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An Economically Sustainable Approach to the Energy Transition in Developing Countries

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The economic growth of a country depends proportionately on the extent to which it is able to mobilize resources. A prosperous economy is an outcome of industrial revolution, technological advancement, optimal mobilization of human capital, and other resources achieved through years of strategic planning and development. Energy consumption escalates alongside economic development. So, as countries develop, their energy consumption pattern will also change. The U.S. Energy Information Administration projects that global energy consumption will grow by nearly 50% between 2018 and 2050. Most of this growth is expected to come from developing countries, or countries that do not belong to the Organisation for Economic Co-operation and Development (OECD).¹

This development trend shows that economic growth comes with an environmental cost. If we use high-carbon energy generation sources, the environment suffers even more as the country's carbon footprint increases exponentially. Many of the world's more developed countries only attained their status by using fossil fuels to meet energy demand. But as the continued use of these fuel sources becomes environmentally unsustainable, developed economies must devote large portions of their GDP to transitioning away from fossil fuels. The price to pay for this transition toward cleaner energy sources is high.

Therefore, as the developing economies of the world work on addressing the basic needs of their people, care must be taken to avoid the same kind of massive energy transition that the developed world is facing. This essay will consider options for developing countries to reduce their dependence on nonrenewable energy sources and adopt a sustainable approach to economic development.

Transitioning to Clean Energy Sources

To attain sustainability, developing countries must adopt clean energy technologies. Developed countries are undertaking lots of research on ways to optimally consume resources to achieve sustainable development goals. For example, Germany launched the Energiewende project in late 2010 under which it shut down coal plants and invested heavily in wind power plants with an aim to transition to renewable energy. Though the project is criticized for setting unrealistic goals, it has helped generate cleaner energy in the country. In fact, renewable energy surpassed coal as Germany's most important power source in 2018.² In the first six months of 2020, 55.8% of the country's power generation was from renewables, with wind power accounting for 30.6% of the total power generation.³

Another example is the European Union's European Green Deal, which was introduced in December 2019 with the goal of making Europe climate neutral by 2050. Under this plan, member countries have pledged to phase out fossil fuel use by adopting greener technology to boost the economy and promote a cleaner environment. Austria, for example, shut down its last coal plant in April 2020, while Portugal announced the shutting down of its last coal plant in July 2020.⁴ In 2019 the EU was able to achieve GDP growth of 1.5% while reducing greenhouse gas emissions by 3.7% year-on-year.⁵ It thus has set the example that economic growth is possible even through green technology.

Learning from such examples, the major focus of developing countries should be on producing as much energy as possible through harnessing renewable energy sources. Yet not all least developed countries have the same potential for clean energy

production. For example, Nepal has an estimated technically feasible hydropower potential of around 43.4 gigawatts (GW), Bangladesh has a huge natural gas reserve and also the potential to generate 50.2 GW of electricity from grid-connected solar photovoltaic systems, and Albania has the technical potential to generate 16.5 GW of electricity from renewable sources.⁶ As per the generation potential, countries may produce energy in the country. The deficient or surplus energy can then be managed through trading between countries or among the region as a whole.

In India, 64% of installed energy capacity is contributed by conventional sources, and more than 600 million tonnes of coal are consumed yearly for power generation.⁷ Fossil fuels have been predominately fulfilling the energy needs in the country. Every year, India spends a huge amount to import coal, and coal price fluctuation largely affects the energy market. In such a scenario, trading can be highly beneficial. India is surrounded by two hydro-rich countries—Nepal and Bhutan—that are yet to harness their full hydro potential. Nepal is envisioned to have an energy surplus in the next few years with the commissioning of many large hydropower projects.

Instead of India investing further in coal plants, it would make more sense for the country to invest resources in building the infrastructure required to trade clean forms of energy beyond geographic barriers. India has well-developed platforms for trading and exchanging power in short- and long-term markets among its 36 states. If this infrastructure can be expanded to include hydro- and solar-rich neighboring countries, carbon emissions could be reduced. India might follow the example of NordLink, which is a project to build a 623-kilometer submarine power cable to link Norwegian hydroelectric plants and German

wind farms so that the two countries can assist each other in exchanging and storing energy generated from renewable sources.⁸ This project teaches an important lesson that bilateral and even multilateral collaboration can be arranged to tap the resource complementarities among countries and thereby facilitate regional carbon reduction.


