

## **Think Global, Act Local – A Policy Prescription towards Sustainable Energy System in India**

*Diptiranjan Mahapatra, Indian Institute of Management - Ahmedabad, India*

India faces three major energy challenges – energy access, energy security and environmental impacts. Besides, India's energy system demonstrates unsustainable patterns of development characterized by growing dependence on imported fossil fuels, rising energy demand and growing CO<sub>2</sub> emissions. With the exclusion of the unintended impacts resulting from the energy production and consumption by the market forces, resource gets allocated suboptimally. As a result, damage to air, soil, and water quality backfires on the rapid economic growth in the form of health impacts. Further, developing countries like India cannot adopt an exclusive climate-centric development pathway as it might prove very expensive and create large mitigation and adaptation burden as compared to sustainable development pathway. Hence, the challenge is to alleviate and reverse these adverse trends to achieve a truly sustainable energy system, while preserving the equilibrium of ecosystems and encouraging economic development. In this research, the life cycle analysis is deployed for full accounting of externalities of energy use for electricity production. The assessed impacts are then monetized providing an estimate of corresponding welfare losses. The estimated impacts are considered robust and, if needed, can be used as the basis for decision-making independently of the monetary values. A “bottom-up” partial equilibrium modeling framework ANSWER-MARKAL is then used to internalize the external costs from the static life cycle analysis to generate dynamic energy system equilibrium and to make comparative policy assessment for India's energy system. Several key results arise from this research having strong public policy implications. The result demonstrates that the shift from the current inefficient equilibrium to an efficient frontier is made at very low cost by introduction of technologies which mitigate emissions of local air pollutants like SO<sub>2</sub>, NO<sub>x</sub> and SPM. Internalization of local externalities too results in co-benefits including strong decarbonisation impact and hence local pollution control comes out to be the most preferred solutions amongst all the scenarios examined. This result comes as an immediate aid and relief to Indian policy makers who are desperately searching for that elusive silver-bullet through direct CO<sub>2</sub> mitigating actions to resolve India's growing CO<sub>2</sub> emission. The renaissance of coal is observed only when it is coupled with low polluting technologies such as DeNO<sub>x</sub>, DeSO<sub>x</sub> and CCS. It then becomes imperative to have strong policy and technology intervention in the coal sector to make India energy secured.