.15). In 2011, approximately 18 GW of additional capacity was installed, suggesting further growth in sectoral employment (REN21, 2012). The Worldwatch report estimated employment in the export-oriented PV sector at 82,000 in 2007 (Pan et al., 2011, p. 13). According to an IEA report, employment in the PV sector had grown to approximately 500,000 in 2011, which is more than Germany, the USA, Japan and Italy combined (see Table 4).

Figure 9 : Global new investment in renewable energy by region (2011, US$ billion)



Source : UNEP et al.(2012)

Figure 10 : Total VC/PE, public markets and asset finance investment in renewable energy in non-OECD Asia excluding China and India (2011, US$ billion)



Source : UNEP et al.(2012)

Table 4: Estimated employment in the PV sector in selected countries, 2011

Country	Research, development, manufacturing and deployment labour places
AUS	10600
AUT	4181
CAN	5320
CHE	10000
CHN	500000
DEU	128000
FRA	27400
ITA	55000
JPN	45000
KOR	11300
MYS	9076
NLD	622
SWE	456
USA	100237

Source : UNEP et al.(2012)

Further employment estimates for countries with major renewable energy sectors are offered by UNEP's Green Jobs report for the year 2006 (see Table 5). The report estimates that India's wind energy sector, standing at approximately 6 GW at the time, had generated 10,000 jobs (UNEP et al., 2008, p.7). In March 2013, cumulative capacity stood at 19 GW (Ministry of New and Renewable Energy, 2013). Finally, Invest Korea (2013) estimated that manufacturing companies in Korea's renewable energy sector provided approximately 17,000 jobs in 2011. For the remaining countries, no employment estimations are available.

Finally, in an Asian-Pacific Economic Cooperation (APEC Energy Working Group, 2010) study, a model for estimating employment impacts from the biofuel sector in APEC member countries was developed. The model was based on sectoral data from Brazil and the US, where biofuels have been in production for many years. On this basis, estimates were made for the remaining countries using extrapolations. According to the study, Indonesia's biofuel sector employs 115,000, followed by Thailand with 21,000 and the Philippines with 19,000 jobs in the sector. According to the model, China and Korea do not have a significant number of jobs in the sector. The remaining countries are not considered in the study's calculations.

In conclusion, evidence on green industries and green employment globally and in the region is still rather incomplete. Estimates of green jobs are highly dependent on the particular methodology and assumptions that are made, leading to strong variations in results (UNCSD, 2011; Upadhyay & Pahuja, 2010). Going forward, it will be important to develop more robust methodologies and collect corresponding data to enable comparisons across countries. Moreover, to enable a meaningful analysis of economic impacts, estimates of job creation in emerging sectors as well as related reductions in employment in sectors that are being displaced by green industries would be needed. Such figures might serve as inputs for the development of socially sustainable green growth strategies.

Table 5: Estimated employment in the renewable energy sector, selected countries and world, 2006

Renewable Energy Source	World*	Selected Countries	
Wind	300,000	Germany United States Spain China Denmark India	82,100 36,800 35,000 22,200 21,000 10,000
Solar PV	170,000**	China Germany Spain United States	55,000 35,000 26,449 15,700
Solar Thermal	624,000-plus	China Germany Spain United States	600,000 13,300 9,142 1,900

Renewable Energy Source	World*	Selected Countries	
Biomass	1,174,000	Brazil United States China Germany Spain	500,000 312,200 266,000 95,400 10,349
Hydropower	39,000-plus	Europe United States	20,000 19,000
Geothermal	25,000	United States Germany	21,000 4,200
Renewables, Combined	2,332,000-plus		

**Countries for which information is available. **Under the assumption that Japan's PV industry employs roughly as many people as Germany's PV industry.*

Source : UNEP et al.(2008)

