Abstract

Energy as a standalone resource has been studied extensively by researchers and modellers around the world. However there are other resources as well as constructs, inter-linkages of which with energy resources are much evident and well-recognized, and therefore need to be integrated with both energy demand and supply for holistic understanding, planning, and policy making.

Consideration of not only energy demand having several links to constructs like ideas, values, culture, behaviour, and so on is necessary but also of supply side links to other resources availability, for example, land, water, etc. Implications of energy resources have on the environment in the form of climate change and air pollution demand equal attention. Therefore, energy modelling necessitates interdisciplinary approach. This becomes an imperative when the demand of energy is intricately linked to a growing economy. Therefore, there is a need to understand the nature of energy demand with a growing economy through a constant feedback loop between energy demand of the sectors of the economy and their nature of growth as the economy takes a certain growth path.

Demand for the energy will also depend on how the lifestyle related factors and behavioural aspects of the people in terms of energy consumption change as the economy grows. In today's world, the growing energy demand is not only related to the endogenous factors of sectoral demand but it is also responsive to the uncertainties of climate change and its impact on rainfall, temperature which thereby affects water availability and hence power generation. With such an uncertainty and large envisaged growth in the sectors of the economy and energy demand across sectors of the economy, it is an imperative to connect the energy supply, demand aspects with biophysical parameters of an economy too. Further, meeting the growing energy demand through fossil fuels or renewable energy resources can also have an implication on the emissions, associated human health implications from such emissions. Emissions through human induced actions can also create climate uncertainties which thereafter impacts the biophysical parameters and hence the energy supply. Therefore, at this juncture also, there is a need to create a feedback loop between energy supply, demand, economy, emissions, biophysical parameters. These need to be done by integrating energy, economy, climate, biophysical models. While econometric modelling can serve to assess the inter-relationships between behavioural, cultural impacts on energy demand: biophysical modelling can be done to assess the dependence of energy supply side on natural resources like land, water etc. Climate models and air pollution - health models can be integrated with the existing energy models to give clarity on environmental, human health implications of energy systems. Therefore, to achieve this, a variety of models, techniques or frameworks can be integrated through hard or soft linking approach by suiting it to the context of the research issue or the policy challenge. There is no one stand alone process of such integration and it will depend more on the context and the essence of the research challenge along with the availability of suitable data and suite of models.