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Resource-efficient and renewable energy transition in the five least developed countries of Asia: a post-COVID-19 assessment

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ABSTRACT

The economic fallout from COVID-19 resulted in an economic slowdown and a contraction in economic output, changed economic structures, and reduced financial inflows in the five least developed countries (LDCs) of Asia – Bangladesh, Cambodia, Lao People's Democratic Republic (PDR), Myanmar, and Nepal. This policy brief discusses these impacts in light of the LDC-graduation procedures of the United Nations together with the challenges that these countries face meeting their nationally determined contributions (NDCs) and the environment-related Sustainable Development Goals (SDGs 7, 12, and 13). The economic slowdown in Bangladesh, Lao PDR, and Myanmar and a contraction in economic output in Cambodia and Nepal has increased poverty in the five LDCs and is putting pressure on biomass resources in the rural areas of these countries. The change in the structures of their economies, which threatens to reverse processes of economic modernization in these LDCs, is undermining two decades of progress regarding the efficient use of natural resources and the associated reduction in greenhouse-gas (GHG) emissions per unit of gross domestic product (GDP). A decline in financial inflows such as remittances, foreign direct investment, and official development assistance (ODA) is also a risk to both short- and long-term prospects of further investment in renewable energy generation and low GHG-emissions technologies. This policy brief suggests policies that target technical interventions and incentivize small-scale renewable energy technologies that are less susceptible to microeconomic and macroeconomic impacts from external shocks such as COVID-19.

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Introduction

In February 2021, the 23rd session of the United Nations Committee for Development Policy (UNCDP) decided to recommend that Bangladesh, Nepal, and the Lao People's Democratic Republic (Lao PDR) graduate from the status of least developed country (LDC) (UNCDP 2021). There are three criteria for LDC promotion. First, a country needs to reach a threshold in gross national income (GNI) per capita of US\$1230. Second, a nation is required to achieve an economic vulnerability index (EVI) of 32 or below. Finally, a country needs to attain a human asset index (HAI) of at least 66. Although Myanmar met these graduation criteria in 2021, a decision to recommend the country for LDC graduation has been deferred until 2024 because of the state of emergency that currently exists (UNCDP 2021). Cambodia is another LDC that met the graduation requirements in 2021 for the first time but to be eligible for a recommendation, the criteria must be satisfied for two consecutive triennial reviews of the UNCDP. While there are twelve LDCs in the Asia-Pacific region, this study focuses

only on five of them – Bangladesh, Cambodia, Lao PDR, Myanmar, and Nepal. These countries have made significant progress across the three criteria for LDC graduation in the last two decades compared to other LDCs in the Asia-Pacific region (UNCDP 2021).

Just as the five Asian LDCs are on the cusp of graduating from the LDC category – a proxy for identifying progress toward improved well-being and achieving each nation's development objectives, COVID-19 has weakened the prospect and is posing a significant threat to delivering the sustainable development goals (SDGs) (Valensisi 2020; OECD 2020). Likewise, the nationally determined contributions (NDCs) of five LDCs produced as part of the requirement of another important multilateral accord, the Paris Climate Agreement, will likely remain undelivered by 2030 in these countries.¹ While the five Asian LDCs account for 3.5% of the world's population, the number of people living in these countries – Bangladesh, Cambodia, Lao PDR, Myanmar, and Nepal – is approximately 270 million (World Bank 2021). A significant threat to the

delivery of the environment-related SDGs (7, 12, and 13) that pertain to climate change and sustainable use of natural resources and to the NDCs in the five LDCs is a matter of concern for the global community given the limited institutional, technical, and financial capacity of these countries. In these circumstances, we lack an understanding of how the five LDCs may approach the goals of multilateral agreements while achieving LDC graduation in a post-COVID-19 world.

Article 4.6 of the Paris Climate Agreement explicitly mentions that LDCs may prepare and communicate their GHG emission-reduction strategies reflecting their special circumstances as climate-vulnerable countries. Achieving the SDGs, including the environment-related goals, is also nonobligatory for all countries, including LDCs. Further, the contraction and convergence narrative about inequitable GHG emissions per capita and resource use per capita will allow LDCs to increase their emissions and resource use (GCI 1996; Kuntsi-Reunanen and Luukkanen 2006; Duro, Schaffartzik, and Krausmann 2018).² Thus, there is a question about whether climate-mitigation actions such as reducing GHG emissions and the sustainable use of natural resources should be an essential policy issue in the five LDCs. The answer is that they should be for the following reasons.