Improving Energy Efficiency

Energy efficiency plays a central role in sustainable energy management. Energy efficiency refers to the smart use of energy rather than the limiting of energy needs in the name of conservation. Countries should begin with behavioral changes in day-to-day activities. Even seemingly meager changes like switching off lights and electronic devices when not in use, limiting the operation of air conditioners, and using natural daylight wherever and whenever possible help with energy conservation. Along with such behavioral changes, countries should incentivize investment in energy-efficient appliances. Particularly in commercial buildings and industries, there is a lot of potential to conserve energy. Performing an energy audit would increase understanding of the energy consumption pattern and thus help identify, enumerate, and evaluate the possible energy-savings opportunities. It further helps to measure the amount of spilled energy so that we can adopt appropriate measures to ensure an efficient system.

Energy efficiency plays a very significant role in the transition to clean energy sources as it helps conserve energy, reduce energy expenses, and curb carbon emissions all at once. Over the past few decades, developed countries have been promoting energy efficiency through policy adjustments and innovative methods and products in the energy market. Developing countries need to encourage economic activities that follow this lead of embracing energy-efficient green technology.

Incentivizing Clean Energy Usage

To achieve sustainable switching to renewable energy, the domestic, commercial, industrial, and transportation sectors should altogether be fueled through clean forms of energy. In the domestic sector, cooking is a key area for improvement. This is a basic necessity that consumes a lot of energy and will not change or stop. Normally, people use wood, biomass, biogas, liquefied petroleum gas (LPG), firewood, and electricity for cooking. Most of the rural households in Asian and sub-Saharan African countries predominately depend on wood, coal, crop waste, and kerosene as the major sources of cooking fuel. Such inefficient practices have negative social and health implications in those communities, including premature deaths from illness attributable to indoor air pollution.⁹ As the highest priority, countries should enforce switching



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to cleaner cooking fuels like electricity and biogas and using improved cooking stoves. In the past few decades, many organizations like the Netherlands Development Organization, Danish International Development Agency, German Corporation for International Cooperation, and Practical Action, to name just a few, have been funding and providing technical assistance to help rural communities in developing countries switch to cleaner cooking practices using locally available resources.

Use of improved cooking stoves, in particular, helps reduce indoor air pollution, cooking time, and fuel consumption, in addition to slowing down deforestation. Women, who generally do most of the cooking in these communities, were found to be utilizing the saved time and energy from cooking efficiently to engage in other productive work such as livestock farming, agricultural activities, arts and crafts, and even education.¹⁰ Along with improvement in living standards for families due to the adoption of clean cooking techniques, women become economically empowered and can contribute significantly in earning income for the family.

Similarly, in urban areas, cooking fuel can be switched from LPG through the use of electrical appliances such as induction cook stoves, boilers, rice cookers, blenders, and ovens, while dishwashers and the like can be used to do general household chores. Even though LPG does not contribute to indoor air pollution, it still is a fossil fuel. Developing countries also often experience gas shortages or price hikes that could be avoided by switching to electricity. Additionally, the efficiency of an induction cook stove can be as high as 80%–84%, while that of LPG is only around 40%, which makes induction cook stoves a better option than LPG stoves.¹¹

With respect to the industrial and commercial use of energy, industries and businesses can make a huge impact on conservation because they consume a large amount of energy and release significant carbon emissions. So, it is essential for industries and businesses to be fueled with clean forms of energy. One good example of a company incorporating green technology is the case of Apple. In the past three years, Apple reduced its carbon footprint by 35% by transitioning to 100% renewable energy to supply the electricity used at its offices, retail stores, and data centers in 43 countries around the world and decreased average product energy use by 70% across all of its major product lines.¹² As industries and new companies are established in developing countries, they need to start incorporating green technology at the inception phase. Along with a reduction in carbon emissions, numerous other benefits are associated with green technology, such as lower operation and maintenance costs, reduced hazardous waste, health and safety of workers, improved quality of products, and increased equipment lifespan. These benefits have a direct impact on competitiveness, profitability, productivity, and product quality.¹³

Establishing an industry requires huge investment, and incorporating green technology further adds to the initial cost. Governments thus should act to provide a conducive environment for industries and companies to adopt green technologies. In particular, they should incentivize the use of renewable sources through tax reductions, subsidies, and quality standards, as well as measures to ensure energy security. Governments should also subsidize the import of energy-efficient appliances or raw materials. Domestic manufacturers should be encouraged to produce energy-efficient

appliances and electrical vehicles that local consumers can buy and use at an affordable rate. Industries can be incentivized through significant reductions in their fixed costs through subsidies and stand to benefit through energy savings from the use of efficient machines and technologies and greater productivity from the improved health of their workforce. These savings can further contribute to reductions in the cost of energy-efficient appliances, thus motivating consumers to choose these options. Green technology can therefore be economically viable for both the manufacturers and consumers.