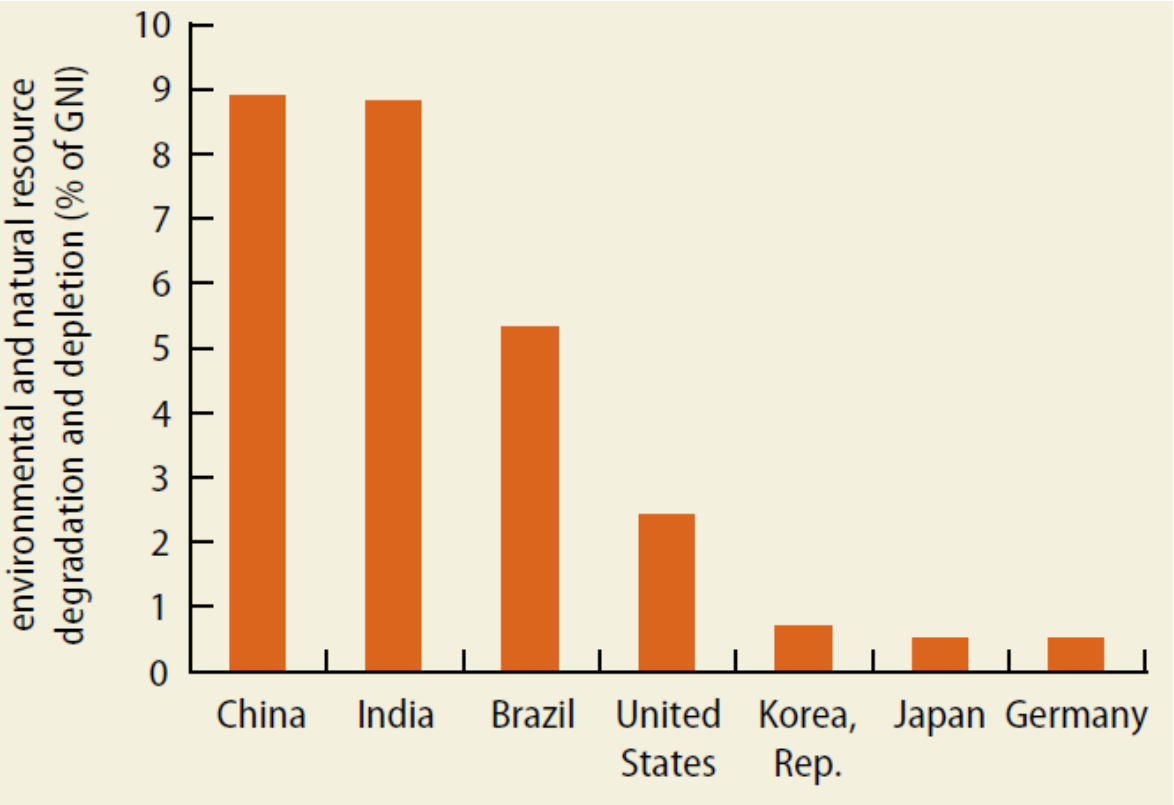
4. Conclusions and Policy Implications

Despite emerging green growth strategies and green industries in the region, Asian economies are far from becoming green, resource-efficient and sustainable. As a matter of fact, resource use and emissions remain relatively high or are even increasing as a result of continued economic development. While renewable energy and energy efficiency policies and the related industries are gaining momentum, the traditional environmental policy agenda still faces severe challenges. The emerging discourse on green growth and climate change offers both opportunities as well as new challenges for promoting a broader greening of Asian economies. Against this backdrop a number of policy options could be explored.

4.1 Ensuring the integration of traditional environmental policy in green growth strategies

As the report has argued, increasing (international) resources are being invested in building capacities for the introduction and implementation of climate policy measures and for promoting green growth. In many cases, however, green growth is being equated to low-carbon growth without sufficient attention being paid to traditional environmental policy issues. An effort should, therefore, be made to ensure that traditional environmental challenges also receive the attention that they deserve. In many cases, addressing traditional environmental challenges - like air and water pollution, soil degradation, etc. – will also bring important economic benefits. In a recent report published jointly by the World Bank and the Development Research Center of China's State Council (2012), the environmental costs of environmental degradation amount to almost 9% of gross national income in China and India (see Figure 11).

Figure 11 : The Costs of Environmental Degradation in Selected Countries



Source : World Bank and Development Research Center of the State Council (2012)

An important entry point for achieving environmental improvements might be to integrate a traditional environmental policy agenda more actively with the climate change agenda. A promising example is the Vietnamese ecological tax reform, where eco-taxes covered not only fossil fuel resources but also a (limited) number of additional products. In some cases, on the other hand, climate change policy may in fact reveal potential contradictions with traditional environmental policy goals or may be accompanied by potentially negative side effects. For instance, low-carbon technologies may require pollution-intensive production processes. Addressing these potential conflicts or side effects and developing corresponding mitigation efforts should be fully integrated in climate change and green growth strategies.

4.2 Strengthening the institutional framework for environmental protection

Addressing environmental problems cannot be expected from market forces and market-oriented policies alone, but it requires robust environmental regulations and policy integration. Environmental regulations and their implementation are also a driving force of environmental technologies. This makes strong environment ministries and implementing agencies essential. Furthermore, to be effective drivers of environmental innovation, environmental policies require complementary sectoral policies. To ensure the consideration of environmental requirements in the different areas of policy making, governments have developed a range of instruments, mechanisms and institutional arrangements, such as strategic planning, interdepartmental working groups, reporting requirements or (environmental) impact assessments. A strong environment ministry plays a crucial role in making these approaches operational and effective.

In a number of Asian countries, climate change strategies have provided the environment ministry with new competencies and have provided them with important mandates for policy coordination. These new mandates have the potential to strengthen environmental ministries vis-à-vis other sectoral ministries. To date, it is not clear, however, to what extent this has also strengthened the broader environmental agenda or whether climate policy has in fact further marginalized environmental issues within environment ministries themselves. Nevertheless, the increasing influence of environment ministries represents a potential opportunity for promoting a broader green growth agenda, where climate change objectives are integrated with other environmental issues. To exploit this potential, approaches for leveraging the increased political clout of environment ministries to promote a broader agenda of environmental protection and green growth might be explored.

4.3 Leveraging fiscal incentives for green growth

As the report has argued, environmental fiscal reform may offer important potential synergies between fiscal and environmental policy objectives. This is especially true for the removal of fossil fuel subsidies, which not only promote excessive consumption of fossil fuel resources but also represent a significant burden on State budgets, especially in India and Indonesia. Similarly, raising additional State revenue via the taxation of natural resources offers the potential of increasing tax revenue while curbing resource use. Vietnam offers a promising first step in this direction and should be exploited to induce other countries to follow suit.

It should also be noted, however, that environmental fiscal reform efforts are often opposed by powerful stakeholder groups, which stand to lose from a change in the status quo. Moreover, the removal of subsidies or the taxation of natural resources may have negative impacts on certain vulnerable populations, frequently an argument against such policy measures. For this reason, environmental fiscal reform efforts would benefit from a rigorous assessment process, aimed at identifying winners and losers of policy reforms. On this basis, strategies for addressing potential political and social challenges attached to the reform process can be formulated.

4.4 Measuring progress towards a green economy

The development of credible assessment tools for evaluating the economic impacts of green growth strategies more broadly is equally important for providing them with the needed legitimacy. Green industries, firms and jobs are still poorly represented in standard national accounts. Green technologies are frequently developed and applied within other sectors of the economy, such as agriculture, energy, transport or the construction sector. As a result, data on the development of green technologies and industries and their impacts on the economy are still not readily available. Hence the sector remains relatively invisible to policy makers and frequently still does not receive the attention that other economic sectors receive. Moreover, data measuring the environmental and resource-related implications of different economic sectors remains relatively scarce.