First, deforestation is a significant environmental problem in many LDCs, including the five Asian LDCs, mainly because of easy access to the forest for biomass (Hasnat, Kabir, and Hossain 2018). Sustainable management of forest resources (biomass) via reducing emissions from deforestation and forest degradation (REDD) projects has contributed to meeting the interests of poor and local communities in Cambodia and Lao PDR (Käkönen et al. 2013, 104). For Nepal, REDD projects have encouraged and created opportunities for local communities to access clean energy for cooking (e.g., biogas), increased local participation in the sustainable harvest of forest products, and reduced indoor air pollution in rural households (Pandit 2018; Sharma et al. 2020). Protection of forests in the five LDCs is important for enhancing carbon-sink potential which is a key determinant of official development assistance (ODA) from developed countries (Halimanjaya 2015).

Second, non-climate benefits such as access to clean energy in rural areas, sustainable transportation, and sustainable agriculture are attractive value propositions for government policy makers because they can address development gaps in LDCs, including the five Asian LDCs to some extent (Howes and Wyrwoll 2012).

Finally, the global discourse on climate change and ODA from international development organizations has presented carbon reduction as a key policy issue in many LDCs (Karkee and Comfort 2016). Consequently, all five LDCs have submitted NDCs to the United Nations Framework Convention on Climate Change (UNFCCC) which show the interest of policy makers in lowering GHG emissions and enhancing sustainable use of natural resources. Bangladesh, Cambodia, Lao PDR, and Nepal were among seventeen countries from the Asia-Pacific region to file more stringent NDCs between 2020 and 2021 after submitting their first NDC between 2015 and 2016.

The looming LDC graduation and the need to deliver both the NDCs and the environment-related SDGs against the background of the economic shock from COVID-19 has put these five Asian countries in a unique position in comparison to the rest of the world. This challenge stems from the fact that they are preparing for promotion from LDC status which is not the case for recently graduated countries and other developing countries in Asia. LDCs are required to demonstrate attaining threshold scores against GNI per capita, EVI, and HAI, as well as their fourteen sub-indices for two consecutive triennial reviews conducted by the UNCDP. This policy brief assesses the unique position of the five Asian LDCs and discusses the pre-COVID-19 situation, macroeconomic and microeconomic impacts, and the post-pandemic challenges to achieving the goals of the multilateral agreements alongside LDC graduation.

Economic outputs, resource use, and GHG emissions in the five Asian LDCs

The high- and middle-income countries in the Asia-Pacific region were the primary contributors of almost 60% of global resource use in 2017 in comparison to 45% in 2000 (WU Vienna 2020).³ Likewise, each of the five LDCs in Asia – Bangladesh, Cambodia, Lao PDR, Myanmar, and Nepal – saw an absolute increase in their resource use of at least 1.5 times between 2000 and 2017 (WU Vienna 2020). Similarly, the factor increase in GHG emissions was at least 1.4 times between 2000 and 2017 for each of the five LDCs (Figure 1). If we link the absolute increase in resource use and GHG emissions to the increase in the size of an economy, measured by GNI, which is one of three criteria for LDC graduation, further increases in resource use and GHG emissions are likely. Resource use (e.g., consumption of energy resources) and economic output (e.g., gross domestic product (GDP) and GNI) are correlated for LDCs, which implies a rise

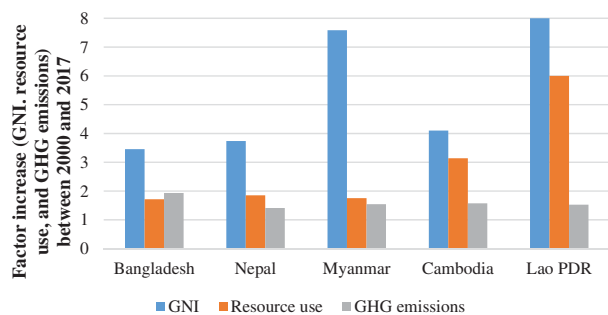


Figure 1. Factor increase in GNI, resource use, and GHG emissions between 2000 and 2017 for five Asian LDCs. Sources: World Bank (2021), WU Vienna (2020), Ritchie and Roser (2020), and The Shift Data Portal.

in economic output will be accompanied by a rise in resource use (Ozturk, Aslan, and Kalyoncu 2010; Rahman and Velayutham 2020). Similarly, previous research has found empirical evidence suggesting an increase in GHG emissions is a consequence of policies focusing on higher economic growth/output for LDCs (Bastola and Sapkota 2015). Therefore, while the COVID-19-related economic fallout will possibly reduce the absolute quantity of resource use and GHG emissions, economic growth is expected to be positive in 2021 and 2022 for South Asian and East Asian countries (Valensisi 2020). Nepal and Cambodia had marginally negative growth rates in 2020 but the other three LDCs experienced positive growth. Each of the five Asian LDCs is projected to have an economic growth rate of at least 4% in 2021 and 2022 (ADB 2021).