In addition to cooking, another vital use of energy is for transportation. Per capita energy consumption can be reduced by encouraging people to use electric vehicles instead of petroleum-fueled vehicles. Public transportation systems could also be switched to utilize renewable energy sources like solar and electricity-fueled trains and large buses that have an ability to accommodate more people at a time. Such changes to the transportation sector will have two major benefits by reducing congestion and pollution and thereby minimizing the carbon footprint in developing countries.

In recent years, Norway has been leading the world in the percentage of electric and hybrid vehicles users. Electric cars accounted for 61.5% of the 15,552 cars registered in the month of September 2020, and when hybrid vehicles are included, the share increases to 89%.¹⁴ The motivation among Norwegians to opt for electric vehicles over petroleum-fueled cars is the result of policy interventions in the country. The Norwegian government made it easy for people to switch to electric vehicles through offering incentives such as tax reductions and subsidies, free road tolls, free parking, and lower annual fees for using the roads, as well as by building enough charging

stations. Norway aims to stop selling petrol or diesel cars in the country from 2025 onward.¹⁵

Developing countries need not adopt every single step taken by the Norwegian government. However, a key takeaway would be to introduce attractive incentives so that people are assured that electric vehicles are a more financially feasible option. Similarly, to induce behavioral changes, people should be made well aware that the choice of energy-efficient alternatives is for the sake of their health, the environment, and the security of future generations.

Prerequisites for a Sustainable Approach to Development

A combined approach comprising green awareness generation, government intervention, and the construction of adequate infrastructure is prerequisite for sustainable development. These activities will not be assertive enough when carried out individually and should be coordinated.

Green awareness generation. Before implementing green initiatives, countries must educate their populations on the importance of achieving carbon neutrality. Accountability comes with awareness, and awareness helps prepare consumers to accept the switching decisions, adopt renewable energy sources, invest in energy-efficient technology, and, most importantly, agree to pay a little extra for energy-efficient technology if and when required.

Government intervention. Intervention by the government is necessary in every major activity envisioned for reducing carbon emissions. Governments should play a guiding role by formulating policies to enforce their renewable energy goals. Policies should incentivize the generation and use of renewable energy through

subsidies, promote investment in green technologies through import duties and tax deductions, and encourage manufactures to produce and supply cost-competitive energy-efficient goods and services for domestic consumers. Incentivizing the generation of clean forms of energy through policy adjustments can help make electricity prices affordable to people of any economic background and assure consumers that choosing renewable energy will be financially feasible compared to fossil fuels.

Infrastructure development. Fuel switching and usage decisions are directly linked with energy security. As a result, necessary infrastructure should be built to ensure the availability, affordability, and reliability of energy. Renewable energy should be a significant percentage of the power-generation mix. Similarly, transmission and distribution networks should be intact to ensure the reliable flow of electricity. Grid connectivity should be streamlined to facilitate the trade of clean energy across countries or regions. Likewise, along with tax and duty subsidies, enough charging stations should be built to promote the use of electric vehicles. Availability of such facilities affects the decisions of consumers to switch to renewable technologies.

Conclusion

It is much easier to begin with the right measures than to rectify them later on. Therefore, developing countries should adopt policies to promote clean and efficient energy use in domestic, transportation, industrial, and commercial sectors from an early stage. Setting up new industries plays an important role in economic development. Although industrial growth is not only the consequence of cleaner fuel usage, there are other benefits from clean energy such as reduced carbon emissions, fewer health issues for employees, better retention of employees, and lower fixed costs.