Emerging approaches to bridge this gap are bottom-up surveys, which describe and analyse the performance of green enterprises as well as the uptake of green technologies. Additionally, a number of countries are beginning to experiment with the establishment of input-output models, which link economic indicators to data on energy, materials and emissions. Strengthening such approaches represents an

important opportunity for promoting the green growth agenda and extending it beyond the most visible sectors, such as renewable energy and energy efficiency. An important reference for such an initiative will be the work being conducted by the OECD on measuring green growth (OECD, 2011c).

4.5 Enabling domestic markets for (cost-effective) environmental innovations

The economic model of most of the countries selected for this study has been strongly influenced by its export orientation. However, as a result of the economic crisis after 2008 as well as growing middle class populations, this is beginning to shift. It has been recognized that future economic development will require the stimulation of domestic demand, in order to reduce the dependence of exports and to better serve the needs of the domestic population. So far, however, this has not had a major influence on the development of markets for environmental goods and services.

Given the important role of environmental policy for stimulating these markets, governments have a key role to play in this context. To meet domestic challenges, governments may have to place greater emphasis on developing policy approaches, which take into account the particular needs and preferences of their domestic populations. Differing cultural practices, income levels and very different urban environments require new, Asian approaches to environmental policy. In this context, it no longer suffices to adopt existing Western models of environmental management, but it may require the development of novel approaches, which are more suitable for stimulating the kinds of environmental goods and services that are needed to meet domestic needs.

In some cases, domestic markets might simply require the adaptation of existing technologies to meet the requirements of a particular climatic or socio-economic context. In this case, an important entry-point for policy might be the support for innovative business or service delivery models, which enable the adoption of environmentally-friendly technologies in an emerging country context. To date, however, many policies to promote environmental technologies have been oriented towards the export sector or the development of technological expertise. (Financial) support for start-ups focused on business model innovations is not a priority.

In other cases, the development of new, less costly technologies represents a more appropriate solution than simply adopting an adapted version of an existing solution. The private sector has identified such "frugal innovations" or "resource-constrained innovations" as an important new business area with large (export) potential in rapidly growing emerging markets (Radjou et al. 2012; Sehgal et al. 2010; Sharma & Iyer, 2012) In the sphere of environmentally-friendly technologies, supportive government policy represents a key factor for enabling the development and diffusion of such frugal innovations, requiring corresponding policy innovations.

To support such policy innovations, it may be useful to support visioning processes aimed at rethinking key sectors, such as energy, food or housing. Such an effort might focus on alternative, more sustainable approaches to delivering the desired system functions. In the transport sector, for example, such a process might focus on the provision of mobility and access to goods and services rather than merely on the expansion of existing infrastructure and technology. Moreover, to promote innovative solutions, it will be important to include civil society actors and entrepreneurs in the discussion process.

Finally, it is likely that those emerging economies that are able to develop success stories in the realm of environmentally-friendly, frugal innovations will serve as role models for other emerging countries. Once cost-effective solutions are found, these are likely to become important export products in their own right (Quitzow, 2013). Already today, emerging economies represent the bulk of global economic growth,

so that solutions tailored to these markets have strong growth potential. Moreover, domestic businesses from emerging economies enjoy an important competitive advantage in this area of business vis-à-vis their rivals in the West who are physically and culturally more distant from these markets.

4.6 Supporting decent green jobs and a just transition to sustainability

On the other hand, it is important to keep in mind that green jobs are not necessarily fair and decent jobs. Moreover, the creation of new green jobs may go hand in hand with the disappearance of well-paying jobs in traditional sectors. It is essential that these social dimensions of greening economic development are adequately considered. This is not only an important question in its own right, but it represents the key to ensuring that environmental policy measures enjoy the social acceptance that they require. As already mentioned, conducting systematic assessments of the socio-political dimensions of green growth policies can help in tailoring strategies, which take into account country-specific challenges. The appropriate sequencing of reforms and the introduction of measures that mitigate negative social impacts represent important factors for making an ambitious environmental policy agenda socially sustainable.

Another important entry-point for promoting decent green jobs is via sectoral initiatives in support of sustainable supply chain management. These initiatives acknowledge the fact that economic activities in emerging countries can no longer be separated from the role they play in global value chains. They may be led by the private sector (e.g. corporate codes of conduct), civil society (e.g. labelling initiatives) as well as governments (e.g. the Frank Dodd act or the WEEE directive). Regardless of the particular sponsor, experience has shown that such initiatives must take into account both social and environmental dimensions to be successful. Moreover, to be effective, it is important to support progressive improvements rather than fixed benchmarks, which might otherwise function as non-tariff barriers to trade for developing countries. Moreover, if standards are implemented so that they anticipate regulatory trends, they may confer early mover advantages to participating firms (Porter & Linde, 1995).

4.7 Entry points for international dialogue

The policy options as outlined above can be linked with ongoing and evolving discourses on pathways for the development of Asian economies and societies. In the context of this study, an analysis of discourses can be at best rough and stylized, and discourses translate differently in the various national contexts. In order to develop powerful and convincing storylines, a more careful analysis of the respective discourses and related actors would be required. Nevertheless, a number of possible entry points for dialogue can be identified:

The global economic and financial crisis has strongly challenged Asia's traditional role as an exporter of manufactured goods for Western Europe, Japan and the US. It has revealed the overall fragility of the global economic system and its over-reliance on the US as the main source of global consumer demand. In this context, a re-orientation of Asian economies towards their regional and domestic markets is an opportunity. If linked to a paradigm of frugal innovation and a vision of green and resource-efficient economic development, this could result in resource efficient products for local consumption and ultimately also new export opportunities. Such a reorientation may also alleviate concerns regarding green protectionism by Western countries.