Areas of impact

The predicted positive economic growth rates in the post-COVID-19 situation portend well for five Asian LDCs as three countries – Bangladesh, Lao PDR, and Nepal – are already recommended for an official LDC graduation in 2026 and Myanmar and Cambodia are currently eligible for graduation (UNCDP 2021). However, we know little about how these countries will transition to LDC promotion in the post-pandemic period and in the aftermath of an economic shock that will affect the possibility of achieving the environment-related SDGs and the objectives of their NDCs. To gain a better grasp, it is necessary to understand the macroeconomic and microeconomic impacts of COVID-19 in the above mentioned five Asian LDCs that will challenge achieving a reduction in GHG emissions and sustainable use of resources. The UNCDP identifies two key economic issues: (1) short-term economic slowdown or contraction of macroeconomic outputs and (2) structural changes in the economy which pertain to adjustments in the share of outputs from various economic sectors (UNCDP 2021).⁴ A sharp reduction in foreign direct investment (FDI) and

remittances in many LDCs are two other economic impacts of COVID-19 that have highlighted the role of strong international support in the form of ODA in the five Asian LDCs (UNESCAP 2021). The changes in economic outputs and structural changes in the economy are two key determinants of resource use and GHG emissions (Baniya, Giurco, and Kelly 2021). Thus, resource productivity – meaning the amount of economic activity generated per unit of resources – depends on economic outputs and the structural features of an economy. Resource productivity is a widespread sustainability indicator that combines economic and environmental information, and high value signals resource-efficient economic activities, meaning more economic prosperity can be attained without increasing overall resource use (Steinberger and Krausmann 2011; Duro, Schaffartzik, and Krausmann 2018).

International development organizations mobilize ODA to support climate mitigation in almost all Asian LDCs (Käkönen et al. 2013, 10; Mahat et al. 2019). Countries with higher GHG emissions intensities, larger carbon sinks, and lower per capita GDP tend to receive more ODA for climate-mitigation actions, such as reducing GHG emissions, deploying clean energy, and protecting forests to enhance carbon absorption (Halimanjaya 2015).⁵ Most LDCs, including the five Asian LDCs, meet the criteria for receiving ODA from their development partners, such as bilateral and multilateral organizations. While ODA for all LDCs will remain critical amid an increase in poverty and the need to continue progress toward the SDGs in all LDCs, how the ODA-related finances will evolve in all LDCs is uncertain because donors have also been experiencing economic stress due to the pandemic (OECD 2021; UNESCAP 2021). Nonetheless, any change in ODA will impact the ability of many LDCs, including the five Asian LDCs, to deliver climate-mitigation actions.

The following section discusses the post-COVID-19 situation regarding the impacts of the economic slowdown in Bangladesh, Lao PDR, and Myanmar and a contraction of economic output in Cambodia and Nepal; structural changes in the economies of these countries; and declines in remittances, FDI, and ODA on their resource-efficient and renewable energy transitions.

Post-COVID situation: challenges for resource-efficient and renewable energy transitions in the five Asian LDCs

In comparison to the pre-crisis situation, lower economic growth rates for Bangladesh (5.2%), Lao PDR (0.5%), and Myanmar (3.3%) in 2020 were observed.

Negative economic growth rates for Nepal (−1.9%) and Cambodia (−3.2%) during the same year were due to contraction in their economic outputs (ADB 2021). These macroeconomic changes reduced resource use (e.g., energy resources such as fossil fuels) and associated GHG emissions in the five LDCs in 2020 (World Bank 2021; ADB 2021). At a global level, energy demand dropped in 2020 by 5% and related emissions by 7% (IEA 2020). Global economic output is predicted to rebound by 5.9% in 2021 and 4.9% in 2022 (IMF 2021), meaning an increase in global energy demand and associated GHG emissions. However, despite projected positive economic growth in all five LDCs in 2021 and 2022, the economic recovery pathway and the accompanying energy demand and GHG emissions will be different for them compared with the rest of the world for three main reasons.