In this respect, developing countries can learn from developed countries on how to march toward economic development while maximizing the efficient use of energy to attain their sustainable development goals. Industries generate employment opportunities, which helps increase per capita income and thereby improve living standards. Incorporating clean energy practices alongside economic development can help decrease the carbon footprint that a country generates while heightening energy security. ∞

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Endnotes

- 1 U.S. Energy Information Agency (EIA), “EIA Projects Nearly 50% Increase in World Energy Usage by 2050, Led by Growth in Asia,” September 24, 2019, <https://www.eia.gov/todayinenergy/detail.php?id=41433#>.
- 2 Benjamin Wehrmann, “Renewables Overtake Coal as Germany’s Most Important Power Source,” Clean Energy Wire, July 10, 2018, <https://www.cleanenergywire.org/news/renewables-overtake-coal-germanys-most-important-power-source>.
- 3 “German Net Electricity Generation in First Half of 2020: Renewables Reach Record Share of 55.8 Percent,” Fraunhofer Institute for Solar Energy Systems ISE, July 1, 2020, <https://www.ise.fraunhofer.de/en/press-media/press-releases/2020/net-energy-production-first-half-of-2020.html>.
- 4 Dimitris Mavrokefalidis, “Austria Moves towards Carbon Neutrality with Shutdown of Last Coal Plant,” Energy Live News, April 20, 2020, <https://www.energylivenews.com/2020/04/20/austria-moves-towards-climate-neutrality-with-shutdown-of-last-coal-plant>; and Simon Frédéric, “Portugal Ends Coal Burning Two Years Ahead of Schedule,” Euractiv, July 15, 2020, <https://www.euractiv.com/section/electricity/news/portugals-coal-phase-out-jumps-forward-by-two-years>.

- 5 European Commission, “Kick-Starting the Journey towards a Climate-Neutral Europe by 2050,” EU Climate Action Progress Report, November 2020, https://ec.europa.eu/clima/sites/clima/files/strategies/progress/docs/com_2020_777_en.pdf.
- 6 H.M. Shrestha, “Exploitable Potential, Theoretical Potential, Technical Potential, Storage Potential and Impediments to Development of the Potential: The Nepalese Perspective,” *Hydro Nepal* 19 (2016): 1–5; P.K. Halder et al., “Energy Scarcity and Potential of Renewable Energy in Bangladesh,” *Renewable and Sustainable Energy Reviews* 51 (2015): 1636–49; and International Renewable Energy Agency (IRENA), Joanneum Research, and University of Ljubljana, *Cost-Competitive Renewable Power Generation: Potential across South East Europe* (Abu Dhabi: IRENA, 2017).
- 7 Ministry of Power (India), Central Electricity Authority, “Executive Summary on Power Sector,” October 2020, https://cea.nic.in/wp-content/uploads/executive/2020/11/exe_summary-10.pdf.
- 8 Gero Rueter, “Norway to Become Germany’s Energy Reservoir,” DW, February 16, 2015, <https://www.dw.com/en/norway-to-become-germanys-energy-reservoir/a-18256802>.
- 9 Each year 3.8 million people die prematurely from illness attributable to the household air pollution caused by the inefficient use of solid fuels and kerosene for cooking. “Household Air Pollution and Health,” World Health Organization, May 8, 2018, <https://www.who.int/news-room/fact-sheets/detail/household-air-pollution-and-health>.
- 10 Ewan Bloomfield, “Gender and Livelihoods Impacts of Clean Cookstoves in South Asia,” Practical Action, November 27, 2014, <https://www.cleancookingalliance.org/binary-data/RESOURCE/file/000/000/363-1.pdf>.
- 11 R. Chheti et al., “Analysis on Integrated LPG Cook Stove and Induction Cooktop for Cooking Purposes in Bhutan,” *International Journal of Science and Research* (2017): 23–26.
- 12 “Apple’s Emissions Reduction Mission,” United Nations, <https://unfccc.int/climate-action/momentum-for-change/climate-neutral-now/apple>.
- 13 Bruce Lung, Sachin U. Nimbalkar, and Thomas Wenning, “Multiple Benefits of Industrial Energy Efficiency: Lessons Learned and New Initiatives,” U.S. Department of Energy, June 1, 2019, <https://www.osti.gov/servlets/purl/1531223>.
- 14 Douglas Broom, “60% of Cars Sold in Norway Last Month Were Electric,” World Economic Forum, October 9, 2020, <https://www.weforum.org/agenda/2020/10/norway-electric-cars-majority-sales>.
- 15 I. Wagner, “Electric and Hybrid Cars Number in Norway 2010–2020,” Statista, February 23, 2021, <https://www.statista.com/statistics/696187/electric-and-hybrid-cars-number-in-norway>.

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