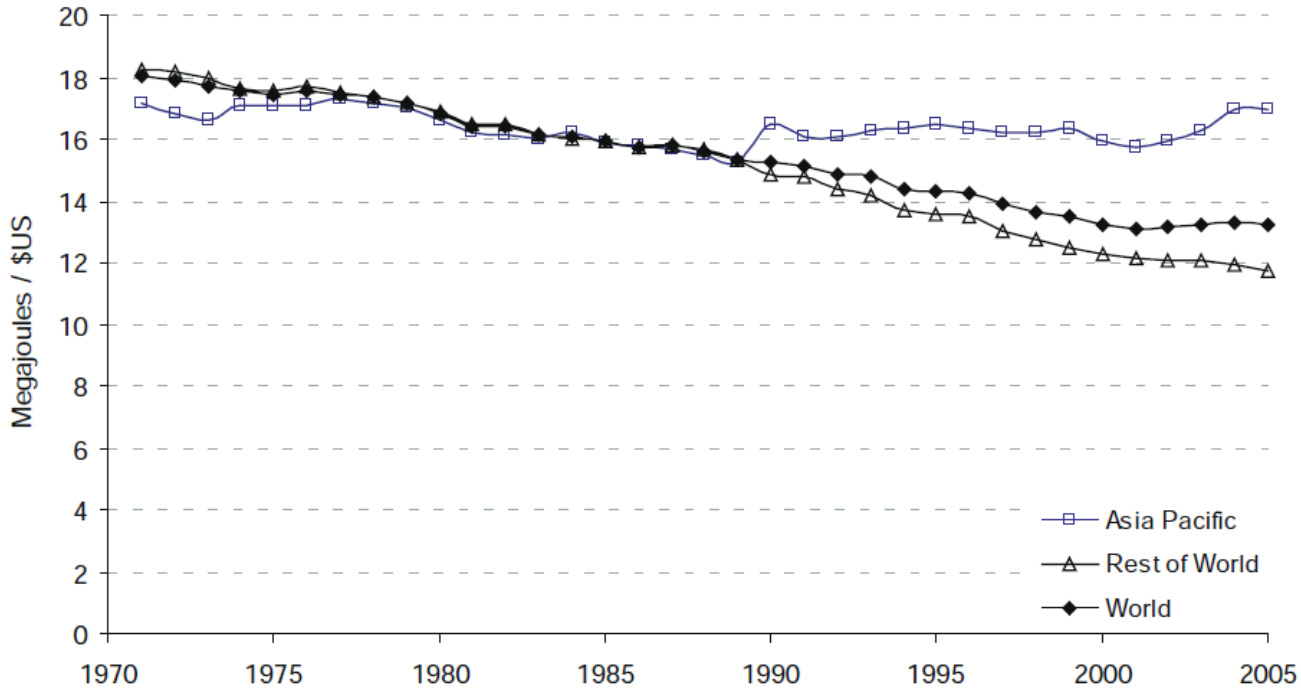
The economic crisis is having considerable impacts on public budgets. In low-income Asian countries, public finance is heavily constrained and taxation on labour does not provide a sufficient flow of incomes, given the high portion of the informal sector. The international financing of climate policies and in particular the maintenance of eco system services as a sink for carbon is a potentially growing source of income. In addition, domestic measures, like the environmental tax reform in Vietnam, may contribute to the generation of public funds.

A third important trend is the emergence of a new middle class and the new set of expectations and aspirations of this sector of the population. With the increasing income of private households, patterns of consumption and private property change. This is linked with changing expectations regarding the quality of the environment and is likely to lead to an increased environmental awareness and the willingness to purchase green products as well as to oppose harmful impacts from emissions. Eventually, such expectations can be linked and framed within a concept of well-being. Already today, immaterial values, such as education, are receiving increasing attention and eventually environmental quality can be integrated in the emerging storylines of prosperity and well-being in Asian countries.

Last, but most likely not least, the availability and quality of labour remains high on the agenda. In a number of Asian countries, the formalisation of employment is only at a beginning, and this may be an opportunity to link the agendas of green jobs with their specific requirements for qualification and the concept of decent jobs. This would imply not only linking environmental policies with industrial and innovation policies, but also integrating environmental concerns in policies for education and training of employees.