First, the projected economic growth rates of all countries under study (except Lao PDR) are less than their economic growth rates in 2019 and indeed their average annual growth rates over the last two decades (World Bank 2021). Therefore, it is reasonable to infer that their energy demand in 2021 and 2022 will likely decline. In the two Asian LDCs, Nepal and Bangladesh, Baniya, Giurco, and Kelly (2021) found that the economic growth rate was driving the absolute increase in energy demand and GHG emissions.

Second, COVID-19 vaccination roll-outs will be delayed in all five LDCs and therefore the resumption of normal economic activities will likely be a few years later than in the rest of the world. The prospect of achieving at least a 90% vaccination rate for the population in these countries by the end of 2021 is extremely improbable. Most of them have made little effort to purchase vaccines by themselves and are dependent on the COVID-19 Vaccines Global Access (COVAX) Program of the World Health Organization (Acharya, Ghimire, and Subramanya 2021). By April 2021, international development organizations spent US\$23 billion in all LDCs to vaccinate only 3.1% of the total population in these countries by June 2021 (United Nations 2021). While the five Asian LDCs are among the top seven in the list, including all LDCs with the highest vaccine rates, they are still far behind compared to other developing countries in the Asia-Pacific region.

Finally, the increase in poverty in the five Asian LDCs because of COVID-19 (Sumner, Hoy, and Ortiz-Juarez 2020) has adversely affected or permanently shut down many small businesses (UNESCAP 2021) as well as reduced household-energy consumption and associated GHG emissions. Therefore, in the shorter term, resource use and GHG

emissions in these countries will likely contract but in the longer term will eventually increase, thus resuming the causal relationship between economic output, energy consumption, and GHG emissions.

A contraction in global economic activity and interruption in foreign trade will affect the exports of most LDCs (OECD 2021). This tendency will reduce energy demand and GHG emissions, mainly in the manufacturing-oriented economies of Bangladesh, Cambodia, and Myanmar which rely heavily on clothing exports. Lao PDR and Nepal are likely to see less reduction in energy demand and GHG emissions because their economies are driven primarily by household consumption within the residential sector. The share of manufacturing value-added was 19% for Bangladesh, 16% for Cambodia, 25% for Myanmar, 7% for Lao PDR, and 5% for Nepal in 2019 (World Bank 2021). This energy-intensive sector was responsible for more than 25% of energy demand in Bangladesh, 21% in Cambodia, 19% in Myanmar, 11% in Lao PDR, and 8% in Nepal in 2018 (IEA 2021a). Energy demand is likely to increase once international trade resumes and the export-oriented manufacturing sectors of Bangladesh, Cambodia, and Myanmar return to their prior production capacity.

COVID-19-induced shifts in the structure of an economy will also reverse significant improvements in resource productivity of the five Asian LDCs because of changes in the relative shares of GDP from services, agriculture, and manufacturing. Figure 2 depicts the improvements in energy productivity and material productivity and the factor increase between 2000 and 2017 for each country.⁶ Baniya, Giurco, and Kelly (2021) found that progress in energy and material productivity can result from structural change in an economy without any intentional technological changes. The economy of the majority of the LDCs has shifted from being agro-based to services-based in the last two decades, meaning that the economies of these countries became less resource-intensive over time (Figure 3). While services value-added accounted for at least 38% of GDP in 2019 for each of the five LDCs and is the leading economic sector for all of them, Bangladesh and Myanmar boosted their manufacturing sector in the last two decades only to be disrupted by COVID-19. The share of agriculture, including forestry and fisheries, which is a sub-indicator for an economic vulnerability index of the LDC graduation, is likely to increase despite declines in agricultural production in the LDCs and the reduced share of manufacturing (UNCDP 2021).

The manufacturing sector has higher resource productivity in comparison to the agricultural sector, particularly if the manufacturing is export-

