

Evaluating sustainable economic development

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Recent concerns in global warming and other environmental issues challenge scientists and engineers toward development of cleaner as well as low-carbon and hence sustainable technologies. One of the general beliefs is that the development of market mechanisms and appropriate regulatory framework may be sufficient to catalyze the transition from fossil fuel-dominated unsustainable technologies to a renewable and sustainable technologies. There is no doubt that finance plays an important role in commercializing and implementing such technologies for a cleaner world. However, this is not the entire story as reported by Best (2017). Best (2017) studied the influence of financial capital on the changes in the energy mix for 137 countries during the period from 1998 to 2013.

Financial incentives and availability of capital through credits and debts definitely support a transition toward capital intensive technologies, but not necessarily toward renewable technologies. The adaptation of a particular technology, through public funding, depends on the development goal of the country, their aspiration to climb the development ladder, issues related local pollutions, creation of jobs, and many such socio-economic factors. On the other hand, a completely different set of economic factors governs the private funding for the commercial growth of a technology. Most of the fossil fuel-based technologies are not capital intensive, but operating cost may be significant. Such technologies defer the immediate need for very high capital investment, which can be

diverted to meet other developmental goals. In emerging economies, this is one of the most important driving forces to invest in such technologies. With increase in the per capita gross domestic products, emerging economics are moving up on the energy-ladder, moving from traditional energy resources toward less-uncertain and high-density fossil fuel driven energy systems. For example, low-income economies (such classification of countries based on per capita gross income may be obtained from World Bank (2017)) are moving from traditional biomass-based energy to coal in their energy mix (Best 2017). Transition from the traditional biomass-based cooking to liquefied petroleum gas-based cooking definitely helps in improving the indoor environment and reducing health hazards. Medium-income economics are at the cross-road. Other than the developmental issues, reliability of the energy supply chain, energy security associated with imported fuels, as well as availability and distributions of renewable energy sources also play important roles for these economics. These economics are looking for a balance between social development and cleaner environment. On the other hand, the availability of capital, along with the relevant policies and economic support, is helping the transition toward capital intensive low-carbon technologies for developed economies. Best (2017) observed that the structure of the financial systems in developed economies is also playing an important role in determining the type of renewable technologies in the energy mix. For example, public credits and debts favor wind energy in the overall energy mix in the developed economy.

To influence the overall movement toward a cleaner world, it is important to embed sustainability issues into the economic framework. In this context, El-Halwagi (2016) proposed an approach to incorporate beneficial as well as detrimental effects of a project on the overall sustainability

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through modified return on investment framework. El-Halwagi (2016) proposed an easy to understand the concept of sustainability-weighted return on investment. Sustainability-weighted return on investment encompasses the economic profit of a project through the conventional return on investment as well as the sustainability benefits of the project through a multiplier that is determined based on the weighted average score of various sustainability indicators. Such a metric can balance the economic issues with the issues of sustainability.

Three pillars of sustainability are economics, environment, and society. Each of these pillars plays a different role on the overall sustainability. As observed by Best (2017), economics influence high-income economy to accommodate cleaner fuels in their energy mix and low-income economy to climb the ladder of social development. They are actually not contradictory pathways. If we

develop inclusive indicators, similar to the one proposed by El-Halwagi (2016), we may see a convergence for the overall development of humanity. Through the lens of sustainability, we need to analyze development holistically.

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