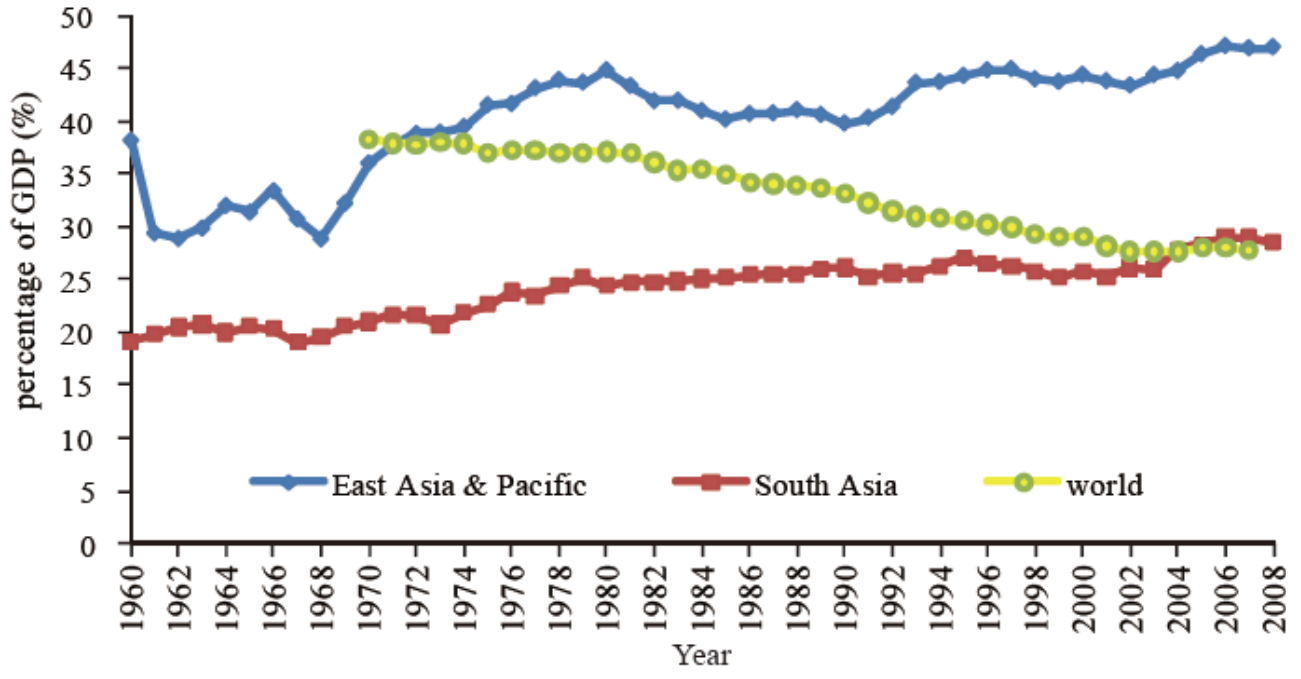
Annex

Figure I : The costs of environmental degradation in selected countries



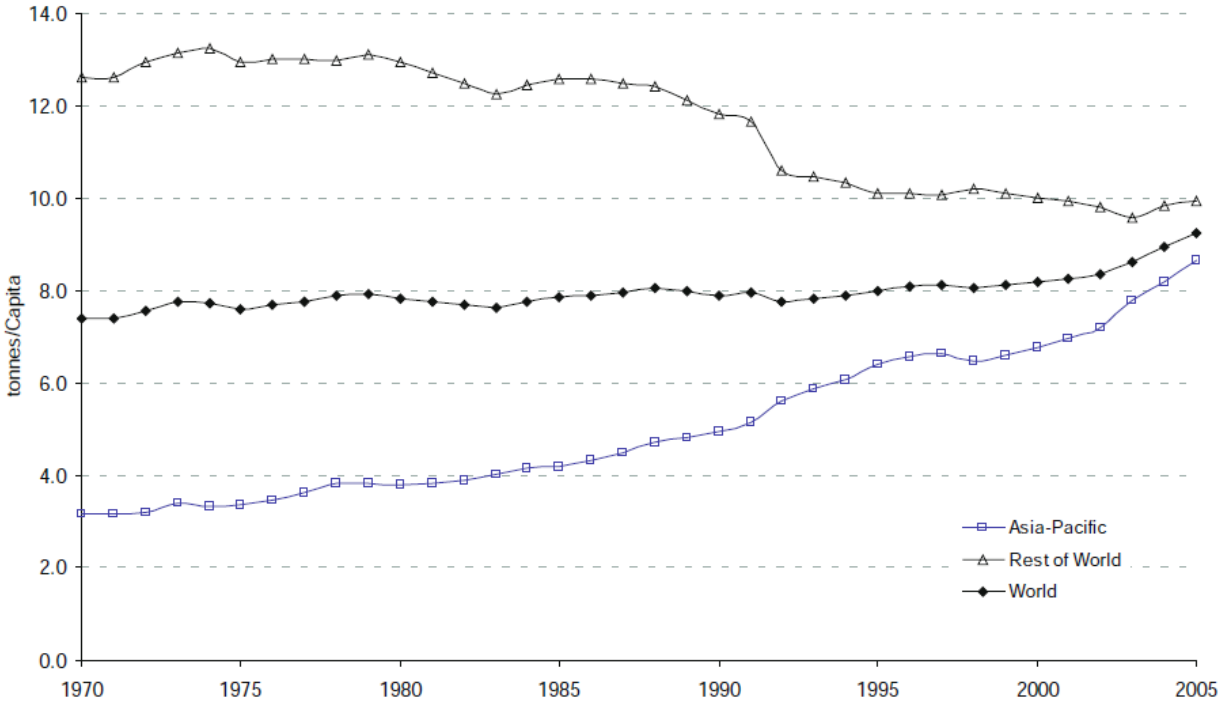
Source : UNEP (2011, p.66)

Figure II : The percentage of industrial value added in GDP between Asia and the world