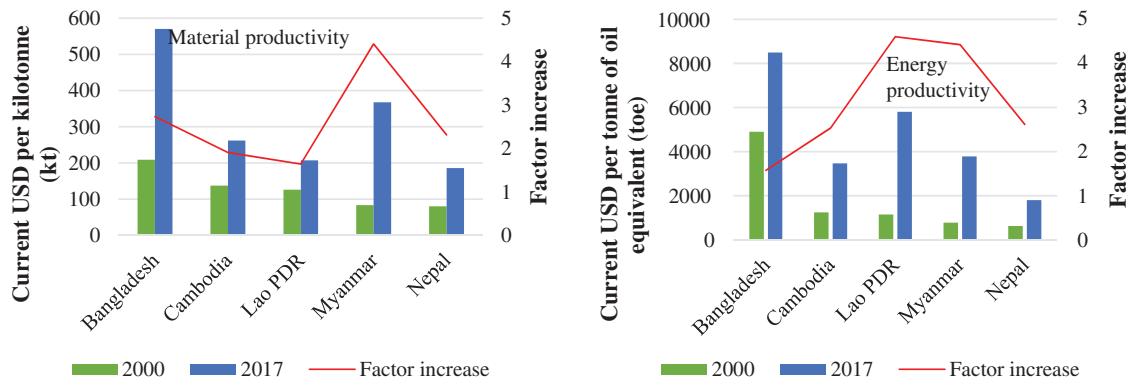


Figure 2. Changes in material and energy productivity values between 2000 and 2017 for five Asian LDCs. Sources: World Bank (2021) and WU Vienna (2020).

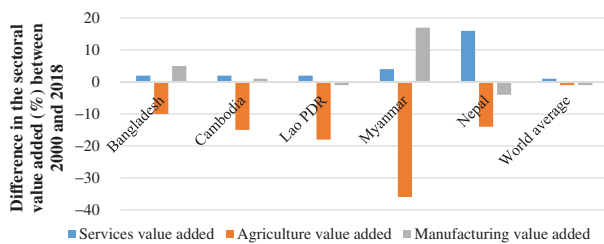


Figure 3. Difference in the sectoral value-added between 2000 and 2018.

oriented. For example, Bangladesh, Cambodia, and Myanmar, which have export-oriented manufacturing sectors, are more productive in using resources (Figure 2). In comparison, a higher share of agricultural value-added makes Nepal less resource productive. Therefore reduction in the share of manufacturing value-added and an increase in the share of agricultural value-added will cause a decline in energy and material productivity, particularly in Bangladesh, Cambodia, and Myanmar. Nepal's and Lao PDR's energy and material productivity values will be least affected by an increase in the share of agricultural value-added. An increase in the share of agriculture (including forestry and fisheries) will potentially increase GHG intensity because the relatively less productive agricultural sector, compared to services and manufacturing, is the main source of GHG emissions in most of these Asian LDCs (Figure 4). Between 1990 and 2016, the share of agricultural value-added (including forestry and fisheries) declined from 30% to 14% for Bangladesh, 45% to 25% for Cambodia, 46% to 17% for Lao PDR, 57% to 23% for Myanmar, and 48% to 29% for Nepal (World Bank 2021). In other words, GHG emissions from the agricultural sector in each of the five countries were declining. While higher GHG intensity at the economy-wide level implies more financial support in the form of ODA from international development organizations for climate mitigation (Halimanjaya 2015), structural shifts in value-added from different economic sectors will challenge the five LDCs in meeting their NDCs. The

NDCs submitted to the UNFCCC by all five Asian LDCs have statements about reducing the GHG emissions from their carbon-intensive agricultural sectors.

Reversal of the process of structural transformation in the economies of the five Asian LDCs because of potential increases in the share of agricultural value-added for the next few years conflicts with the economic modernization pathway that these countries have followed whereby value-added from services grew uniformly before COVID-19. A paradigm shift from traditional agro-based economies to economic modernization in the five Asian LDCs improved their resource productivity. However, disruption in the growth of services value-added and its share in economic output will have a notable impact on resource productivity, absolute resource use, and associated GHG emissions in all of these nations. Contrary to developed countries, where services value-added tends to be generated from knowledge-intensive services (e.g., banks, insurance companies, consulting firms, and educational institutions), services value-added in LDCs is dominated by the less knowledge-intensive and informal sectors (e.g., retail trading and restaurants). In the five Asian LDCs, the share of knowledge-intensive services is only one-fourth of the total value-added from services (UNCTD 2019, 2020a). As a result, the less knowledge-intensive and informal sectors are the most vulnerable to economic shocks and in all of these countries they have been severely affected by multiple COVID-19-related lockdowns. This implies that services value-added, its share of economic output, resource productivity, and absolute sectoral resource use and GHG emissions are likely to decline at least until the end of 2021.

