Editorial: Requirements for accelerated transformation of energy systems in civil and industrial infrastructure

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Environmental Laboratory (INEEL), Idaho Falls, Idaho, USA. He is a 19-year veteran at the INEEL, has over 30 peer-reviewed publications, and authored the safety-environmental chapter of an International Atomic Energy Agency (IAEA) book on Inertial Fusion Reactors. He also leads a research project to improve science-based decisions of decommissioning-stewardship-waste management decisions. He is currently a deputy for the Environmental Systems Research and Analysis (ESRA) Program and co-PI for a new project to understand long-term performance of near-surface engineering environmental barriers.

Innovations in energy generation, transmission and utilisation systems are needed for enhancing energy sustainability. Per the recognition of the World Energy Council, the sustainability of any energy resource can be measured using the triple characteristics: availability, accessibility and acceptability. Regional geology and climate influence the availability of specific energy resources in specific regions. For example, solar energy may have better prospects in some tropical countries than in some Nordic countries. Also, geothermal energy has greater potential in geodynamically active continental margins such as western North America than in more stable areas. Energy generation from biomass would not be the target of countries in desert countries. Energy transmission infrastructure may also be a constraint on the introduction of power into power grids. Even in the USA, this may become a critical problem in the future, especially in the Southeast. The deployment of sustainable energy systems fits into the context of energy acceptability. With considerations of global climate change, its undesirable impacts on ecosystems and human health, and the attribution of the impacts to emissions from the use of traditional energy systems, alternative energy has gained importance in national development plans and public consciousness.

Increase in the percentage of alternative energy systems in the energy use mix requires innovative programs and incentives, as well as coupling of regional/national programs to international initiatives to mitigate the "tragedy of the commons". In doing this, it should be recognised that fossil fuels will still remain the primary source of energy for at least the next 20 years (90% as estimated by the International Energy Association). Rapid and wholesale translation from traditional to alternative energy systems can not be accommodated by any regional or national economy. The inertia derives from the prohibitive capital cost of switching from established physical and organisational infrastructure to new systems that are still laden with uncertainties. Improvements in energy systems will most realistically be accomplished through micro-generation (which allows fruitful use of renewable energy where possible), increase in the efficiency of machinery (in transportation and coal combustion systems), improvements in energy transmission and distribution infrastructure, and innovations in emissions management technology. An example of the latter is carbon sequestration. It is important to approach the target of energy sustainability through both policy options and technological advancement.

This special edition covers some advances in technology and policy analyses in the direction of improving energy system sustainability and encouraging innovations in energy system that should guarantee its availability, accessibility and acceptability. The guest editors are grateful to the authors and reviewers. The efforts of Mr. Humphrey Zebulun as an editorial assistant is also applauded.