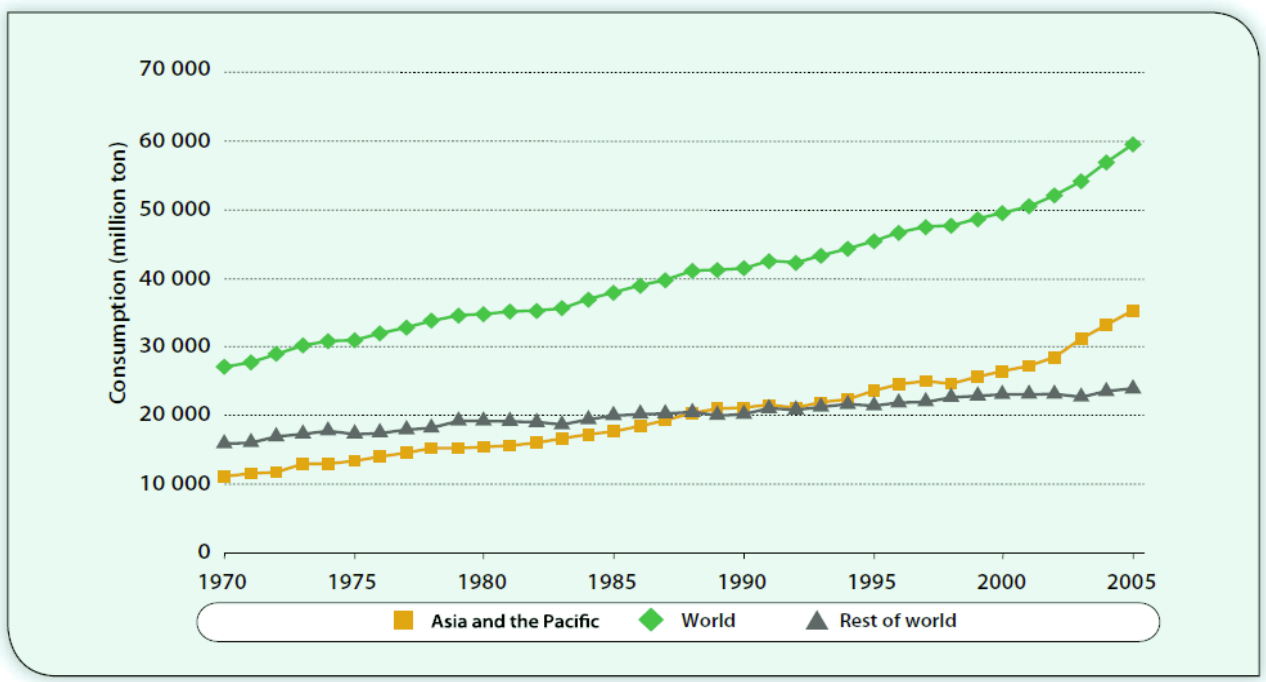
Source : Association of Academies of Sciences in Asia (2011, p.69)

Figure III : Domestic material consumption per capita in the Asia-Pacific region and the world



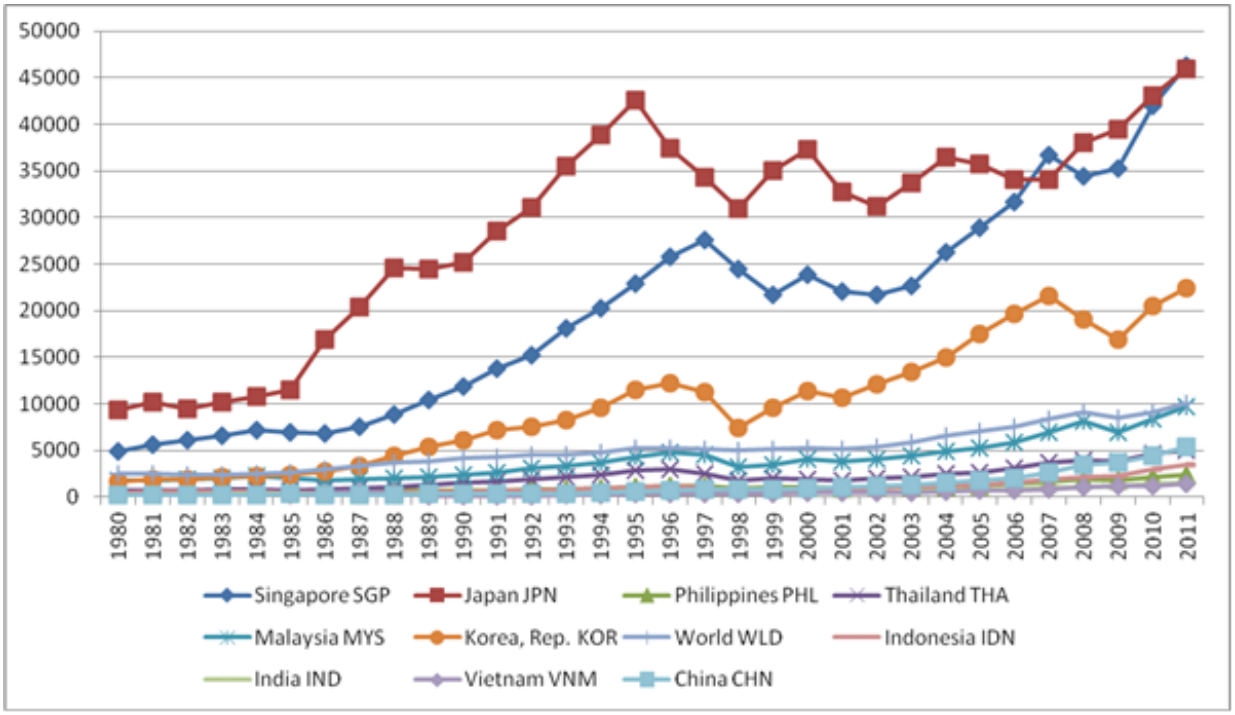
Source : UNEP (2011, p.26)