Despite progress on the productivity front, the share of renewable energy (a combination of modern renewable energy and traditional use of biomass) in the energy mix is declining for the five Asian LDCs (Figure 5).⁷ If we exclude the

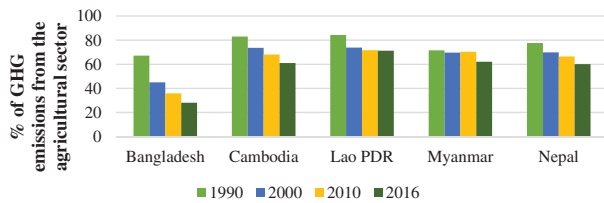


Figure 4. Share of greenhouse-gas (GHG) emissions from the agricultural sector, including forestry and fishery. Sources: World Bank (2021) and The Shift Data Portal.

traditional use of biomass, the share of renewable energy in total energy consumption is very low – 0.3% for Bangladesh, 6% for Myanmar, 19% for Cambodia, and 6.7% for Nepal. The traditional use of biomass accounts for a considerable share of total material consumption and a combination of biomass and fossil fuels comprises a large share of total energy consumption in all of these countries. Decline in the share of renewable energy in total energy consumption continues amid a drop in the levelized cost of electricity (LCOE) production from modern renewable energy technologies such as solar photovoltaics, wind, hydro, and bioenergy that ranges between US\$0.02 and 0.26 per kilowatt hour (kWh) for the Asian region (REN 2017, 128).⁸ Modern renewable energy sources are generally used in the form of electricity, while the traditional use of biomass and nonrenewable fossil fuels is for residential cooking and heating, transportation, and industrial processes in the five Asian LDCs.

The decline in the share of renewable energy in the energy mix will likely continue for all five Asian LDCs for the following reasons. First, an increase in poverty means that a proportion of the rural population will return to accessing biomass which tends to be a free resource.

Second, despite the increase in global renewable energy demand (0.9%) in 2020 amid a drop in global energy demand, the five Asian LDCs are less likely to invest specifically in renewable energy deployment during the post-COVID-19 era. Owing to the trend of a declining share of renewable energy in the total energy consumption for these countries (Figure 5), it is reasonable to anticipate that the business-as-usual pattern in these countries will continue and there will be less new utilization of modern renewable energy technologies. Further, composition of modern renewable energy sources is dominated by hydroelectricity in all five Asian LDCs which requires larger upfront investments than other small-scale modern renewable energy sources like solar photovoltaics, wind, and bioenergy.⁹ The declining trend and higher investments for much-favored hydroelectricity, coupled with easy access to biomass from forests, create uncertainty about the prospect of investing in small-scale and low-cost modern renewable energy technologies.

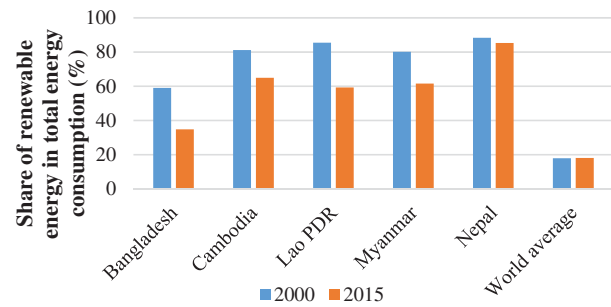


Figure 5. Share of the renewable energy in the total energy consumption. Source: World Bank (2021).

Finally, a decrease in remittances and FDI is likely to stall potential investments in renewable energy technologies in all five Asian LDCs. The FDI inflow in these countries is expected to decline in the short- to medium-term, and remittances to South Asian countries fell by 22% in 2020 (World Bank 2020; UNCTD 2020b). There is a well-established causality between FDI and renewable energy, meaning they complement each other to reduce GHG emissions (Jebli, Ben Youssef, and Apergis 2019). There is also empirical evidence for a direct causal relationship between remittances and renewable energy consumption (Das, Mcfarlane, and Carels 2021), which highlights the role remittance-recipient households can play in adopting and operating rural-scale renewable energy technologies such as solar photovoltaics and off-grid micro-hydro. A decline in remittances will severely impact Nepal (29% of GDP in 2019) and moderately affect Bangladesh (6% of GDP in 2019). Likewise, a drop in FDI inflow will severely influence Cambodia (13% of GDP in 2019) and Lao PDR (8%), moderately impact Myanmar (3%), and have less severe effects for Bangladesh (less than 1%) and Nepal (less than 1%) (World Bank 2021; UNESCAP 2021).

A COVID-19-related reduction in remittances and FDI will have a two-fold impact on the five Asian LDCs. First, a reduction in remittances and FDI inflows will reduce potential investments in renewable energy technologies, given the causal relationship (Das, Mcfarlane, and Carels 2021). Second, a decline in energy consumption and associated GHG emissions will follow a reduction in remittances that drive the consumption of household commodities, including energy, in the recipient countries. The share of recipient households with international remittances is 14% for Bangladesh, 9% for Cambodia, 16% for Lao PDR, 18% for Myanmar, and 24% for Nepal (Takenaka et al. 2020). While the first impact is negative in the sense that reduced financial inflows will limit the ability of households to install small-scale modern renewable energy technologies, the second is positive from

a climate-mitigation perspective. However, both impacts are expected to be short term, given that the source countries for the five Asian LDCs are the United States and countries in the Middle East (Takenaka et al. 2020). By mid-2021, the United States, the United Arab Emirates, Saudi Arabia, Qatar, and Bahrain have fully vaccinated at least 50% of their populations and partially vaccinated at least 60%, meaning that a return to normal economic activity – barring a new variant or other resurgence of the virus – is likely foreseeable in these countries.¹⁰

Given the likely temporary decline in FDI and remittances in the five Asian LDCs and its impact in the shorter term, ODA is one of the few financing mechanisms available to counter COVID-19-related economic shocks. While donor countries finalized the ODA budgets for 2020 and 2021 before the crisis, there is uncertainty about how much recipient countries will receive, mainly because donor countries are considering an addition to the existing budget instead of reallocations (Brown 2021). However, if we consider the economic impact of COVID-19 in the donor countries that have challenged the mobilization of the pledged ODA, the ODA inflows to the LDCs, including the five Asian LDCs may decline (Francisco, Sandrina, and Caiado 2021). The ODA received as a percent of GNI varies between 1.5% and 4.5% for the five Asian LDCs (World Bank 2021). In a worst-case scenario, if ODA inflow declines for LDCs for the next few years, further deployment of low-carbon technologies will be challenging for these countries. Freire-González and Vivanco (2017) found that foreign financial assistance such as the ODA is crucial to promoting low-carbon technologies and reducing the cost of renewable energy technologies. The ODA was also found to positively influence the electricity-generation capacity of recipient countries (Gualberti, Martins, and Bazilian 2014). These funds have been used as a financial instrument to achieve the dual objectives of greening energy generation from more renewable energy sources and lowering GHG emissions (Carfora, Scandurra, and Thomas 2021). The impact of declines of ODA will be felt more strongly in Nepal, followed by Lao PDR, Cambodia, Myanmar, and Bangladesh. However, unlike the effects of remittances and FDI on energy consumption that will likely be immediate and less enduring, the impact of ODA reductions may take longer to become manifest and persist for the longer term. This difference is because, unlike remittances and FDI that contribute mainly to household consumption and the private sector, respectively, ODA investments tend to be targeted toward infrastructure

development and to foster bilateral government relationships.

Conclusion

This policy brief has considered the key areas in which COVID-19 has disrupted progress on a resource-efficient and renewable energy transition in five Asian LDCs. The discussion highlights the likely recovery pathway of these countries from economic contraction, short-term reduction in resource use and GHG emissions, and a possible decline in resource productivity. The trends are significant because, unlike the rest of the world, which will likely resume normal economic growth, resource use, and GHG emissions in the relatively short term, the five Asian LDCs will need to overcome several challenges. First, the economic modernization process that these countries have followed over the last two decades has been shown to be quite fragile and resuming patterns of improving resource productivity will require coordinated effort. Second, a potential slump in investments in future energy generation and renewable energy technology is likely to have both shorter and longer term effects because of the decline in remittances, FDI, and ODA. Finally, increased poverty may expand the utilization of accessible but inefficient biomass resources, particularly in rural areas.

While reversal in the economic modernization process and a major setback to the export-oriented manufacturing sector will reduce resource productivity, these circumstances provide an opportunity to reconsider the deployment of technological measures to offset resource-productivity losses due to structural shifts in the five Asian LDCs. Resource-productivity improvements from technical interventions are less sensitive to macroeconomic and microeconomic impacts from external shocks like COVID-19. This is especially the case with respect to structural changes in an economy from agro-based to service-based – a common feature in the countries considered in this analysis. We suggest that technical interventions such as dissemination of energy-efficient biomass cookstoves and rural household biogas in the residential sector across all five Asian LDCs is necessary, given that the majority of their energy consumption occurs in the residential sector. This is manifest in the fact that the share of energy consumption in total final consumption is approximately 50% for Bangladesh, 45% for Cambodia, 45% for Laos, 56% for Myanmar, and 73% for Nepal (IEA 2021b).