Figure IV : Domestic material consumption in Asia and the world



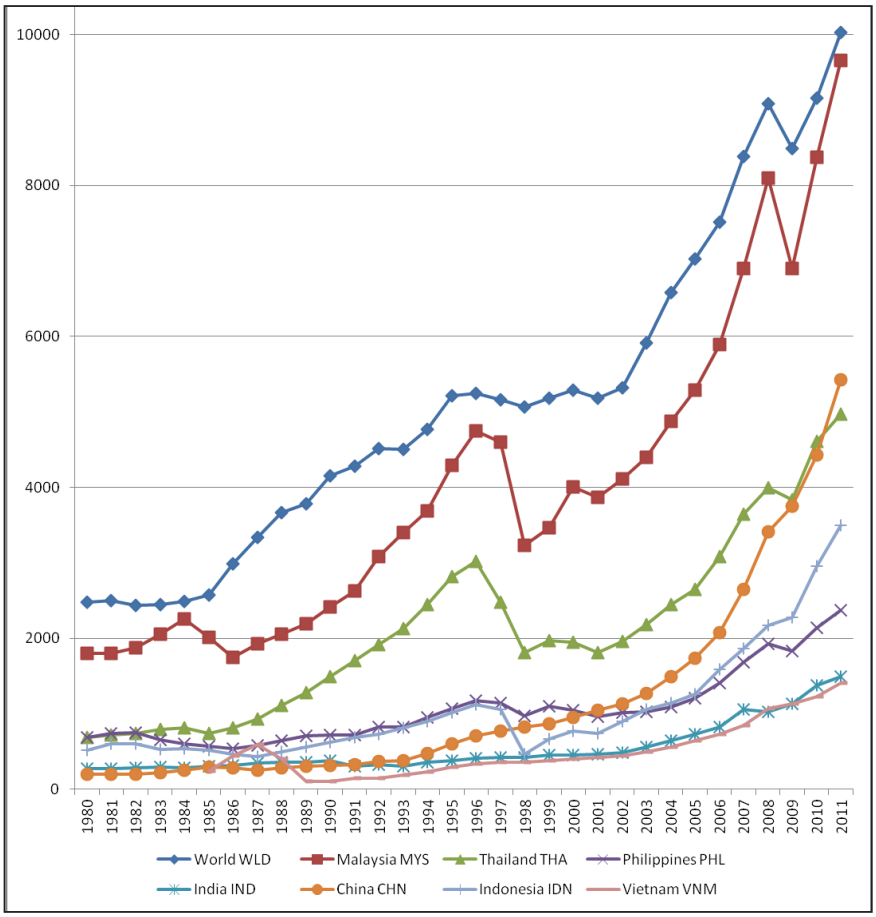
Source : UNESCAP et al., (2012, p.26)

Figure V : GDP per capita of selected Asian countries (current US$)



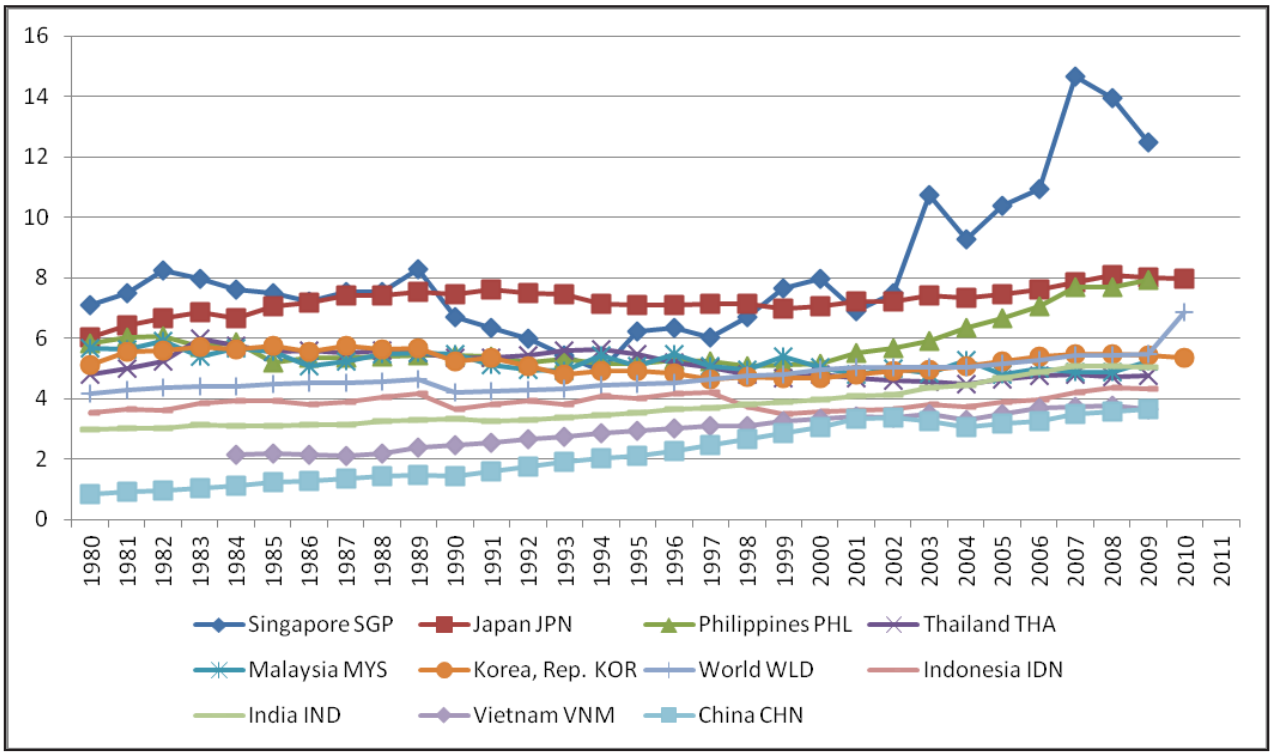
Source : World Development Indicators, World Bank

Figure VI : GDP per capita of selected low and middle income countries (current US$)