The NDCs of the five Asian LDCs have a limited number of intended actions regarding energy consumption and GHG emissions in the residential

sector and they are mostly qualitative statements of intent. Short-term policies focusing on a renewable energy transition from traditional and low energy-intensity biomass to small-scale modern renewable energy sources such as solar home systems, off-grid micro-hydro, and biogas can also help these countries address the problem of high upfront investments required for much-favored hydroelectricity. For small-scale modern renewable energy technologies applicable for rural households in the Asian region, the cost ranges from US\$500 to US\$700, whereas for small to large hydroelectricity plants with a production capacity above 25 megawatts the necessary investment is significantly higher (REN 2021). Hydroelectricity can continue to become a major contributor to the total energy generated from modern renewable energy resources in the longer term.

In light of the declining LCOE from small-scale renewable energy technologies that tend to be affordable even for households in LDCs, we recommend policies that incentivize these sources because of their multiple and immediate benefits, particularly for rural households. First, there will be an increase in the share of renewable energy in total household-energy consumption. Second, resource productivity (both energy and material) will improve even under the structural shift. Finally, access to energy will likely improve as a result of incentives targeting the upscaling of small-scale modern renewable energy technologies. For example, Nepal's use of approximately 400 off-grid decentralized micro-hydro projects provides power to more than half a million people (Malhan and Mittal 2021). As a result, the share of the country's rural population with access to electricity increased markedly from 20% to 89% between 2000 and 2019 (World Bank 2021).

While such suggestions may appear to be overly ambitious in the context of the post-COVID-19 situation, government-led incentives, at least until remittances, FDI, and ODA inflows rebound, can be an intermediate intervention. There is also a synergy between these recommendations and the LDC graduation indices. For instance, reduced dependency on the forestry and agricultural sectors implies increased EVI – one of three criteria for LDC promotion. The EVI has two agriculture- and forestry-related sub-indices, and therefore reduced reliance on these sectors improves the EVI score. Similarly, improved access to higher quality energy sources such as biomass and electricity for cooking and energy-efficient biomass cookstoves improves a nation's HAI score, another criterion for LDC graduation. The two sub-indices, the under-five mortality rate and the maternal mortality rate, will likely decline from a reduction of indoor air

pollution in rural households, meaning a higher HAI score for the five Asian LDCs. Moreover, access to better quality and higher intensity energy sources (electricity) contributes to climate-change mitigation, poverty reduction, and opportunities for local economic activities, meaning increased GNI per capita, which is also one of three criteria for LDC graduation.

Notes

1. The NDCs communicate a country's post-2020 climate actions (GHG emissions reductions) and are required to be submitted to the UNFCCC under the Paris Climate Agreement.
2. The term resources in this policy brief refers to energy resources. Material consumption (including non-metallic minerals and metals ores) is also discussed briefly in light of the significant share of biomass in the total domestic material consumption of the five Asian LDCs.
3. The term resource use in this policy brief refers to the consumption of both energy and materials (e.g., biomass, fossil fuels, metals, and non-metallic minerals)
4. Economic slowdown occurs when there is a lower but positive economic growth rate compared to the previous year. Contraction in economic output is a consequence of a negative economic growth rate compared to the previous year.
5. The GHG intensity refers to the quantity of GHG emissions generated to produce a dollar's worth of economic output (e.g., GDP and GNI).
6. Energy productivity is measured as the ratio of economic output to the quantity of energy used (e.g., biomass, fossil fuels and other renewable energy sources). Material productivity the ratio of economic output to the quantity of materials used (e.g., biomass, fossil fuels, metals, and construction materials).
7. The term "modern renewable energy" refers to renewable energy sources that exclude the traditional use of biomass, especially in the context of cooking, which contributes to a harvest rate of forest products that is higher than its replenishment rate (REN 2021, 15–35).
8. Bioenergy refers to processed biomass that has relatively higher energy intensity than traditional raw biomass (e.g., biogas and gasifiers).
9. Modern renewable energy technologies (excluding hydroelectricity) are used as small-scale technologies in the five Asian LDCs.
10. Data on vaccination rates are from <https://ourworldindata.org/covid-vaccinations>.

Geolocation details

This study was conducted in Asia-Pacific region.

Disclosure statement

No potential conflict of interest was reported by the authors.

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