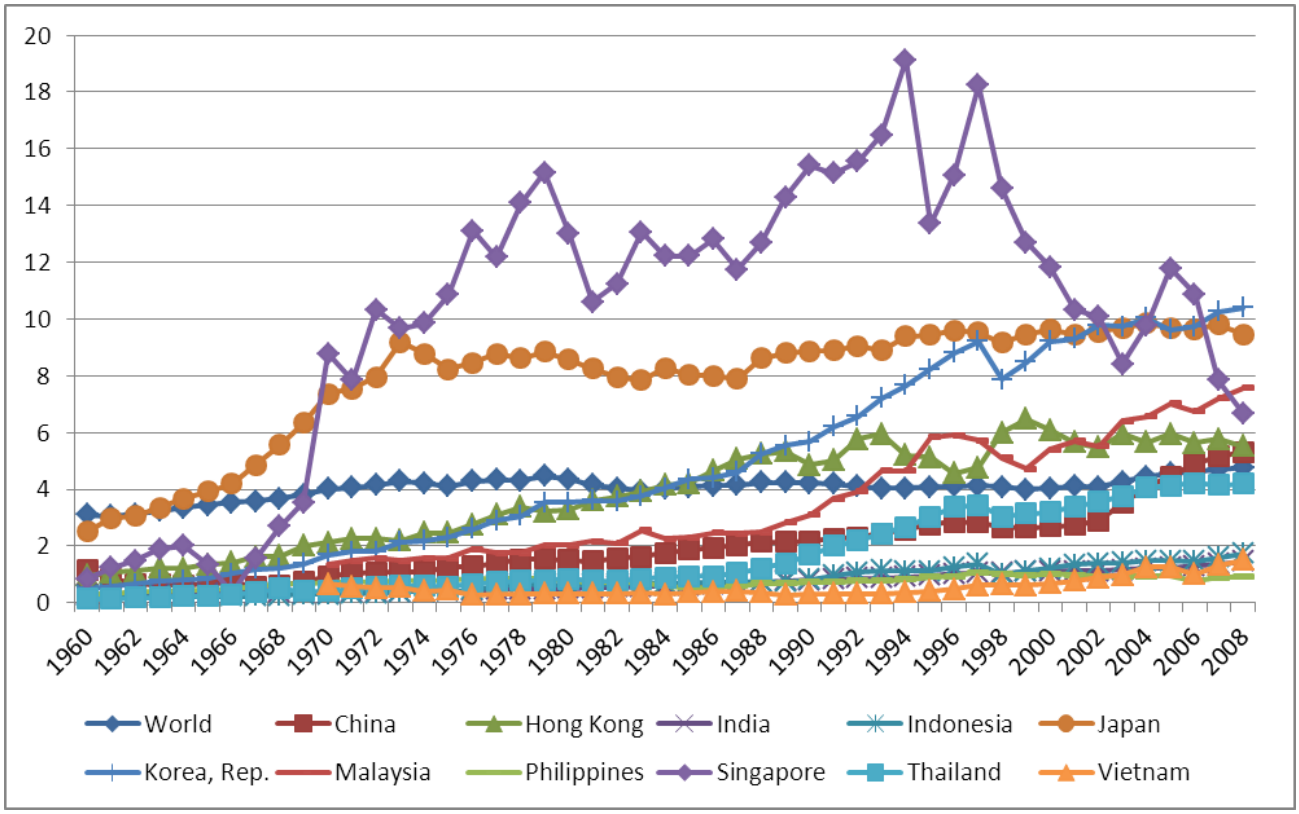
Source : World Development Indicators, World Bank

Figure VII : Energy intensity in selected Asian countries (constant 2005 PPP US$ per kg of oil equivalent)



Source: World Development Indicators, World Bank

Figure VIII : Per capita CO_2 emissions



Source : World Development Indicators, World Bank

Table I: Global value of LCEGS in £million by top 50 countries for 2010/11

Country	Sales £m	Rank	% of Total
USA	644,769	1	19.5
China	435,323	2	13.1
Japan	205,372	3	6.2
India	204,860	4	6.2
Germany	140,370	5	4.2
UK	122,222	6	3.7
France	101,161	7	3.1
Brazil	97,829	8	3.0
Spain	89,698	9	2.7
Italy	87,339	10	2.6
Russian Federation	84,546	11	2.6
Mexico	65,848	12	2.0
Canada	59,307	13	1.8
South Korea	58,270	14	1.8
Indonesia	51,109	15	1.5
Taiwan	35,679	16	1.1
Australia	33,011	17	1.0
Turkey	31,720	18	1.0
Iran	31,619	19	1.0
Thailand	31,400	20	0.9
Argentina	29,448	21	0.9
South Africa	28,682	22	0.9
Poland	27,889	23	0.8
Netherlands	27,483	24	0.8
Philippines	25,693	25	0.8

Country	Sales £m	Rank	% of Total
Pakistan	20,418	26	0.6
Saudi Arabia	20,015	27	0.6
Egypt	18,905	28	0.6
Ukraine	18,835	29	0.6
Colombia	18,590	30	0.6
Belgium	18,180	31	0.5
Bangladesh	17,213	32	0.5
Vietnam	16,957	33	0.5
Sweden	14,368	34	0.4
Hong Kong	14,050	35	0.4
Austria	13,999	36	0.4
Switzerland	13,811	37	0.4
Malaysia	13,581	38	0.4
Greece	12,867	39	0.4
Algeria	12,799	40	0.4
Romania	11,285	41	0.3
Chile	10,917	42	0.3
Czechia	10,731	43	0.3
Norway	9,848	44	0.3
Portugal	9,779	45	0.3
Peru	9,646	46	0.3
Hungary	9,529	47	0.3
Venezuela	9,413	48	0.3
Denmark	8,982	49	0.3
Finland	8,882	50	0.3

Source : Department of Business Innovation and Skills (2012)

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Imprint:

Friedrich-Ebert-Stiftung
Department for Asia and the Pacific
Hiroshimastr. 28 | 10785 Berlin | Germany

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http://www.fes.de/asien

ISBN 978-3-86498-729-8